from about 2,500 B.C. to 500 B.C. is a strange gap in India's cultural unity, but the immigration of the Aryans into India and their colonization may be fitted up somewhere into this period. The Mauryan art and architecture, the Graeco-Buddhist school of Gandhara, the western caves of India and the Brahminical temples in Western and Southern India have helped to give us a wealth of information to study India's more recent historic culture, art and architecture.

The foregoing accounts in the various chapters are suitably illustrated with a number of maps, sections, sketches and photographs. Those who wish to seek for more information will find the bibliographical references given at the end of almost every chapter very helpful. Investigation conducted in India in Geodetic Science has somehow failed to find a place in this excellent self-contained outline of the field sciences of India. However, the coloured orographic map of India inserted to form the frontispiece, " should enable the readers not only to locate the various places referred to in each chapter but will also give a clear idea of the physical features of the country, a knowledge of which is absolutely essential for a proper study of the field sciences ".

This composite publication—which so materially differs from any ordinary Gazetteer type both in the selection of its subject-matter and in the manner of its presentation, was meant to help the foreign delegates attending the Science Congress, to a proper appreciation of the manifold problems involved in the study in India of several field sciences. A glance through, clearly indicates that the book has amply fulfilled the original intention of the author of this scheme of publication. As pointed out in the Editorial Preface, the compendium will also have a much wider appeal to specialists and to the students of science in India—to the former because of its influence in creating a broader outlook and promoting co-operation amongst the workers in the various branches of science which involve an essentially " out-of-door " study ; to the latter because of the excellent manner in which it summarises within the range of a few small pages the vast amount of information scattered in the various official and other publications that have appeared from time to time.

The printing and get-up of the book is very good.

M. B. R.

CENTENARIES

By S. R. Ranganathan, M.A., L.T., F.L.A.
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Palmer, Henry Spencer (1838–1893)

H. S. PALMER, a royal engineer, was born at Bangalore, April 20, 1838. Having received his earlier education at private schools in England, he obtained admission to the British Royal Military Academy at a public competition in 1856.

His Career

Palmer was first appointed to the expedition to British Columbia (1858–1864) and was actively engaged in making surveys and explorations and was given a share in the construction of roads and bridges. From 1864 to 1873, he worked in the ordnance survey, except for a short visit to British Columbia in 1868–69 to survey the Senai Peninsula. In 1875, he assisted the New Zealand Government in placing the provincial surveys on a scientific basis. After serving in the Barbodas for a short while, he went to Honkong in 1878 and served there in various capacities till 1882. In 1884, his services were requisitioned by the Japanese Government for the construction of various water works and harbour works. Accordingly, he spent the last decade of his life in Japan.

His Scientific Work

In 1874 he was nominated the chief astronomer of the New Zealand party appointed for the observation of the transit of Venus. His industry and achievements were highly praised by Sir George Airy, the astronomer-royal. While at Honkong he designed a physical observatory, which is

said to be a model one. He also made an exact determination of that station in 1882.

Singing Sands

In his survey of Senai, Palmer made a special study of the Jebal Negus, which is a high sand slope about 200 ft. high and 240 ft. wide at the base, with an inclination of about 30°. Sandstone cliffs overhang it and bound it partially on either side. Excavation was impossible on account of the continuous flow of sands when disturbed. Palmer found by experiment that when surface sand, at a temperature of 103°, exposed to the sun's full glare, rolled gradually down the slope in thin waves an inch or two deep, there is heard, at first, a deep, swelling, vibratory moan, rising gradually to a dull roar, loud enough, when at its height, to be almost startling. Palmer communicated the results of his investigation to the British Association Meeting (1871) at Edinburgh. It is said that there is a similar singing sand slope at Reg. Ravin, forty miles north of Kabul. An exact explanation of this curious accoustic phenomenon is not yet said to have been given.

According to a quaint native legend founded on the former monastic occupation of this part of Senai, the sounds are said to proceed from the *Nagus* or " wooden gong " belonging to a monastery buried beneath the sand.

While engaged in designing an extensive system of graving docks and a repairing basin for the Yokohama harbour, Palmer died suddenly at Tokio, March 10, 1893.

Hyatt, Alpheus (1838–1902)

ALPHEUS HYATT, an American zoologist, was born in Washington D.C. April 5, 1838. His father being a leading merchant of the place, he was given every educational advantage. Under the influence of an early teacher, he was attracted to fossils and natural history. He entered the Yale College in 1856. But his mother, who desired him to become a Roman Catholic priest, sent him to Rome, hoping that the proximity to the Papal Court would serve her purpose. But Hyatt determined to devote his life to science. He returned to America in 1858 and began to study engineering. But he soon came under the influence of Louis Agassiz and took up the pursuit of natural history. Hyatt's admiration for Agassiz went so far that he is said to have learnt his famous *Essay on classification* by heart. He graduated from Harvard in 1862.

His Career

Having served in the Civil War, he returned to Cambridge, Mass. and again took up scientific work, having been placed in charge of the fossil cephalopads in the Museum of Comparative Zoology. In 1870 Hyatt became the custodian of the Boston Society of Natural History. He was Professor of Zoology and Palæntology at Massachussetts Institute of Technology from 1870 to 1888 and he also taught the same subjects at Boston University from 1877 to 1902. In addition he also conducted the Teachers' School of Science of the Boston Society of Natural History from 1872 to 1902. He assisted in establishing the Peabody Academy of Sciences (1867) and in founding the *American naturalist*, of which he was one of the editors from 1867 to 1871.

His Contributions

Recognising the great value of first hand contact within the laboratory with animal forms, he helped in the foundation of the Wood Hole Marine Biological Laboratory, which is the chief of its kind in America and he also became its first President.

His chief contribution to thought was in establishing exact methods of investigation in phylogenic and ontogenic studies. While his terminology was technical and sometimes made his writings hard for a beginner to read, his ideas were remarkably stimulating. The principles he enunciated constitute the foundation of a young and vigorous school of evolution, which is making itself felt in the scientific world. His basic paper on the subject is entitled the *Phylogeny of the acquired habit* and it came out in the *Proceedings of the American Philosophical Society* in 1894.

Hyatt was active to the last moment. As he was on his way to attend a meeting of the Boston Society of Natural History, he died suddenly of heart failure, January 15, 1902.

Billings, John Shaw (1838-1913)

JOHN SHAW BILLINGS, an American surgeon and librarian, was born in the State of Indiana, April 12, 1838. As a boy, John read voraciously and made an agreement

with his father to waive all claim to an inheritance in favour of his sister, if his father would help him through college. He graduated at Mimi University in 1857 and at the Medical College of Ohio in 1860. During the Civil War he served as a surgeon from 1861 to 1864. In the latter year, he was transferred to the Surgeon-General's Office. After retirement from this office, some thirty years later, he became the director of the New York Public Library, which was just then formed, and continued in that position till his death.

His Contributions

(1) *Hospitals.*—About 1873, John Hopkins of Baltimore died, leaving a generous endowment for a great hospital. The trustees asked five experts to design the building and sketch out the organisation. The plans of Billings were accepted and Billings became the medical adviser of the trustees. In this capacity, he prepared a series of reports upon hospital construction and organisation and the relation of hospitals to the training of nurses and medical men, which have become classical. In one of them he wrote "A sick man enters the hospital to have his pain relieved—his disease cured. To this end the mental influences brought to bear upon him are always important, sometimes more so than the physical. He needs sympathy and encouragement as much as medicine. He is not to have his feelings hurt by being, against his will, brought before a large class of unsympathetic, noisy students, to be lectured over as if he were a curious sort of beetle....In this hospital I propose that he shall have nothing of the sort to fear". With these words Billings swept away the old fashioned clinical lecture.

(2) *Preventive Medicine.*—Billings was also a pioneer in preventive medicine. He was one of the original members of the American Public Health Association (1872). His persistent efforts to root out the alarming epidemic of yellow fever won for him the presidentship of that Association (1879). He specialised in vital statistics, which is an indispensable foundation of preventive medicine. He was in charge of the vital statistics of the censuses of 1880 and 1890. In this capacity, he introduced corrected death rates and life tables. He is said to have been the first to suggest the possibility of mechanical methods of tabulation.

(3) *Medical Bibliography.*—It is not without significance that Andrew Carnegie selected him as one of the foundation trustees of the Carnegie Institution of Washington. Speaking at the Billings Memorial Meeting at the New York Public Library, Osler said, "Years after the iniquity of oblivion has covered Dr. Billings's work in the army, as an organiser in connection with hospitals, and even his relation to this great library, the great Index will remain an enduring monument to his fame". He added "There is no better float through posterity than to be the author of a good bibliography". The reference in these remarks of Osler are to

(i) the *Index medicus* which was planned and founded by Billings and Fletcher in 1879 as a monthly guide to current medical literature and of which they were joint editors for the first twenty years; and

(ii) the *Index catalogue* of the library of the Surgeon-General's Office, of which 49 volumes have been published so far at a cost of about Rs. 49,00,000.

This *Index catalogue* is pronounced on all hands as "America's greatest contribution to medicine". As the first librarian of the library of the Surgeon-General's Office, who conceived the idea of such a catalogue, who planned it sixty years ago in a way that is still pursued as the most helpful one and who brought out the first sixteen volumes under his own direction, Billings is rightly claimed to be "America's greatest bibliographer". When Billings was nominated for membership in the National Academy of Sciences, his claim to this high distinction was founded by his friends upon his application of skill in scientific classification.

A Rare Fulfilment

In some reminescences of his younger days, Billings speaks of his student aspiration, "to try to establish for the use of American physicians a fairly complete library and in connection with this prepare a comprehensive index which should spare medical teachers and writers the drudgery of consulting thousands or more indexes or the turning over the leaves of many volumes to find the dozen or more references of what they might be in search". The opportunity he craved when young came by a singular good fortune into his possession in 1864 when he was appointed the first librarian of the library of the Surgeon-General's Office (now known as Army

Medical Library). Billings took charge of the library with less than 1,000 volumes and left it with 300,000 volumes. Its stock is now fast approaching 1,000,000 volumes, constituting the biggest medical library in the world.

To keep abreast of a library growing at that rate and to index its contents closely would require an unfailing fund of energy and an industry which would never need the refreshment of idleness. Billings had that rare gift—the industry of the minute. When somebody suggested to him "the need for leisurely play and the exercise of open air sports, he said that he obtained recreation by turning from one form of brain use to another. That was play enough".

Billings died of pnueumonia after an operation, March 11, 1913.

ASTRONOMICAL NOTES.

Eclipses.—There will be two eclipses occurring during May, both of them invisible in India;—a total eclipse of the Moon on May 14 and a total eclipse of the Sun on May 29. The line of totality of the solar eclipse lies in the southern part of the Atlantic Ocean.

Planets during May 1938.—Venus will be a bright object visible in the western sky soon after sunset; Mercury can be seen as a morning star throughout the month: on May 4 it will be stationary and on May 19, its elongation from the Sun will be greatest (25° 37′W.), when it will be visible for nearly an hour and a half before sunrise.

Mars, although not favourably placed for observation, can still be seen low down in the western sky at sunset. A very close conjunction of the planet with Venus will take place on May 8, the angular distance between the two being only about two minutes of arc. Jupiter rises about midnight and will be a conspicuous object in the sky in the latter part of the night; on May 22, the planet will be in quadrature with the Sun. Saturn will continue to be visible as a morning star rising about three hours before sunrise. Uranus passes conjunction with the Sun on May 4 and towards the end of the month can be seen low down in the eastern sky a little before sunrise. It will be about a degree to the north of the star σ Arietis. Neptune is situated in the constellation Leonis very near the star σ Leonis (magnitude 4·1).

The minor planet Vesta will be in opposition on May 21 and can just be seen with the naked eye, its magnitude at the time being 5·9. It will be moving in the constellation Scorpio and can be picked up midway between the two-third magnitude stars ϵ Ophinchi and β Scorpii.

The Variable Star VV Cephei.—For the last thirty years the star VV Cephei was recognized to be a variable whose brightness was fluctuating between 4·9 and 5·6 magnitudes. Little was known about the nature of its variation and the star was classified as an irregular variable. In an interesting paper (*Harvard Circular* 421) Dr. Gaposchkin has discussed in detail all the available photometric and spectroscopic observations obtained at various places during the last forty years. He concludes that the star is an eclipsing binary with a period of 20·4 years. The system, he finds, consists of a supergiant red star of M-type spectrum and a smaller blue star of spectral type B. The giant star has a diameter 2,400 times that of the Sun and a mass 44·5 times the Sun's mass. The smaller component whose diameter is only one-hundredth of that of the larger, has a mass, equivalent to 35·4 times the mass of the Sun. The supergiant star appears to be about five times larger than the largest star yet known. The approximate distance of the system is estimated to be one thousand parsecs.

T. P. B.