notice. As it is, however, we can only point out, that, separated as they are by lofty mountains, the Indians and Burmans have little in common; but the Buddhist religion, and the Buddhism of Burma, are said to differ in many essential points from that of India. Then, too, the caste distinctions of the one country do not obtain in the other, and, finally, the system of land tenure and administration in vogue in this part of the land of the white elephant, is unique in the institutional history of mankind. Any one interested in the subject is referred to a work in two volumes, entitled 'The Burman,' by an author who conceals his identity under the euphonious pseudonyme of Shway Yoe, and to the late Captain Forbes's invaluable work on British Burma.

If the Burmans are the rulers of the country as a whole, their hold on the tribes living between Bamo and the Yunnan frontier is very slight. On the hills nearest Bamo live the Kakhyens, a savage and godless people, who worship 'nats' and tyrannize over travellers. They are few in numbers, and, with the English once in possession of Bamo, could offer little opposition. Intermingled with them in Siam, and spreading thence to the south well into Siam, and to the east beyond the Chinese frontier, live the Shans, who are much more capable of civilization than the wild Kakhyens, and even now lead a peaceable and well-ordered life. The Shans seem to be related to the Siamese rather than to the Burmans, and, indeed, the southern tribes are tributary to Siam. So, too, in theory, are the Burman Shans tributary to Burma. In practice, however, it is not so, and the power of the Burman government, which grows rapidly less as one gets away from the despot's palace in the centre of Mandalay, becomes nothing long before the Yunnan frontier is reached. Indeed, some Shan tribes are reported as paying a nominal tribute to the rulers of both countries, while obeying neither.

Passing over the boundary, we come at once to that portion of Yunnan which for eighteen long years was the scene of the Mohammedan revolt against the Chinese yoke. At last, in 1874, this rebellion of the Panthays, as the Mussulmans are called in Yunnan, was finally crushed. In the course of the eighteen years of civil war, however, the country had been in great measure depopulated, its agriculture ruined, and its commerce paralyzed. Now, again, caravans are reported as arriving at Bamo. This part of our globe is so rich in the products of its soil, in the mineral wealth lying within easy reach, provided the cost of transportation was not so great, and in its splendid forests of teak and other hardwood trees, that there seems no doubt but that the first nation to penetrate to the interior, and build the necessary roads and railways, will for many years monopolize the trade of a large portion of Farther India. EDWARD CHANNING.

AESTIVATION OF MAMMALS, WHAT IS IT?

THE occurrence of æstivation, or something considerably like it, is a possible mid-summer feature of the animal life in southern New Jersey; and yet I find no reference to the subject in any work descriptive of the habits of our fauna. What is æstivation? In Stormonth's dictionary, the definition is as follows: the sleep or dormancy of animals during the hot or dry season in warm climates; the analogue of hybernation in cold regions.

The condition of certain mammals, as reported to me during the summer of 1884, brought the subject prominently to mind, and I found that in past years I had made many memoranda concerning unconscious animals; but the full significance of which I did not, until recently, recognize; and indeed, I may not now correctly interpret the facts.

The following is an instance of the supposed occurrence of æstivation, or something closely akin to it:—

A family of white-footed mice was found in an exposed position in an open field; the nest being made of a few leaves and some thistle down, under an old tin pan, the bottom of which had nearly rusted away. When these mice were taken up—and they were handled with great care—they were found to be soft and warm, as when in full vigor, but gave no signs of life. The female mouse and her three young, which were more than half grown, constituted the family. As there was no apparent cause for the death of the mice, I determined to investigate the matter very carefully. One of the young was pricked on the ear with a needle, when it flinched slightly. The others were similarly tested, and all gave evidence of life to the same extent. Carrying these mice to a shady spot, and placing them in a comparatively cool position, they regained their ordinary activity in about seven hours; the process not appearing to be as gradual as it really was, but resembling closely the awaking from an ordinary sleep. They were then replaced in their nest in the field, which they promptly abandonded, but returned thereto, in the course of the next day. Three days later, these mice were found in precisely the same condition. Time, noon; thermometer 106° F. These mice were taken directly to a cellar, forty-two degrees cooler than the open field, and the sudden change proved too great a shock. The young died in one

hour; the old mouse, in less than three hours. Had these mice, after their first removal, when replaced in the field, directly become stupid or actually dormant, it might naturally be inferred that the heat had seriously affected them; but, as we have seen, such was not the case. During the evening of the day following my replacing them in the field, the air became cooler by twenty-nine degrees, by 7 P. M., and was thirty-four degrees cooler four hours later; and the mice were active and fed heartily upon bread crumbs placed near their nest. Now, why, it may be asked, did they not seek out a cooler retreat in the woods near by? I can only suggest that the supposed æstivating condition was not inconvenient or unpleasant, and that it was preferable to the abandonment of their nest, which was suited to their needs for all time, except such extraordinary spells of hot weather. Either these mice were excessively stupid, or a dormant condition, caused by excessive heat, was nothing unusual with them.

There is, in this instance, a marked difference from a hibernating sleep, in that the period of dormancy was of but a few hours duration; but was like the torpid slumber of a hibernating animal, in that the condition was one from which it was not possible to arouse them, as from ordinary slumber. The awakening had to come from a change of temperature, and just in proportion as the evenings were warm, the mice were tardy in returning to consciousness. To more effectually test this, I carefully removed these mice from the field, and placed them near a stove, so that the midday temperature could be maintained. The result was the continuance of the dormant condition for eighty-four hours.

When the effect of a protracted drought and heated terms upon our animals has been more fully worked out, I believe it will be found that many a mouse and other small mammal which is found lying dead as supposed, is really not in a moribund but dormant condition, and if left undisturbed, would revive. But what other evidence is there of this? The white-footed mice are not, of themselves, sufficient to prove that æstivation is an established habit. What other evidence among mammals have we?

In August, 1880, I found bats on four different occasions, all of which were apparently in full health, yet they did not, for some reason, which I supposed to be excessive heat then prevailing, resume, at sundown, their crepuscular flights at the usual hour. These bats had 'gone to roost' under leaves on trees and a grape-vine, and were, no doubt, fully intending to resume their activity after the nap of a day's length was over. Why did they not? The following days were excessively hot, until the fourth, which was a few degrees cooler. It clouded over early in the afternoon; soon it became damp, and just before the commencement of a passing shower, these bats were stirring a little, as they hung. Quivering their wings, as though to see if all was in working order, and then, away they flew, after, in each case, nearly ninety hours of rest. Does it adequately explain all the facts to say that these bats were overcome by the heat? They were resting in the shade during the whole day, and the nights, when they would be active, were cooler; but in these cases, very little cooler. They were nights to be remembered for their sultriness, and may it not be, that there was not sufficient difference in the midday and evening temperature to enable them to throw off the nervous prostration caused by the heat of the day? Explain it thus, and then we are left to consider what is this nervous prostration? In the case of the bats mentioned, they were all in a perfectly torpid state, and gave not the least sign of life when handled; and only flinched slightly, when wounded by being pricked with a needle. Would not nervous prostration that produced insensibility, lasting several hours, almost certainly produce death? In the case of the bats, a torpid condition of ninety hours produced no ill effects. I am disposed to believe that the coming hot and dry weather was anticipated, and these bats retired for the purpose of escaping it, and entered into a condition widely different from ordinary sleep, which was to last until the so-called heated term was over, the lowering of the temperature being the one means through which they would be restored to consciousness. There occurs this deliberate action on the part of certain mammals, which regularly hibernate—why should not the same be true of them when the extreme is one of heat, instead of cold?

As bearing upon this question, let me quote a few lines from the Encyclopedia Brittannica—ninth edition—article, Hibernation. It says: "The dormouse not only hibernates in the strict sense of the term, but will sleep at intervals for several days together, during mild weather. When a Myoxus, an allied animal inhabiting Africa, was brought to Europe, it hibernated as if this were its normal habit. Whether it æstivates in its native country is not known, but its hibernating in Europe shows a greater power of adapting itself to changed conditions of life than we should have been inclined to suspect."

I would briefly call attention to two points in the above: that in temperate climates prolonged sleep is not unknown among rodents; and also, that some tropical rodents probably æstivate. In the case of the white-footed mice, and, too, of the

bats, I am very positive that their condition was not that of ordinary slumber, and the tropical temperature, at the time, even through the night, certainly suggests æstivation as the most plausible explanation of the phenomena I have described.

C. C. ABBOTT.

THE LIFE OF GEN. EMORY UPTON.

GENERAL EMORY UPTON, at the time of his early death in 1881, was probably the most accomplished officer in the United States army. He had a genius for the science of military tactics, and, as a thinker and writer upon this subject, has left a name of enduring renown. General Michie, the well-known professor of physics at West Point, aided by General James H. Wilson, who was distinguished in the cavalry service during the civil war, has recently published an extended memoir of Upton, tracing the various steps of his advancement through boyhood, with his strong desire to go to West Point; through his cadet life, in which he won high rank; through his varied and arduous experience in the three branches of army service during the war, winning success in each; through his career as the commandant of cadets, as an instructor in artillery at Fortress Monroe, as an official observer and student of the armies of Europe and Asia, and especially as an authority on military principles and practice. General Wilson says of Upton, that he was "as good an artillery officer as could be found in any country, the equal of any cavalry commander of his day, and, all things considered, the best commander of a division of infantry in either the union or rebel army." This is high praise, but the volume by General Michie shows how such success was won, and leads us to believe that Upton's name, as years roll by, will be honored more and more as one of the greatest tacticians of modern times. His personal character was as remarkable as his professional. Like Havelock, Stonewall Jackson, Chinese Gordon, and many other heroes, he developed a religious life of the purest and most lofty type. Toward the end of his life he was engaged upon a study of the military policy of the United States during the revolution, and from that time down to the year 1862, when his manuscript ends. In this work he was associated with his classmate at West Point, Col. H. A. Du Pont, by whom the task will doubtless be completed. From the outline given by General Michie, it is clear that the treatise will be of the greatest value, not to military men only, but to all students of history, and especially to statesmen. It will throw a great deal of light on the causes of success and of failure in the various campaigns which have taxed the resources of our countrymen. The publication of this manuscript is greatly to be desired.

As a soldier and as a writer, Upton may be described as one who applied the principles of scientific method to the organization and management of armies. His aim was lofty; his success was great.

Life and letters of Emory Upton, Brvt. Maj.-Gen. U. S. army. By PETER S. MICHIE. With an introduction by Jas. Harrison Wilson. New York, *Appleton*, 1885. 28+511 p. 8°.

DOOLITTLE'S PRACTICAL ASTRONOMY.

PROFESSOR DOOLITTLE has given us an excellent manual, either for the student or for the worker in the field. Intended only for field astronomy and navigation, we find no treatment of observatory methods with large instruments, but its own field is thoroughly covered. "The author has not sought after originality, but has attempted to present in a systematic form the most approved methods in actual use at the present time." It is a comfort to turn the pages and find standard formulæ in a familiar dress. Much of the 'originality' of many modern text-books consists in rigging out old accepted formulæ in a new alphabetical suit, so that no one can be quite sure he is using just the right one without constant reference to the great 'original.'

We can only give an outline of the contents. The introduction develops in a simple but thorough manner the method of least-squares and the subject of interpolation. The different systems of spherical co-ordinates, the formulæ for their transformation and for parallax, refraction, etc., are very completely developed. Under the subject of angular measurements, verniers, micrometer-microscopes, graduated circles and their sources of error, chronometers, clocks, and chronographs are fully described and investigated. With the treatment of the adjustments and errors of the sextant, is introduced an example of the determination of the eccentricity by star observations, from the work of Professor Boss on the northern boundary survey; and chapter v. develops thoroughly the best methods of determining time and latitude by the sextant or any altitude instrument. The transit-instrument in its various forms, both in the meridian and prime-vertical, is very fully treated; likewise the determination of longitude by chronometers, by telegraph, by lunar distances, by moon-culminations, and by occultations of stars. Of course, the zenith-telescope claims its due share of attention, and an unusually complete chapter

A treatise on practical astronomy, as applied to geodesy and navigation. By C. L. DOOLITTLE. New York, *Wiley*, 1885. 8°.