hardly seem fitted for *popular* perusal, and yet so clearly are the fundamental principles treated that any intelligent man, or high-school scholar, for that matter, would hardly fail to be understandingly interested in the application of these principles to important facts of every-day life. The consideration of catalysis leads to its application in the manufacture of sulfuric acid and the hardening of fats, and to some of the facts concerned with digestion; in connection with electricity are discussed the refining of metals, the manufacture of chlorin and caustic soda, and many electric-furnace products; the colloidal state is illustrated by photographic plates, the sedimentation of rivers, plasticity of clay, dyeing and water and sewage purification. Perhaps the most interesting chapter is that concerned with the fixation of nitrogen, particularly applicable to the demand, both for munitions and for fertilizers, at the present time. Other chapters are "Combustion, and the production of fire," "The chemistry of illuminants," "Energy, fuel and explosives," "Cellulose and cellulose products," "Glass, soda, soap," and "Synthetic chemistry." All are exceedingly readable, and are to be recommended, not only to the man who desires to get a glimpse of what modern chemistry is doing for the comfort and needs of life, but quite as well to the first-year student of chemistry, in school or in college, who has far too often come to regard the study as a mass of unconnected facts and abstruse theories, mingled with a mess of dirty test tubes and beakers. In this book one gains a glimpse of the beauty of it all, if indeed one has any comprehension of beauty.

One word remains to be said. Many of us were trained in our earlier years to believe that for the past half century all chemistry was "made in Germany," and in this there was far more of truth than of fiction. And yet it is hardly an exaggeration to say that in England, America and France more progress has been made in the past thirty-six months than had been made in Germany in the previous thirty-six years. Perhaps the same has been true of Germany; our information regarding this is meager. As never before, chemistry is "coming to her own," and hence the timeliness of Dr. Findlay's "Chemistry in the service of man."

JAS. LEWIS HOWE
WASHINGTON AND LEE UNIVERSITY

Ulugh Beg's Catalogue of Stars. By EDWARD BALL KNOBEL. Carnegie Institution of Washington, Publication No. 250. 1917. Pp. 109.

Mr. Knobel's compilation of Ulugh Beg's Catalogue forms a fitting sequel to Ptolemy's Catalogue of Stars, also edited by Mr. Knobel in conjunction with Dr. C. H. F. Peters. Ulugh Beg, born in 1394, succeeded his father as ruler of Persia in 1447. Two years later he was killed by his son. He devoted much of his time to astronomy, was the founder of an observatory at Samarkand, which is located in the southern part of Russian Turkestan, and in the year 1437 published a catalogue of stars.

Such catalogues furnish at best only rough determinations of stellar positions because of a number of causes. To add to the insecurity of the positions, it is not always certain whether all the stars of such a catalogue have been directly observed by the author, or whether, for the sake of completeness he has added star positions determined by predecessors, and reduced to the epoch of his own catalogue in a manner unrecorded. Added to this is the doubt whether the manuscripts available contain a true record of the original catalogue.

While it is eminently worth while to preserve such a catalogue, if only for historical purposes, great care should be taken not to place too great dependence upon its star positions.

Mr. Knobel has apparently made a thorough investigation of the subject. In addition to the catalogue proper he has included a comparison of Ulugh Beg's star positions with positions reduced from Piazzi's catalogue, with the exception of 300 stars whose positions were reduced from the catalogues of Danckwortt and Neugebauer. Following the comparisons he has collated the manuscripts which were examined, and closes the volume with a vocabulary of Persian words prepared

by Dr. Peters which Mr. Knobel has subsequently revised and amended.

BENJAMIN BOSS

DUDLEY OBSERVATORY,
ALBANY, N. Y.

FIVE YEARS OF STARVATION OF LARVÆ

THE specimens concerned are the larvæ of *Trogoderma tarsale,* a small beetle well known as a museum pest. The last of a large number of specimens lived, without a particle to eat, for the suprisingly long period of five years, one month and twenty-nine days or, to be more specific, from October 28, 1911, to December 25, 1916, a period of 1,884 days. The case is decidedly outstanding, as to my knowledge, nothing similar has ever been recorded as a result of starvation experiments with other animals. It is very probable that under otherwise non-disturbing conditions the starving larvæ would have lived for even a longer period. The specimens concerned in this article had undergone considerable disturbance after the first two years of starvation, since many of the larvæ made the trip between Idaho and Wisconsin with me three or four times, and several of them covered the distance five times. The trips one way varied in duration from four to seven days. There is no doubt but that the jarring of the train had accelerated the metabolism of the larvæ. This fact was evinced by the moulting of practically every individual toward the end of the trip or within a few days after it, and by the decided decrease in the dimensions of the larvæ immediately following such a moult. Larvæ placed under starvation shortly after my arrival in Idaho in the summer of 1913, which have not been so disturbed, show indications of even greater tenacity than is here recorded.

It will not be out of place here to mention how the starvation experiments with this particular species which proved to be of such unusual interest came about. While a graduate student at the University of Wisconsin the writer got into a dispute concerning the classification of the larvæ. To prove his point he decided to grow some of the specimens to maturity and thus obliterate the uncertainty of identification. A number of the largest larvæ available were placed in glass dishes together with some food material. Not having plenty of the favorite food material at hand at the time, several specimens were placed in other dishes without food and set aside in a separate drawer with the intention of providing for them later. However, these were neglected until the opening of school the following September when the writer accidently discovered them in their secluded place. Much to his surprise all of the specimens were alive, in spite of the fact that they had remained there for five months without a thing to eat. It was also noticed that the larvæ had decreased in size. This observation was further substantiated by the gradual decrease in size of the various cast-off skins, which this species is not known to attack. This interesting information later led to experimental work on the longevity of the larvæ, without food, on a large scale.

A number of specimens varying in size from newly hatched to practically full-grown larvæ were placed in individual sterilized vials for the purpose of ascertaining the period of time that they could live without food. Even the newly hatched specimens showed an amazing tenacity by living over four months without ever having eaten at all. Some of the one fourth grown specimens lived for fourteen months; those about one half grown lived almost three years; those three fourths grown lived four years; and most of the largest specimens lived over four years, several of them over four and a half years, and one five years and seven days; while the last one died after five years, one month and twenty-nine days of starvation.

One of the most interesting phases of these experiments is the gradual decrease in size of the individual specimens. Many of the largest larvæ which were about 8 mm. in length dwindled down to practically the hatching length of 1 mm. before dying, and practically all of the specimens which were below 7 mm. at the beginning of the experiment dwindled down to the same dimensions. Many of the larvæ of 2 and 3 mm. were reduced to some-