poison depends on self-immunisation, called forth by swallowing their own venom, or by repeatedly inoculating themselves. This is highly improbable, if we remember that some of the innocent snakes are very resistant against cobra poison, as, *e.g.*, the *Ptyas mucosus* and the *Tropidonotus natrix*, and also that, as the writer has shown, the *Varanus Bengalensis* is possessed of a marked tolerance, and that, according to Fayrer, other species of *Varanus* survive the bite of a cobra 24 to 48 hours. Jourdain further gives a list of four innocent snakes which are immune against viper venom. In what manner are we to account for this immunity? Interesting observations on the poisonous nature of serum of innocent and poisonous snakes are also found in Calmette's paper of April 1895, which, while rendering Fraser's theory still more improbable, do not assist us in clearing up the mystery. The explanation must be left to future researches; for the present we must be thankful for the promise which the researches of Calmette and Fraser have given us, of allaying an almost national calamity.

A. A. K.

SCIENTIFIC KNOWLEDGE OF THE ANCIENT CHINESE.

THE question of China has been so much to the front lately, that an article which appeared in one of the August numbers of the *Revue Scientifique*, on the knowledge of science possessed by the Chinese, seems very *à propos*. It cannot be denied that the Chinese of the present day have very elementary ideas on any branch of science. This however, was not so formerly.

In early times, as far back even as 2000 B.C., we find that science in China had reached a fairly advanced stage. The Chinese possessed undoubtedly a great knowledge of astronomy; inscriptions have been found which prove this. In the "Chou-King," a book of records, we read that Emperor Yao, who reigned 2357 B.C., did much to advance the study of this science. He ordered his astronomers to observe the movements of the sun, moon and stars, and showed them how to find out the commencement of the four seasons by means of certain stars. We read also that he told them that a year consisted of a little less than 366 days, and as he divided the year into lunar months, he taught them the years in which the additional lunar month ought to be included. It is also known that the Chinese had the annual calendar, that they observed the planets Mercury, Venus, Mars, Jupiter, Saturn, and were able to calculate eclipses, and knew the difference between the equator and the ecliptic. It is quite probable that the ecliptic was not known of before the Mussulmans occupied the Mathematical Tribunal, which they held for three centuries.

We see, therefore, that the knowledge of astronomy was very extensive. With regard to the meridian, it was apparently unknown to them. M. Chavannes, who is at present Professor of Chinese at the College of France, says that it is not mentioned in any astronomical book. As substitute a certain star was observed at the same hour, according to the times of the year, note being taken of its positions with regard to the horizon.

Astronomy has always been closely connected with astrology. By means of astronomy the time was ascertained for the numerous public ceremonies recorded in the Imperial calendar; it likewise regulated the affairs of the Government. But the calendar has long since ceased to be used for this latter purpose, and the majority of the Chinese population merely look upon it as a means of continuing the mysterious ceremonies and oracles connected with the different positions of the planets. It is ordered in the "Collection of the Laws," that at each eclipse, ceremonies should be gone through to deliver the eclipsed sun or moon. At this time therefore, an alarm is sounded on the drums, the mandarins arrive armed, utter many objurgations, and thus deliver the endangered bodies.

In the seventeenth century, certain Jesuit missionaries arrived in China. On seeing the low state into which the Mathematical Tribunal had fallen, they offered to help it. They found an observatory containing many instruments, which shows plainly that this branch of science had at one time reached an advanced stage. This decay of science is not to be wondered at when we remember that twenty-two dynasties were brought on the throne by actual revolutions. Nor is this decay confined to astronomy. According to the ancient books and traditions, we find that various branches of science had reached a high degree of culture.

The Emperor Kang-hi, who reigned in the seventeenth century, had a great love of study himself, and endeavoured to advance the general education in China. The Jesuit missionaries instructed him in geometry and physics. He translated some text-books into Chinese.

The Chinese have generally been credited with the invention of gunpowder. A certain document has been found, however, by Archimandrite Palladius, a Russian sinologue, stating that in the ninth century a Persian regiment, under the Chinese sovereign, made known a material similar to wild fire, which was afterwards used for fireworks.

Apparently, chemistry has never been studied, unless by a certain sect, the Tao-tse, who spent all their time endeavouring to discover the philosopher's stone and the elixir of life.

The Chinese have not a great knowledge of geology. The mines have been worked without any machinery, and are not very deep, therefore fire-damp has rarely been the cause of destruction. Coal was extracted at as early time as 200 B.C. in the dynasty of Han. Although the mode of extraction was very primitive, enough was obtained to satisfy all wants.

About 1861 the Government handed the exploration of the mines over to American prospectors. The work, lasting from 1862-64, was directed by Prof. Pumpelli, who at its termination sent the Emperor a report and a map of the coal-fields. The Smithsonian Institute of Washington have had these documents published; they have also appeared in the diplomatic correspondence of the United States (1864). Later on, Baron de Richtofen did similar work, and found that the coal-fields in China are even more extensive than those in North America.

Research work has not been carried far in natural science. In zoology their classifications are quite wrong. The drawings in zoological and botanical books can often scarcely be recognised. Their most ancient work on botany dates from 2700 B.C., and is a treatise written by the Emperor Shen-nung; it is merely enumerative. Another work, the "Rh-ya," dates from 1200 B.C., and shows signs of progress. The "Pen-tsao," an encyclopedia, is, according to M. Bretschneider, of little value.

This Russian investigator speaks of the Chinese as follows: "It is an undeniable fact that the Chinese do not know how to observe, and have no regard for truth; their style is negligent, full of ambiguities and contradictions teeming with marvellous and childish digressions."

However, in a more recent communication, M. Bretschneider retracts his words, and says that it is more that the Chinese will not observe, than that they cannot, for Lichi-Tchen, author of several interesting pamphlets, brings forward many facts concerning cultivated plants.

With regard to medical science, it is very elementary. Occasionally here and there a successful doctor is to be found. This lack of knowledge is not to be wondered at, for Buddhism forbids dissection of bodies. In the temple of Confucius a bronze figure is to be found, on which all the different parts are marked where the surgical needle

may be applied. This needle is practically the only instrument used in the profession.

The height of civilisation in China was reached at the end of the reign of Kang-hi. The gradual decline is supposed to have commenced with the Tartar domination.

THE FLORA OF THE GALAPAGOS ISLANDS.

DR. G. BAUR'S theory of the origin of the Galapagos Islands is too well known to need explanation here; yet it may be briefly designated the theory of subsidence. He argues that the islands were formerly connected with each other, and at an earlier period with the American continent. It is also almost needless to say that this theory has met with an exceedingly hostile reception ; few indeed accepting it, even as restricted to a former union of the islands themselves. The publication of an account of the botanical collections[1] affords an opportunity of examining this theory from a botanical standpoint. For the purposes of the "Botany" of the *Challenger* Expedition, and ever since the publication of that work, I have collected all the data coming under my notice bearing on the dispersal of plants to considerable distances by wind, water, birds or other creatures excepting human. The evidence thus collected sufficiently accounts for the vegetation of low coral islands, and the littoral vegetation of widely separated countries ; but it in no way helps to explain the vegetation of the enormously distant islands of the Antarctic seas, for example, or that of the islands of the Galapagos group, to give another instance.

But these are not parallel cases ; they are the two extremes in the amount of differentiation in connection with isolation.

The biological phenomena of the Galapagos Islands left a deeper impression, probably, on the mind of Darwin than those of any other part of the world he visited, and doubtless had much to do with his later conception of the origin of species. The fact on which he laid special stress was that the genera, to a very great extent, were the same in all the islands, and the species different in each island. Dr. Baur's much more extensive zoological and botanical collections and observations confirm and emphasise the correctness of the view of his illustrious predecessor of fifty years ago. Darwin specially refers to the existence of different species or races of tortoises and mocking-thrushes in many of the islands ; and Baur's examination of the lizards of the genus *Tropidurus*, from twelve of the islands, reveals the same condition of things. The botanists bring forward *Euphorbia viminea* in illustration of this phenomenon. This species was described by Sir Joseph Hooker from a single specimen collected by Macrae in Albemarle Island, and the author remarks that he "knew of no species with which to compare this highly curious one." Dr. Baur collected it extensively in eight of the islands, and the specimens from almost every one of them exhibit distinct racial characteristics. *Acalypha*, a genus of the same natural order, presents somewhat more pronounced variation in the different islands, which some botanists regard as of specific value ; other botanists as of varietal value only. Whatever status we give these forms, the flora as a whole is a most instructive and convincing illustration of evolution.

A remarkable peculiarity of the Galapagos flora, as an insular flora, is the almost total absence of endemic genera, for the two or three genera of the Compositæ restricted to the islands are so closely allied to American genera as hardly to count as distinct. Indeed the whole flora is so thoroughly American that, apart from geological difficulties, it might be regarded as a differentiated remnant thereof, rather than derived therefrom, after the supposed elevation of the islands. Analogous conditions and phenomena are repeated in the deep valleys of the great mountain chains of northern India and western China, where, in neighbouring valleys, the genera are to a great extent the same and the species different.

Returning to Dr. Baur's extensive botanical collections from the Galapagos, it may be mentioned that they yielded about a dozen new species belonging to the predominating genera.

Looking at the composition of the Galapagos flora, especially with an eye to the probabilities of the transport of the seeds of its constituents, combined with present conditions, Dr. Baur's theory seems deserving of more serious consideration than it has hitherto received. My very slender knowledge of geology alone prevents me from taking up a more decided position.

W. BOTTING HEMSLEY.

[1] B. L. Robinson and J. M. Greenman, in *American Journal of Science*, vol. l. pp. 135-149.

N.B.—Dr. G. Baur was attached to the United States Fish Commission steamer *Albatross*, and spent nearly three months in the islands, from June 10 to September 6, 1891.

THE LATE PROFESSOR HOPPE-SEYLER.[1]

II.

Hoppe-Seyler's Work in Berlin, 1850-54 *and* 1856-61.

IT has already been stated that Hoppe selected as the subject of his inaugural dissertation some observations on the structure of cartilage and on chondrin.[2] Chondrin had been first separated and examined by Johannes Müller,[3] and afterwards by Mulder and Donders. Pursuing his study of the chemical reactions of the so-called chondrin, Hoppe in 1852[4] described its lævorotatory property, and showed that when decomposed by long boiling with dilute mineral acids it yields leucine, but neither glycocine nor tyrosine. Still directing his attention to the connective tissues, Hoppe in the following year published a valuable and interesting paper[5] on the structural elements of cartilage, bone, and tooth. Virchow had shown[6] the possibility of isolating the so-called bone corpuscles. Hoppe now alleged facts which seemed to prove that the lacunæ and canaliculi of bone are lined by a tissue resembling elastic tissue, and are left surrounding the bone cells when decalcified bone is boiled in a Papin's digester. Extending his investigation to tooth, Hoppe studied the chemistry of the organic basis of dentine, and isolated the "dentinal sheaths," which he showed to correspond structurally and chemically to the more internal portion of the ground substance of bone, which may be separated as a distinct investment bordering the lacunæ, canaliculi, and Haversian canals. There can be no question of the important bearing which these early histologic-chemical researches had upon the development of our knowledge of the relations and affinities of the connective tissues; attention has been drawn to them for this reason, as well as because they differed somewhat in their scope and method from the work with which Hoppe afterwards mainly busied himself.

Passing over three interesting papers on auscultation[7] and communications of minor importance on chemical

[1] In the fragmentary notes which follow, I do not pretend to give a complete or entirely consecutive account of Hoppe-Seyler's labours ; my object is to draw attention to some of the principal results of his life-work, and to indicate in this way his position among those who, during the last half-century, have contributed to the advancement of biological science.—A. G.

[2] F. Hoppe, "De Cartilaginum Structura et Chondrino nonnulla," Diss. Inaug. Berol. 1850.

[3] Joh. Müller, *Poggendorff's Annalen*, vol. xxxviii. (1836) pp. 295-356.

[4] Hoppe "Ueber das Chondrin und einige seiner Zersitzungsproducte," *Journ. f. Prakt. Chemie*, vol. lvi. (1852) p. 129.

[5] Hoppe, "Ueber die Gewebselemente der Knorpel Knochen und Zähne,' Virchow's *Archiv*, vol. v. (1853) p. 170.

[6] Virchow, "Verhandl. d. Phys. Med. Gesellschaft zu Würzburg," vol. ii. p. 152.

[7] Virchow's *Archiv*, vol. vi. (1854) pp. 143-173, vol. vi. (1854) pp. 331-349, vol. viii. (1855) pp. 250-259.