early 19th centuries. India was to them a laboratory that supplied novel and interesting data for the inductive generalisations of a science that had been developing in Europe from Theophrastus to Linnaeus. The Botanical investigations of these Europeans in India were thus new contributions to the already growing fund of European Botany and flourished absolutely independent of what the ancient Hindu masters might have observed and recorded, preserved and developed till the days of the Maratha hegemony.

The terms "Indian Botany" and "Indian Forestry" are thus really misnomers[2], for they do not indicate anything beyond the fact that the rich flora lying within the geographical limits of India have been identified, named, registered, tabulated and described, botanically or economically, according to the terminology, nomenclature and taxonomy of a science that was then passing through its infantile stages. The sole interest of the pioneers of the so-called "Indian Botany" was identification and botanical description of the vegetable denizens of India in the interest of European science, industry and commerce.

In 1790 Sir William Jones, founder and first President of the Asiatic Society of Bengal, gave a discourse on the medicinal plants of India in which he clearly indicated the lines of work that should be followed by botanical explorers and writers:—"Some hundreds of plants, which are yet imperfectly known to European Botanists, and with the virtues of which they are wholly unacquainted, grow wild on the plains and in the forests of India. The *Amara-kośa*, an excellent vocabulary of the Sanskrit language, contains in one chapter the names of about three hundred medicinal vegetables; the *Medinî* may comprise many more; and the *Dravyâbhidhâna* or Dictionary of natural productions, includes, I believe, a far greater number; the properties of which are distinctly related in medical tracts of approved authority. Now the first step, in compiling a treatise on the plants of India, should be to write their true names in *Roman* letters, according to their most accurate orthography, and in *Sanscrit*, preferably to any vulgar dialect; because a learned language is fixed in books, while popular idioms are in constant fluctuation, and will not perhaps be understood a century hence by the inhabitants of these Indian territories whom future botanists may consult on the common appellations of trees and flowers."[1]

The founder of the first oriental research society in India was naturally anxious to do spade-work[2] for enriching European art, industry and science. Exactly similar were the motive and enthusiasm that inspired the *Flora Indica* (1855), the monumental work on Indian Botany, prepared at Kew, under the direction of Dr. Hooker, at the chief cost of the Secretary of State for India.

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[1] *Asiatic Researches*, Vol. II. XXII. pp. 270-271.

[2] Another such modern misnomer is *Indian Economics*, a term which does not seem to mean anything beyond the description and cataloguing of the present day economic resources and organisations of the country.

In 1874 Mr. C. B. Clarke, in the Preface to the Reprint of Roxburgh's pioneer-work[1] on Indian Plants, describes the merits of Hooker's labours which were directed mainly to a proper identification and cataloguing. "The Kew Indian Flora is of the highest value to Botanists, it tells those in India what material there is at Kew and *how the names are arranged*[2] there. And it will, when finished, form the foundation on which all future botanic work in India will be grounded. After the plants have been botanically *determined* and the *names attached, so that we are tolerably sure in general that we all mean by the same name the same thing,* we may commence economic and other branches of investigation with advantage. Drs. Hooker and Thomson have rightly urged that the Botanical determination of the plants must come first before any satisfactory progress elsewhere can be made ; and Indian Botanists have been right for generations in concentrating and narrowing their work in the manner that Drs. Hooker and Thomson indicated."

Identification and Determination of Indian Plants were thus the principal objects of the founders of the so-called "Indian Botany." There were some investigators who were not content with mere cataloguing and botanising, but added to these a study of the economic uses of Plants, as medical drugs or otherwise. Thus, to quote Mr. C. B. Clarke again, "Roxburgh contains all the economic Indian botany known to him. * * * Roxburgh is most trustworthy in his economic botany. * * * The Government of India but a few years back, called on Mr. Kurz to draw up a Forest Hand Flora for Burma which should comprise (among other things) a classified account of the different sets of forests, with all the trees in each, and the plants that usually accompanied each: an account of the method and habit of growth of each tree, and an account of the quality of the wood of each, and a special account of all the species likely to prove of economic value."

In his paper[3] on the study of indigenous drugs, Surgeon-Captain (now Major) B. D. Basu, I. M. S. gave an account of the work of scholars in the medical department of the economic aspects of Indian Plants from the establishment of the Asiatic Society of Bengal to 1891. "In the beginning of this century John Fleming contributed a valuable paper on the medical plants of this country. For the first time the scattered information on the subject was collected and placed before the medical profession. * * * Dr. Waring, who edited the Indian Pharmacopoeia,[4] was one of the most painstaking and careful observers of the properties and uses of indigenous drugs. His attention was drawn to the subject when serving out in Burma. The stock of

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[1] Roxburgh's *Flora Indica* was published in 1832.

[2] The Italics are ours.

[3] *Indian Medical Gazette*, August, 1892.

[4] Published under the authority of the Secretary of State for India "with the view of bringing to the notice of the profession in India those indigenous drugs which European experience has proved to possess value as medicinal agents, and which may be employed as efficient substitutes for imported articles."

his European medicines having been exhausted, he was in great perplexity and hardly knew what to do. In such a crisis, he turned to the medicinal plants of the country. He found indigenous drugs to answer his purpose as satisfactorily as the costly imported medicines of Europe."

Enough has been said to show that, during the period from the last two decades of the 18th century, the sole aim of botanical researches in India has been

(1) to study scientifically or economically the vegetation of the Indian continent, according to the accepted doctrines of contemporary European thinkers;

(2) to look upon India solely as a vast herbarium supplying specimens for the scholars in the western world; and

(3) to ransack or exploit Indian vegetation in the interest of a foreign industry, commerce and science.

There has been no attempt

(1) to take stock of the existing Hindu literature on the subject of plants, whether *as plants*, or as drugs and useful commodities, or

(2) to maintain and continue the studies of the ancient and mediaeval scholars of India (whether scientific or utilitarian), and develop the intellectual heritage bequeathed by them to posterity. Thus, during the period which has witnessed the growth of Botanical sciences, arts and industries from the insignificant juvenile condition (which was almost on a par with that obtaining among the Hindus) into one of immense magnitude, the genuine Indian Botany, which should have been a continuation and further development of the work of the ancestors of the present race of Indians, is not only where it was, but has been managed to be forgotten and thrown into the limbo of oblivion, from which it is today impossible and even regarded as unnecessary to rescue.

The so-called 'Indian Botany' of the modern times, pioneered by Europeans and collaborated at both by Indian[1] and western scholars, covers really an insignificant niche in the daily-growing museum of the sciences, arts and economic products built up by the people of western countries And Indians are left in the position of mourning over a national loss: "When we remember how great a part Indian plants have played in contributing to the material and spiritual wealth of India, and in influencing Indian life in its manifold aspects; and when we take into consideration the important place Botany should occupy in every scheme of liberal education, not only as a particular branch of physical science, but also as the most stimulating and refreshing subject of learning, we can estimate the loss both in intellect and material wealth we have been suffering from owing to the neglect of this study. The irony of the situation is that we do not see that the study is the cheapest and

[1] Important Indian names are Uday Chand Dutt, Moodeen Sheriff, K. R. Kirtikar, T. N. Mookerji, N. G. Mookerji, Upendra Nath Kanjilal, Bhaudajee, Naraindajee, B. D. Basu, Sakharam Arjun, Lisboa, Ranade, Kanay Lall Dey, Kaviraj Biraja Charan Gupta.

least expensive. To add to the tragedy, we forget that the study is also the most paying; for India is *the* country where worldly careers and lucrative professions can be built up on the products of the vegetable kingdom alone."[1]

In the history of Hindu Botany, then, the whole 19th century—the period of Botany strictly so called in Europe—is a total blank. It has not only given rise to no men who could undertake independent original investigations in the scientific aspects of Plant-life, but has even produced none who could collect, summarise, and adapt or modernise the teachings of their forefathers. The practitioners in the *Ayurvedic* system of medicine have but kept up a tolerable second-hand familiarity with the names and uses of the indigenous medicinal plants, through the services of professional herbalists, the Musheras in Central and Upper India,[2] the low caste Maules, Bâgdis, Pods, Chandâls, Kaoros and Karanges in Bengal, and the Chandras, Bhils and Gâmtâs in Bombay.

3. *Summary of Researches in Hindu Botany.*[3]

Under these circumstances, it is not strange that people should entertain doubt regarding the achievements of Hindus in botanical science and the existence of such a thing as the Science of Botany in ancient Hindu literature. The field is altogether untrodden, and awaits the thankless labour of patient investigators, who must be adequately equipped with the double engine of a thorough mastery of modern Botany and a general grasp of the several branches of Hindu literature. And the problem is to carefully glean from the extraneous literary, medical and economic associations, in which the plants have been mentioned by Hindu authors, the abstract ideas and purely scientific concepts, if any, regarding their life-history, morphology, physiology, habit &c.

In the following pages quotations from the works on subjects more or less allied to these topics are being appended, to give an idea of the up-to-date research undertaken.

(*a*) *Gondal.*

The Thakur Sahib of Gondal's *History of Aryan Medical Science*,[4] though not the first work on the subject of Hindu medicine, contains perhaps the first treatment of Hindu Botany. The following is taken from Chapter VII, called Indian Materia Medica. The Ancient Aryans have taken the trouble to examine and study all the herbs that came under their observation, and classified them into groups or *Gaṇas*. Charaka gives fifty groups of ten herbs

[1] *The Economic Botany of India* by Prof. Bhim Chandra Chatterji (published by the District Council of National Education, Malda, Bengal 1910), pp. 12-13.

[2] See the paper *On the Study of Indigenous Drugs* By Surgeon-Captain (now Major) B. D. Basu, I. M. S., in the *Indian Medical Gazette*, July 1891.

[3] See the history of mineralogical literature for the names of treatises dealing with plants and plant life. Mineralogy, Chemistry and Botany of the Hindus are to be culled mainly from their medical literature. Non-medical literature is also likely to yield genuine scientific notions, if critically studied.

[4] Published by Macmillan & Co., London, 1896. Previous works are those of Drs. Wise and Udoychând Dutt.

each, which, he thinks, "are enough for the purposes of an ordinary physician"; though at the same time he adds that "the number of groups can be increased to any extent." Similarly, Susruta has arranged 760 herbs in 37 sets, according to some common properties. Other writers have added to the list, which forms an interesting literature of the materia medica of India. They have also described the proper seasons for gathering the herbs, the period of their growth, when they possess their distinctive properties, the localities from which they should be collected, and the manner of treating them, extracting their active principles, and preserving them. Some of the groups[1] mentioned by Indian writers are given below :—

1. Anga marda praśamana (anti-spasmodic), as Vidarigandhâ (Costus speciosus)

2. Anuloma (Cathartic), as Haritaki (Terminalia chebula)

Agnivesa enumerates no less than 500 classes of medicinal agents, arranged according to their real or supposed virtues in curing diseases A few classes have been selected from this and other sources and noted above.

The chief notable feature in connexion with the nomenclature of the Indian plants is that in several cases their names are descriptive either of their character or of their property. A few instances of names,[2] descriptive of the prominent specific character of the herb, may be given below :—

(*a*) *Brachyramphus sonchifolius* is called Âkhu-karṇî (rat-eared), as the leaves of the plant resemble the ears of a mouse

(*b*) *Acorus calamus* is called Ugra-gandhâ (strong-smelling), because it gives off a very pungent odour.

(*c*) *Clitoria ternatea* is called Go-karṇî (cow-eared), from the supposed resemblance of the seeds to the ears of a cow.

(*d*) *Datura alba* is called Ghantâpuṣpa (bell-flower), from the shape of its flowers.

The following are a few names[3] descriptive of the inherent virtue of the herb :—

(*a*) *Amygdalus communis* is called Vâta-vairî (wind-enemy), as it cures disorders of the wind.

(*b*) *Embelia ribes* is called Krimighna (worm-killer), from its anthelmintic properties.

(*c*) *Ophelia chiretta* is named Jvarântaka (fever-ending), for it is supposed to check fever.

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[1] A list of 75 names has been given by the Thakur Sahib. See pp. 104-110.

[2] A list of 10 names has been given. See pp. 110-11.

[3] A list of 10 names has been given. See pp. 111-113.

(*d*) *Semecarpus anacardium* is known as Aruskara (eschar-causing), because when applied to a living part its juice gives rise to an eschar.

Each successive writer, after a patient and careful investigation, appears to have added new drugs [1] to the existing list. Some of the writers emphatically assert that all curative agents mentioned in their treatises have been thoroughly tested and recommended after a long practical experience. Susruta strongly recommends that physicians should be able to identify the various remedial agents they have to deal with. They should personally go to the jungles, and with the help of shepherds, graziers, ascetics, travellers and others familiar with the forest, gather the herbs when they are in flower, taking care to avoid those injured by insects, or growing in situations containing nests of white ants, or where bodies have been burnt or buried, or from ground in which there is much salt. Narahari Pandit (author of *Râjanighantu* of the 17th century) describes the properties of different kinds of soil, the nature of soils suitable for the cultivation of various medicinal plants, varieties of trees, cereals, oils, vegetables, roots, leaves, flowers and fruits.

(*b*) *Dr. Sen.*

It would appear that the Thakur Sahib did not approach the subject from our standpoint, *viz.*, the study of the strictly scientific ideas of the Hindus regarding plants and plant life. However, no subsequent scholar has interested himself in the subject to any special extent, and this is all that constitutes the foundation of modern researches in ancient Hindu botanical studies.

In his paper on the study of medical science in ancient India,[2] Dr. Gaṇanâth Sen gives the following paragraph on the subject: "In Botany, unfortunately, very scanty records have been left in the writings of Râghava Bhatta and Sârangadhara—an important section of which (*Upavanavinoda*) the humble writer of this paper had the honour of editing and translating some years ago. The informations contained in these books are numerous. Plants have been called *sthâvarajîva*, or fixed animals, and pleasure and pain have been attributed to them. (Compare in this connection the recent discoveries of *Plant Response* by the illustrious Dr. J. C. Bose of Calcutta). Again, plants have been called *sexual* and *a-sexual*, although the details of the sexual phase are missing. Much advance in the practical application of Botany appears to have been made. A regular symptomatology of plants has been described under the name, *Brikṣâyurveda*, and the treatment of certain diseases of plants has been stated. Then, again, an interesting science of finding out *sub-terranean veins of water*,[3] as the geologist calls them, has been briefly described by certain signs, which, says tradition, often come off correct."

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[1] See *Hist. of Ar. med.* 8c. pp. 118-123, for the new drugs introduced by successive writers. The Thakur Sahib's chronology requires to be corrected in the light of recent research, *e.g.*, of Dr. P. C. Ray in the *History of Hindu Chemistry*.

[2] Read at the *Sâhitya Sabhâ* of Calcutta, September, 1906, published by the same society in 1908.

[3] Cf. Chapter LIV of *Bṛihat Samhitâ*, called *Daṗârgalam*.

(c) *Prof. Chatterji.*

In the *Economic Botany of India*[1] by Prof. Bhim Chandra Chatterji of the National Council of Education, Bengal, there are a few more details about the achievements of Hindus in the field of botanical science, with remarks as to their relative, historical and comparative values by reference to the progress of the science in Europe. His general remarks on Indian Botany are given below: "This characteristic of Indian culture[2] that it was essentially practical, meant for and adapted to, the thousand and one duties of actual life, has made it always very comprehensive, all-embracing, and all-inclusive. Every Sâstra or Purâṇa or Samhitâ has thus become an Encyclopædia; * * * and, as in the physical, so in the human sciences, we search in vain for the differentiation of knowledge into various branches corresponding to the various aspects of human life. We have no Indian psychology, no Indian ethics, no Indian politics, just as we have no Indian physics, no Indian chemistry, no Indian botany, and so forth, as independent and distinct branches of learning, differentiated from the treatises on universal knowledge.

"* * * European Botany has had a far different history. * * * Not only were the main branches of learning divided among specialists for exclusive study; but each of the various departments of the same branch began to enlist on its behalf the whole time and energy of special sections of the devoted men of science. Add to this the intellectual energy of Europe that became multiplied by being divided and differentiated for the furtherance of national interests and promotion of national glory (owing to the creation of national churches, national states, national literatures, and national schools), and we may form an idea of the enormous labour that has been spent ungrudgingly upon what is to-day a vast Botanical science, which, again, is being split up into independent sciences, distinct from one another.

"But Indian Botany has claims to our recognition on *absolute* grounds as well, as having suggested, recognised or discovered some truths about vegetable life which are accepted by modern phytotomy and physiology."

In Internal Morphology we have such descriptions as those of *Tinospora cordifolia* (Guduchi) which is characterised as *Chakrângi*, *Kundali*, *Mandali*, &c,—terms referring to the annular rings so prominent in the cross-section or transverse section of the creeper. Metamorphosis of leaves, descriptions of characteristic leaves according to the similarities with the animal world, knowledge

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[1] This brochure was published by the District Council of National Education, Malda, (Bengal) in 1910 and intended to interest people in the forthcoming work on *Indian Medicinal Plants* (a Systematic study, along modern scientific lines, of the most important medicinal plants of India, specially those mentioned in the original Sanskrit works, and also of several other useful plants) with 1800 plates, by Lt. Colonel K. R. Kirtikar, Major B. D. Basu, Prof. Bhimchandra Chatterji and an I. C. S. The work has been in the press for some time and will be published by the Pâṇini Office, Allahabad, in 1915.

[2] Pp. 23-24.

of adventitious roots &c., may be referred to as evidences of the study of external morphology. In physiology it must be credited to the Hindus that they know of plants as living organisms. Prof. Chatterji quotes from the *Sântiparva*[1] of the Mahâbhârata to prove their acquaintance with the sap-circulation[2], nourishment, power of movement, independent growth and reproduction of plants. "It reflects great credit on those scholars that they conceived the idea of the sexuality of plants and the truth that flowers are the organs of sexual reproduction in higher plants--notions which were first suggested by Camerius towards the close of the 17th century and which have been demonstrated in the 18th and 19th centuries by the studies of Koelrenter, Herbart and Gaertner in hybridisation. To express this sexuality some are even expressly named as such, *e.g.*, *yonipuṣpa* (Cletoria termeata), *lingapuṣpa* (Nerium odorum), meaning respectively the female and the male--and these, together with such terms as *vajrapuṣpa*, menstrual blood of a certain type in Tantra, would lead to the idea that the fact of the flower being the genetive organ of the tree was not unfamiliar to them."

Phosphorescence[3] and exudation[4] of water were probably known. The

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[1] घनानामपि वृक्षाणामाकाशोऽस्ति न संशयः ।
तेषां पुष्पफलव्यक्तिर्नित्यं समुपपद्यते ॥
ऊष्मतो म्लायते पर्णं त्वक् फल पुष्पमेव च ।
म्लायते शीर्य्यते चापि स्पर्शस्तेनात्र विद्यते ॥
वाय्वग्न्यशनि-निर्घोषैः फलं पुष्पं विशीर्य्यते ।
श्रोत्रेण गृह्यते शब्दस्तस्माच्छृण्वन्ति पादपाः ॥
वल्ली वेष्टयते वृक्षं सर्व्वतश्चैव गच्छति ।
नह्यदृष्टेश्च मार्गोऽस्ति तस्मात् पश्यन्ति पादपाः ॥
पुण्या पुण्यैस्तथा गन्धैर्धूपैश्च विविधैरपि ।
अरोगाः पुष्पिताः सन्ति तस्माज्जिघ्रन्ति पादपाः ॥
पादैः सलिल-पानाच्च व्याधीनाञ्चापि दर्शनात् ।
व्याधि-प्रतिक्रियत्वाच्च विद्यते रसनं द्रुमे ॥
वक्त्रेणोत्पलनालेन यथोर्द्ध्वं जलमाददेत् ।
तथा पवनसंयुक्तः पादैः पिबति पादपः ॥
सुखदुःखयोश्च ग्रहणात् छिन्नस्य च विरोहणात् ।
जीवं पश्यामि वृक्षाणामचैतन्यं न विद्यते ॥ शान्तिपर्व्व, महाभारत ।

[2] Sap-circulation was discovered by Harvey in the 17th century.

[3] वनेचराणां वनितासखानां दरीगृहोत्सङ्गनिषक्तभासः ।
भवन्ति यत्रौषधयो रजन्यामतैलपूराः सुरतप्रदीपाः ॥
तां हंसमालाः शरदीव गङ्गां महौषधिं नक्तमिवात्मभासः ।
स्थिरोपदेशामुपदेशकाले प्रपेदिरे प्राक्तनजन्मविद्याः ॥ Kumârasambhavam.
ज्योतिष्मती तु कटभी सुवर्णलतिकेति च ।
ज्योतिष्काख्याऽग्निभासा च स्वर्णोक्ता च दुर्ज्जरा ॥ Dhanwantari-nighantu.
ज्योतिष्मती स्वर्णलताऽनलप्रभा ज्योतिर्लता सा कटभी सुपिङ्गला ।
दीप्ता च मेध्या मतिदा च दुर्ज्जरा सरस्वती स्यादमृतार्कसंख्यया ॥ Râjanighantu.
स्वादुकन्दी लवणतोया वज्जीवन्यमृतस्रवा ।
रोमाञ्चिका महामांसी पवनी सुधास्रवा Râjanighantu.

knowledge of Heliotropic movement is indicated by such terms as *Âdityakrânta*, *Suryabhakta*, etc., that of Nyctitropic movement by such terms as *Anjalikârikâ* (folded palm), *Namaskâri* (plant which bows down), *Sparsalajjâ* (which feels bashfulness at touch), referring to *Mimosa pudica*. Rejuvenation, separation and multiplication of the individuals which are so essential requisties of reproduction seem also to have been well understood.

Prof. Chatterji traces in the Rig Veda (VIII—47-9 and II, 1-14) the knowledge of Photosynthesis and the action of light and storage of energy on plants. The facts that the sun is the source of energy in the fuel, that it is the setting sun, *i.e.*, that having less refractive rays whence the energy is transformed and kept in the potential form in the fuel, and that this potential energy is manifested as fire or heat, are also known.

The two points, (1) the assimilation of potential energy from the sun and (2) the special suitability of red, orange and yellow rays for the more effective assimilation of plants, *i.e.*, for the storage of energy in the potential form, are definitely suggested in the following :—

अपूस्वमे सधिष्टव सौषधीरनुरुध्यसे गर्भे सञ्जायसे पुनः । Rig. viii. 43-9.

त्वे अग्ने विश्वे अमृतासो अद्रुह आसादेवा हविरदन्त्याहुतम् ।
त्वयायान्तः स्वदन्त आसुतिं त्वं गर्भो वीरुधां जज्ञिषे शुचिः ॥ Rig. 2-1-14.

अग्नावोषधिषु च तेजोनिधाय रविरस्तं यातीति आगमः । Mallinâtha.

दिनान्ते निहितं तेजः सवित्रेव हुताशनः । Raghuvamsam.

The first of these is clearly stated in the above by the terms "गर्भे सञ्जायसे पुनः" "त्वं गर्भो वीरुधां" and in the whole of the last texts, which further show that the sun is the source of the energy in the fuel and that it is the setting sun, *i.e.*, having the less refractive rays whence the तेजः or energy is transformed and kept in the potential form, which is manifested as fire or heat.

The *Theory of Evolution* has been described in the following —

(1) तत्तादात्मन: आकाश: सञ्जायत । आकाशात् वायु: वायोरग्नि: अग्नेराप: अद्भ्य: पृथिवी, पृथिव्या ओषधय: ओषधिभ्योऽन्नं अन्नात् रेत: रेतात् पुरुष: । Chhândogya Upaniṣat.

(2) स्थावरं विंशतेर्लक्षं जलजं नवलक्षकं
कूर्मास्च नवलक्षाश्च दशलक्षं च पक्षिण: ॥
त्रिंशल्लक्षं पशूनाञ्च चतुर्लक्षं च वानरा: ।
ततो मनुष्यतां प्राप्य तत्तत्कर्म्माणि साधयेत् ॥
एतेषु भ्रमणं कृत्वा द्विजत्वमुपजायते ।
सप्तर्षीणि परित्यज्य ब्रह्मयोनिमतोऽभ्यगात् ॥ Brihat Viṣṇu Purâṇa.

In the *Brihat Viṣṇu Purâṇa* an attempt has been made to give the successive stages of development of man to even *Brahmayoni*, the highest form of existence. The *Phylogenetic* and *Ontogenetic* developments are laid down as well as the comparative duration of the stages. The successive number of stages would indeed be visible only after thousands of years of persistent scientific observation of a race of Darwins.

Two things should be further noticed in the text of *Brihat Viṣṇu Purāṇa*. First, that aquatic life precedes the monkey life, and that the monkey is the progenitor of man. Again, the descent of man from some aquatic animal, although by a remote degree, is grasped with equal acuteness. These ideas are attributed to Darwin; and our countrymen are scarcely aware of the fact that the truths did not fail to strike the savants of ancient India.

Vidyāpati has given the order from the highest to successive lower stages:—

किर नाशुय पशु पाखी भये जनमिये।
अथवा कीट पतङ्ग॥
करम बिपाक गतागत पुन पुन।
मतिरहु मुया पर सङ्ग॥

That Indian literature should contain such a full account of the evolution of the animal kingdom from the vegetable world, which could be seen only by a Darwin or a Hæckel in such recent times as the 19th century, ought to inspire thoughtful Indians with a noble vanity, and should infuse into our countrymen a spirit of research with a view to finding out the truths in our Śāstras.

"The idea of gradual evolution of higher organisms from lower, was familiar to the Greek philosophers, but a scientific basis was given to this hypothesis in the last century" (Strasburger). Says Prof. Chatterji: "Is it not our duty to demonstrate to the world that the Hindu sages conceived the idea long before it was dreamt of by any other nation, and as such, their names should precede those of any other philosophers? Had the commentators been as acute in explaining these texts, Darwin might have been anticipated in our country long before his name could be heard in the world; or is it that some such commentators lie unnoticed in the dark caves of the Himālayas?—"Some mute inglorious Milton here my rest!"

In all the above, however, I would only remark that these truths of Botanical Physiology were known to the Hindus simply *as facts*, but no trace has been found as yet regarding their knowledge of the "science" of physiology, *i.e.*, as to *how* these take place in nature; in short, they have observed the facts without caring to 'explain' them or *assign reasons*. And here, again, as in so many other things, we have to continue, by our specialised efforts, the work of our ancestors, and develop them along the proper lines, just as the European scholars of the 17th, 18th and 19th centuries have, by their own labours, improved upon, and added to, the heritage bequeathed by their ancestors of the classic age.

In *Systematic Botany* nothing approaching the keen observation and generalisation of modern times is to be found. One peculiarity has not been traced through a sufficiently large number of plants, and we find only isolated instances of two or three plants classified under one group. Thus, सरल (*Pinus longifolia*) and देवदार (*Pinus deodara*) are placed in one group, *i. e.*, one is described just after the other in *Madanapāla-Nighantu*, and such instances are found in abundance in all the authors. चिलगोजा or चिलोगोजा (*Pinus gerardiana*) could have also been placed in the same group, but, instead, it is named along with अखोड़ (*Juglans regia*), etc.

The basis of classification is the property of the plants; *e.g.*, in चन्दनादिवर्ग all sweet-scented things, such as Sandal wood, are mentioned, and in शाकवर्ग all vegetables. In these, however, further subdivisions are made, and here we find some more systematic arrangement, as all कर्कोट, (*Cucurbita papo*), कुष्माण्ड (*Benincasa cerifera*) etc., are grouped together. When one thing has more than one property it is grouped to bring out, as in *Cucurbitaceæ*, the most prominent characteristic, the whole being adjusted to the convenience of a practical man.

खदिर (*Acacia catechu*), रक्तखदिर (*Acacia sundria*), श्वेतखदिर बिट्खदिर (*A. farnesiana*) and अरि (*A. pennata*) are all put together in Dhanvantari and in Râja-nighantu in शाल्मलीवर्ग, which is based on the common possession of thorns. Again, many of the plants in *Cucurbitaceæ* have been placed together most possibly for similarity of the fruit. पाषाणभेद, वटपत्री, श्वेतशिला, चतुष्पत्री in *Saxafraga* and निम्ब (*Melia azadirachta*), महानिम्ब (*Melia azadirachta*), कडर्य्य (*Alianthus excelsa* Roxb), of the *Melianceæ* order, have been placed together for the similarity of the bitterness of the principle in flowers, fruits and leaves. Plants producing bulbs are sometimes placed together. So, in short, any quality or peculiarity has been taken, and plants divided into various artificial groups.

The above will substantiate the view that, under each *varga* or principal group, the members of the same family have been placed together, these so often possessing many properties in common.

The identifying principle accepted by the Indian Botanists depends upon a large number of facts, such as (1) locality, which touches upon Geographical Botany, (2) description of the plant by comparison of its leaves, flowers, roots, fruit, branch, juice, colour, smell and property etc., with some other known things. These things are so given that in most cases all the connotations of one are not found in any other; but very unfortunately, in many cases, the synonyms are highly preplexing indeed

One instance will be sufficient here to show the difficulty. शालुकणी (*Salvania cucullata*) and द्रवन्ती (*Ipomœa reniformis*) are thus described :

Ipomœa reniformis:

द्रवन्ती शम्बरी चिता न्यग्रोधा भूपिकाह्वया ।
प्रत्येकग्रेथी वृषा चण्डा पुलग्रेण्याखुपर्णी का ॥ Dhanwantari.
द्रवन्ती शाम्बरी चिता न्यग्रोधी शतमूलिका ।
प्रत्येक्ग्रेथी वृषा चण्डा पुलग्रेण्याखुकर्णी का ॥
भूपिकाह्वादिका कर्णी प्रतिपर्णी त्रिपत्रा च सा ।
सहस्रमूली विक्रान्ता क्षेत्रा स्याच्छुतुरेकधा ॥ Râja-nighantu.

Salvania cucullata:

स्यादाखुकर्णी वृषिका द्रवन्ती चिता सुकर्ण्युन्दुरुकर्णि का ।
न्यग्रोधिका भूपकानाम कर्णी स्याद्वदिचकर्णी बहु कर्णि का च ॥
ज्ञाता भूमिचरी चण्डा शम्बरी बहुपादिका ।
प्रत्येकग्रेथी वृषा चैव पुलग्रेण्यद्रिभूह्वया ॥ Râja-nighantu.

The comparison will show the synonyms, and the description of one will be seen to be a mere repetition of the other. The local name is also भूपाकाणी for

both. The properties, however, in one are different from those in the other; fortunately, these are observed in local usages. Hence, the one can be distinguished from the other simply by taking advantage of the properties and nothing else.

Such synonyms recur in many places, and we find the following rule for identification :

नानाभिधेयमथ यन्न शिवा सनङ्गा
श्यामादि नाम निगमेषु निवेदितं यत् ।
प्रस्तावबीर्य्यरसयोगवशादमुष्य
बुद्ध्वा विमृश्य भिषजाऽत्र धृतिर्विधेया ॥ Râjanighantu.

In many cases, however, the descriptions are quite characteristic, as in हस्ताञ्जली, *e g.*, *Orchis latifolia*, which is thus described.

हस्तपर्य्यायपूर्व्वस्तु:जोङ्घिवेद्वर्वरः स्मृतः ।
करजोड़िमिति ख्यातो रसगन्धादिवर्ज्जितः ॥ Râjanighantu

In this, instead of speaking of any of its peculiarities, the specialist just compares it with the folded palm of the hand which will at once identify it and differentiate it from the rest of the vegetable world.

From terms used in the slokas as synonyms, we get the entire clue to the identification of the plant. A negligence in thoroughly examining these terms has led to disastrous mistakes which have spoilt half the merit of our well-tried system of medicine.

The classifications adopted in Charaka in describing *षड्विरेचनशताश्रयाः* and in Susruta in सप्ततिंशद्गणाः are based purely upon the properties of plants; consequently these involve the repetition of one plant in different places. Of the same plant possessing several properties, for instance, यष्टिमधु (*Glycyrrhiza glabra* or *Liquorice* root), mention has been made in connection with

1. जीवनीयानि (medicines which prolong life)

2. सन्धानीयानि (medicines which promote the union of fractured or divided parts.)

3. वर्ण्यानि (medicines which improve the complexion)

4. कण्ठ्यानि (medicines which improve the voice)

5. कण्डूघ्नानि (medicines which cure pruritus)

6. छर्दिनिग्रहणानि (medicines which relieve vomiting)

7. पुरीषविरजनीयानि (medicines which alter the colour of the fæces)

8. मूत्रविरजनीयानि (medicines wich alter the colour of urine)

In each of these groupings there are ten plants mentioned. So there is a *cross division* in many cases.

In Susruta also we find similar classification, according to properties of matter. Other treatises on Medicine also group them according to certain peculiarities, and each grouping is fantastically named after a certain distinguished member of the group. For example, we find in ***Dhanwantari***

Nighantu—गुडूच्यादिवर्गः, शताह्वादिवर्गः, पर्पटादिवर्गः, पिप्पल्यादिवर्गः, शाल्मल्यादिवर्गः, प्रभद्रादिवर्गः, करवीरादिवर्गः, आम्रादिवर्गः, चन्दनादिवर्गः; *in Madanapâla Nighantu*— अभयादिवर्गः, शुण्ठ्यादिवर्गः, कर्पूरप्रभृतिसुगन्धिद्रव्यवर्गः, वटादिवर्गः, फलादिवर्गः, शाकवर्गः इक्षुवर्गः, धान्यवर्गः, *in Bhâvaprakâsa*— हरीतक्यादिवर्गः, गुडूच्यादिवर्गः, पुष्पवर्गः, वटादिवर्गः, आम्रादिफलवर्गः ।

It would thus appear that the Indian system of classification does not accurately correspond to the classification into Natural Orders which has been founded under the unfluence of the Dogma of the Constancy of Species during the period from 1750 to 1850, and under that of the study of the Cryptogams in the latter half of the 19th century. It differs widely from the artificial classifications of Brunfels, Fuchs, and other Botanists of Germany and Netherlands who flourished in the 16th century, or of Cisalpino, the Italian Botanist of the same century, who attempted to divide plants into groups by philosophical reflection. While *mainly artificial*, the Indian system may be compared not to that of Linnæus, but of Jussieus, who based it on properties. And for all practical purposes, whatever may be said against its scientific value, a system based on properties was more useful than the systems of the early European Botanists, which, according to Sachs, were too vague and insufficient for identification.

(*d*) *Other Scholars*

In a recent publication[1] Dr. Sumant B. Mehta, lately personal physician to H. H. the Maharaja Gaekwad of Baroda says : "Susruta divides the vegetable kingdom into Vrikṣa, Gulma, Vanaspati, and Virudha More information of the science exists in the writings of Râghava Bhatta and Sârangadhara, a section of which, called *Upavanavinoda*, has been translated by Dr. Gaṇanâth Sen of Calcutta. The divisions mentioned above have been worked out into minute subdivisions, but a systematic Botany like the one developed in Europe in modern times did not exist in India. Occasional mention of the habitat of plants, and the description of their foliage exists, but there is no system about it The ancient physicians have indeed written several books on the Materia Medica, and they have laid great stress on the individual characteristics of drugs, which would make the work of identification easy."

In a very short paper[2] on the names of Vedic plants, Mr. Bijaychandra Majumdar has drawn the attention of Bengali readers to the scientific aspect of Hindu Botany, but has touched only the fringe of it.

APPENDIX A.

(*e*) *Dr. Seal.*

Dr. Brajendranâth Seal has kindly furnished me his notes on scientific concepts of the Hindus regarding plant physiology and classification. His studies are based mainly on non-medical literature and rare commentaries of older authorities. His researches therefore exculde the sources that are generally utilised by students of Hindu botany and medicine. The papers, however,

[1] *The Ayurvedic System of Medicine* (Navsari, Bombay, 1913), p. 28.

[2] The Bengali monthly, *Bhârati*, for Kârtic 1913.

reacned me after the printing of this work had considerably advanced. Hence they are placed in the Appendix along with other papers from the same pen.

4. *Concluding Remarks.*

The foregoing account is a summary of all that has been done in investigating the contributions of the ancient Hindus to the universal science of botany. The account is very meagre, indeed, and indicates that up till now no serious effort has really been made to estimate the botanical value of the Hindu writings on medicine, agriculture, grammar, astronomy, &c. It is high time that the work should be taken up in right earnest as a piece of historical research.

Identification and determination of Indian plants have been rendered tolerably easy. "The principal factors which have contributed to increase our knowledge of indigenous drugs during this century have been the labours of men like O'Shaughnessy, Waring, and Kanny Lall Dey, the holding of Exhibitions, the works of botanists, and forest-officers; and lastly the various scientific societies, notably the Bengal Asiatic Society, the Calcutta Medico-Physical Society, and the Agri-Horticultural Society."[1] The work before Indian Botanists to-day is to equip themselves with a knowledge of Sanskrit and Vernacular literatures and ransack the whole field of Indian literature in order (i) to find out the species of plants named or described therein and (ii) discover in the light of modern knowledge the scientific truths or half-truths they were intended to impart.

There is no reason for despair. The new Teaching Universities with Research Departments that are being promoted throughout the length and breadth of India at important centres, the Oriental Research Institute projected by the Government of India, the College of Science financed by the philanthropic donors of Bengal, Sir Târak Nâth Pâlit and Dr. Râshbehâri Ghosh, the private Academies of Research, and literary as well as educational Councils that have been ushered into being during the last two decades or so, under the impulse of popular upheaval here and there and everywhere in India—all these are expected to be seminaries of independent thought and nurseries of original scholars who would devote themselves to studying the pressing problems of the day together with the antiquities of the country. So that in the near future the national culture and civilisation of India may assert their rightful place in the consciousness of mankind and the history of human progress.

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[1] *The Study of Indigenous Drugs* in the *Indian Medical Gazette*, August, 1892.

CHAPTER VI.

THE DATA OF ANCIENT INDIAN ZOOLOGY.

SECTION 1.

The Secular Sciences of the Hindus.

In trying to estimate the knowledge of the Sukra authors regarding the physical and objective world, we have incidentally noticed in the two preceding chapters several important facts in the history of Indian culture :

I. The mineralogical, medical, chemical, and botanical sciences, industries, and arts were wide and deep enough to be drawn upon with advantage by writers of general Sociological treatises like *Sukraniti*.

II. In these physical or "nature studies" lay the *forte* of special schools of Hindu thinkers, who, as masters or commentators[1], were the authors of specialised[2] branches of scientific literature.

III. These schools of Hindu physical science, whether embodied in individual 'masters' or collective organisations like the Parisats (*i.e.*, Academies), stood up not simply for the conservation of the statical products of a bygone age, but represented in and through them the dynamical processes of the march of human knowledge. They thus kept moving (i) from epoch to epoch and (ii) from province to province according to the progress of scientific spirit and general culture in Hindusthan, and hence more or less resembled, both in diversity of administration and uniformity of language and literature, the so many scattered centres of culture and learning, called the Universities, which sprang up into existence in the German[3]-speaking world, during the period from the 14th to the

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[1] The importance of these commentators in Indian Literature who were not servile copyists or imitators, but enriched the texts commented upon by the addition of their own original investigations as well as the culture of ages, has been critically vindicated by Goldstücker in his *Pánini*.

[2] See Major Basu's paper on *Indigenous Medicine* in the Modern Review for March 1914.

[3] See the account of the development of German Universities in Merz's *History of European Thought in the 19th century*, Vol. I, pp. 159-163; also the Footnotes. The great cultural uniformity of Hindusthan and the fundamental unity of the Indian Soul as attested by the (i) existence of Sanskrit as the common language for educated and spiritual India and the (ii) predominance and emphasis of the same sets of morals, manners, sentiments and traditions in the everyday life and institutions of the people throughout the length and breadth of India (inspite of the thousand and one barriers to political unity presented by the kaleidoscopic revolutions and boundary-settlements) may be compared with the unifying conditions of German culture, learning and civilisation, inspite of the diversity and disunion of political life that characterise the history of the German peoples till the formation of a nationality and an empire in 1870.

The following facts about the history of German culture have a close parallel in the history of Indian civilisation: "It is not a stationary power, but is continually

18th century. The Indian sciences should not, therefore, be regarded as the finished creations of certain golden eras in Indian history or the characteristic products of one or other of the various races that have peopled India, but are the results (i) of a continuous evolution incorporating the cumulative experience of ages, and (ii) of the conscious or unconscious collaboration of master-minds, systematisers, compilers and commentators belonging to the north, south, east, west and middle of India.

IV. A rigid and unbiassed comparison of the achievements of the Hindus in physical sciences, whether as academic and abstract branches of learning or as aids to practical and utilitarian aspects of life with the contributions of the western thinkers to the same would show that in Europe it is really during the Revolutionary period (1789-1815) or more strictly speaking since 1815[1] that the epoch of the Industrial Revolution and the pre-eminently scientific era which characterise the modern age really begins. And that previous to that, *i.e.*, up to about the beginning of the 19th century, the Hindu as well as the European thinkers were almost on a par. The inductive sciences of the west had not till then displayed the magnificent results which we have been accustomed to associate with them during the latter half of the 19th century. So that it is only the last century's work by which the people of Hindusthan are behind their colleagues in the west.

Section 2.

The Alleged Decline of Hindu Intellect.

This aspect of the question requires a little elaborate treatment, since even one of the greatest scientists of our country seems to have been carried away and have supplied the cue for a lament over the "decline of scientific spirit" among the Hindus, and over "this land of intellectual torpor and stagnation."

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on the move from south to north, from west to east, to and fro, exchanging and recruiting its forces, bringing heterogeneous elements into close contact, spreading everywhere the seed of new ideas and discoveries, and preparing new land for still more extended cultivation." "The migration of students as well as eminent professors from one University to another is one of the most important features of German academic life." "There is scarcely a stronger bond of union between the various parts of Germany than that supplied by the Universities, and in no other respect have the barriers that separated state from state been so long broken down." See in this connexion Prof. Radhakamud Mookerji's *Fundamental Geographical Unity of India.* (Longmans Green & Co., 1914).

[1] For an account of the comparatively recent origins of the 'modern' sciences see Weir's *Historical Basis of Modern Europe* (Swan Sonnenschein & Co, London, 1886, pp. 315-469; Mackenzie's *19th century* (Nelson & Sons, 1823), pp. 181-206 309-315, 338, 372-73, 429-432; Price's *Political Economy in England* (Methuen & Co., London, 1900), pp. 5-7; Merz's *History of European Thought in the 19th century* in two Volumes (Blackwood and Sons, London, 1904); Marshall's *Principles of Economics.*

Dr. P. C. Ray concludes his celebrated History of Hindu Chemistry thus :

" The arts being thus relegated to the low castes and the professions made hereditary, a certain degree of fineness, delicacy and deftness in manipulation was no doubt secured, but this was done at a terrible cost. The intellectual portion of the community being thus withdrawn from active participation in the art, the *how* and *why* of phenomena—the co-ordination of cause and effect—were lost sight of. The spirit of inquiry gradually died out among a nation *naturally prone to speculation and metaphysical subtleties*,[1] and India for once bade adieu to experimental and inductive sciences. Among a people ridden by caste and hide-bound by the authorities and injunctions of the Vedas, the Purâṇas and Smritis, and having their intellect thus cramped and paralysed, no Boyle could arise. Her soil was rendered morally unfit for the birth of a Boyle, a Descartes or Newton, and her very name was all but expunged from the map of the Scientific World."

Far be it from our object to detract from the absolute contributions of these western thinkers to the World of Science. It must not be forgotten, however, that the greatest duty the Hindu thinkers were called upon to perform during the period of the so-called torpor and decline of Hindu intellect was the preservation of national existence and the conservation (with necessary adaptation or modification) of the culture of their race against the inroads of aggressive Islam. The greatest achievement of the Hindus and the most marvellous feat of their genius consisted in this that, while other races had to succumb to the steam-roller of 'the Koran, the sword or the tribute' and extinguish all vestiges of their national traditions and institutions, the Hindus alone not only succeeded in withstanding this levelling influence and maintaining their individuality and original race-consciousness, but also in assimilating and utilising the new world-forces in the interest of their own expansion, development and progress.

But for this assimilative capacity, this extraordinary power of displaying and distributing their energies in a *latent* form in the work of social re-construction and synthetic re-adjustments, the whole civilisation of the Hindus would have been swept off the face of the earth and have been driven underground. And instead of a living, moving, growing, and expanding people of to-day the Hindus would perchance have to be excavated and unearthed anew like the fossils of Egyptian, Babylonian and Hellenic culture by future archæolo-

[1] The italics are ours. It is difficult to appreciate the logic of these remarks. If up to the middle of the 17th century, *i.e.*, for a period of over 2,000 years, as Dr. Ray proves by his researches, the so-called caste restrictions and religious prejudices did not stand in the way of scientific work on the part of Hindu scholars and could not prevent them from being at the vanguard of nations, why should these be held responsible for the alleged torpor and demoralisation during the 17th and 18th centuries? More facts require to be unearthed before anything can be proved one way or the other; and a more 'scientific' interpretation of World-Forces that go to make history is also necessary.

gists as merely interesting curios, through which could be dimly deciphered the hieroglyphics of a by-gone age.

The "Doctrine of Substitution" applied by modern economists to the interpretation of the motives and tendencies that underlie human activity in the choice of 'lines of least resistance' and in the investment of resources along various channels in such a way as to derive from each the greatest 'return' with the smallest expenditure, is nothing but a sociological equivalent of, or at any rate, a corollary to, the great Biological Doctrine of the display of vital energy under diverse forms and in varied directions, under the impulse of the 'struggle for existence' and the 'instinct' of self-preservation. The problem before the Hindus during the period referred to by Dr. Ray was pre-eminently and essentially one of social self-preservation, stock-taking and assimilation, re-synthetising of old and new conditions. The struggle was between one socio-religious ideal and another socio-religious ideal, for the Mussalmans did not bring with them any other instruments of culture, ostensibly or as a matter of course. That being the conflict, 'competition' and instinct of self-preservation induced the people of Hindusthan to present not greater and greater original discoveries and inventions in science, industry and philosophy, and an extension of the bounds of human knowledge—[because what they had inherited from their ancestors and developed up till then was already too adequate for what their opponents could possibly display from their armouries and arsenals of cultural equipment, or for what the whole encyclopædia of the Saracenic, Græko-Roman and Teutonic-European learning could exhibit], but mainly a more liberal and elastic interpretation of their socio-religious ideals and institutions, a more philosophic re-laying of the foundations of their social and domestic system, necessitated by the changes in the circumstances of their age.

A really scientific reading of the conditions of life produced in India by the advent of Islam would show, not that the Hindu national mind was totally slain during this period, but that it addressed itself to the more pressing needs of the time; not that the Hindu intellect became 'unscientific,' uncritical, totally abstruse and metaphysical, but that it was solving the most practical and secular problems of the age; not that the Hindu race produced only second-rate, third-rate and eighth-rate intellectuals, only commentators, annotators and copyists, but that it gave rise to some of the most original-brained, synthetic philosophers, scientists and sociologists, who were the Newtons, Leibnitzes and Descarteses of the Hindu national life in re-organising the old and thereby creating the new.

Universal History, if philosophically and biologically interpreted, yields only one fundamental lesson about human progress, *viz.*, that the culture of a race is 'relative' to the conditions of the age. According to this doctrine of the Relativity of Culture, which again is really a corollary to the great Biologico-sociological Doctrine enunciated above, it would be easily admitted that the epoch from Bacon to Linnæus, Humboldt, Whitney and Herbert Spencer has

not probably done for humanity an *iota* of work in any way nobler or greater than what has been achieved in Hindusthan by the band of master-minds from Kavira, Chaitanya, Tukārāma, Nānaka, and other givers of social laws and morals to the days of Rāmaprasāda, Rāmamohana, Vidyāsāgara and Rāmakrishna Paramahamsa.

There is another side of the self-humiliation contained in the assertion of Dr. Ray. He does not seem to have looked upon the achievements of modern Europe with a historic and critical eye, and hence the statement is necessarily partial, one-sided and erroneous.

Even supposing that, about say the middle of the 17th century—the age of Newton—Europe began its career of conquest over the powers of nature and marvelleous achievements in physical or secular sciences and industries, we cannot too often remember

(1) that all these achievements were not altogether of a higher order or greater brilliancy than what the Hindus had achieved and maintained even up to the end of the 18th or beginning of the 19th century, so far as ministration to the 'necessaries, comforts, and decencies' of life is concerned;

(2) that it is only since the epoch of "Industrial Revolution," *i.e.*, the second decade of the 19th century, that the west has really been distancing and eclipsing the people of India in the marvels of theoretical science as well as practical arts;

(3) so that, strictly speaking, the modern spirit, the thought that Europe has actually contributed to the culture of universal humanity, is not more than a century old.

That those sciences and industries, which have marked a complete cleavage between the past and the present, for not having contributed to the making of which the Hindus are fallaciously and unnecessarily condemned as non-practical, un-secular, other-worldy, are only the achievements of yesterday, does not require any laborious historical investigation to be substantiated. In the 13th Edition (revised and partly re-written with additions) of *Discoveries and Inventions*[1] by Routledge, the author says: "The enormous material advantage which this age possesses, the cheapness of production * * * are traceable to the division of labour; to the steam-engine; to increased knowledge of the properties of metals; to the use of power tools * * * Little more than a century ago everything was slowly but imperfectly made by the tedious toil of the working man's hand. * * * Let the young reader who wishes to understand why the present epoch is worthy of admiration as a stage in the progress of mankind, address himself to some intelligent person old enough to remember the century in its teens; let him inquire what wonderful changes in the aspect of things have been comprised within the experience of a single life-time."

It would thus be clear that it is only "a single life-time's work," taking a very narrow and practical and rather non-scientific and unhistorical view,

[1] Published by George Routledge and Sons, London, 1900.

by which modern Europe is in advance of mediæval Europe, or what is the same thing, by which India is behind the western world. A rational interpretation of history would thus be a powerful corrective of the cheap and superficial interpretation of India's past which is inclined to explain one and all of the so-called failures of the Hindus by two catch-words describing their national life and character, *viz.*, caste and religiosity.

Dr. Ray's *History of Hindu Chemistry* is itself one such corrective. Ram Raz's fragmentary *Essay on the Architecture of the Hindus*, published in the earlier years of the 19th century is perhaps the first work on the subject of Hindu achievements of a secular character. The works of Râjendralâl and Udaychând also belong to the same category. Another eye-opener, in our own times, is Prof. Mookerji's *History of Indian Shipping*. And that monumental product of Dr. Seal's massive intellect, the *Mechanical, Chemical, and Physical Theories of the Hindus*, is also most emphatically calculated to give the lie to the alleged inferiority of the Hindu race in secular[1] and scientific achievements.

Section 3.

The Zoological Lore of the Hindus.

The remarks in section 1 indicate, in the first place, the position of Natural History and Science in such sociological treatises as *Niti Sâstras*, and in the second place, at once the achievements and limitations of the Hindus in investigations regarding the facts and phenomena of the physical world. The Zoological Data in the *Sukranîti* also point to the same conclusions.

(*a*) *A brief survey of Zoology in Europe.*

Like metals, jewels and plants, animals and animal-life also have been the subjects of copious literature in India. For, since the earliest times, Indian Fauna have played an important part in the socio-economic and socio-religious as well as political spheres of Hindu life.

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[1] Recently, Mr. K. P. Jayaswal, in reviewing Dr. Schoff's *Periplus of the Erythraean Sea* for the *Modern Review*, has entered another protest thus :—

"Mr. Schoff has quoted at p. 187 the oft-quoted lines of Matthew Arnold that India let the legions thunder past and she plunged in thought again. The lines have really converted history into a vast 'Mississippi of falsehood.' They ought not to find room in any serious treatise. Hindu history at every step gives a lie to the allegation. The very fact of the Greek invasion, on which Mr. Schoff has quoted the lines, instead of being forgotten, was remembered as late as the 5th century A. C., when the defeat of Seleucus was repeated on the stage at Pâtaliputra. The poet wanted the history of Chandragupta, the Maurya, to be re-enacted by Chandragupta the Gupta. Mr Schoff must be aware of the inscriptions of the so-called Andhras and the Guptas which proudly celebrate conquests over 'the legions.' Medhâtithi, writing after the defeat of the Huns, defined India as a country where 'the legions' could not get a footing even after repeated attempts. The victory of Sâtakarṇi II over Nahapâna is still remembered by hundreds of millions of Hindus who hear and repeat the historical romance of the Vikramâditya, the Destroyer of the Sakas."

Up to the 18th century the progress of Zoology in India is almost parallel with the course it has had in Europe during the "legendary" stage and the "age of collectors and travellers." Indian literature, if minutely studied in the light of modern theories, would furnish some of the earlier among the following landmarks in the history of Zoology obtained from the records of European research :

"Anatomy and the study of animal mechanism, animal physics and animal chemistry, all of which form part of a true Zoology, were excluded from the usual definition of the word; * * * and, whilst the Zoologist was thus deprived of the means of anatomical and physiological study, * * * the demands of medicine for a knowledge of the structure of the human animal brought into existence a separate and special study of human anatomy and physiology.

"From these special studies of human structure the knowledge of the anatomy of animals has proceeded. * * * Thus comparative anatomy came into existence as a branch of inquiry apart from Zoology; and it was only in the latter part of the 19th century that the word 'Zoology,' applied to a knowledge of animals which expressly excludes the consideration of their internal structure, was rejected

"Scientific Zoology really started in the 16th century with the awakening of the new spirit of observation and exploration. * * * The active search for knowledge by means of observation and experiment found its natural home in the universities. Owing to the connexion of medicine with these seats of learning it was natural that the study of the structure and functions of the human body and of the animals nearest to men should take root there. * * * The influence of the great academies of the 17th century was precisely to effect that bringing together of the museum-men and the physicians or anatomists which was needed for further development * * * It was not until the 19th century that the Microscope (constructed by a Dutch naturalist in 1683) was perfected as an instrument and accomplished for Zoology its final and most important service. * * * It was reserved for Charles Darwin in 1859 to place the whole theory of organic evolution on a new footing" [1]

The brief and not by any means exhaustive survey of Hindu Zoological literature that is given here to indicate lines of research in this field would suggest that, with the exception of Plasmology or "the study of the ultimate corpuscles of living matter, their structure, development and properties, by the aid of the microscope—exemplified by Malphighi, Hook, Schwann and Kowalewsky," almost all the other "currents of thought and mental preoccupation which have been historically manifested in western Europe in the gradual evolution of what is to-day the great river of Zoological doctrine" have had their more or less perfect embodiments in the history of Hindu thought also. Thus, it will be easy to cull from Indian literature, Sanskrit, Prākrit and vernacular, casual references to, as well as specialised treatises on, ani-

[1] *Encyclopædia Britannica* (11th Edition), Vol. 28, pp. 1022-1024.

mal-life, which may be grouped under the following branches of Zoological study detailed by Sir Edwin Ray Lankester in the latest edition of the *Encyclopædia Britannica*:

(1) Morphography—the work of the collector and systematist exemplified by Linnæus and his predecessors, by Cuvier, Agassiz, Hæckel.

(2) Bionomics, lore of the farmer, gardener, sportsman, and field-naturalist, including thremmatology or the science of breeding, and the allied teleology or science of organic adaptations: exemplified by the patriarch Jacob, the poet Virgil, Sprengel, Kirby and Spence, Wallace and Darwin.

(3) Zoo-dynamics, Zoo-physics, Zoo-chemistry—the pursuit of the learned physician,—anatomy and physiology: exemplified by Harvey, Haller, Hunter, Johann Muller.

(4) Philosophical Zoology—general conceptions with regard to the relations of living things (especially animals), to the Universe, to man, and to the Creator, their origin and significance: exemplified in the writings of the philosophers of classical antiquity, and of Linnæus, Gœthe, Lamarck, Cuvier, Lyell, H. Spencer, and Darwin.

(*b*) *Vedic Fauna.*

The Zoological lore of the Vedic age is not very copious, but gives an adequate picture of the attempts of the people to make themselves acquainted with the various phases of animal-life which came across them.

"The ploughmen sang merrily to the steers (R. V. *viii*, 20, 19), while ploughing. * * * They kept away birds from robbing them of the growing corn by uttering loud cries (R. V. x 68, 1). * * * The enemies of the agriculturist were rodents, insects and demons which were exorcised by means of spells (A. V. vi 50) A great number of them are named, but cannot be identified. * * * Cattle-rearing followed as subsidiary to agriculture. Cowherds took cows out to pasture daily (R. V. x 19, 4, 5). * * On return from pasture the cows were kept in stalls (*gotra*, R. V, ii; 23, 8, *vraja* A. V. iii; 11 5, *gostha* iv; 21, 1), and water troughs were provided for them in various places. * * Draught-oxen were castrated. * * * They reared also goat and sheep. Fat rams for cooking (R. V. x 27, 17) and the ewes of Gandhara, famous for their wool (R. V. i 126, 7), are referred to. Dogs guarded cattle and houses and barked at human thieves (R. V. vii 55, 3), at wolves worrying sheep (A.V. V, 8 4; vi 37), and tigers which plague the men rich in kine (A. V. iv 36, 6).[1]

The animal foes of man were roaring lions (R. V. ix 64, 8), wild elephants 'eating forests' (R. V. i 64, 7), tigers, wolves and hyenas (A. V. xii 1, 49) as well as snakes,[2] metaphorically called "ropes with teeth" (A. V. iv, 3, 2), 'brandishihg as it were a club' (A. V. i 27, 2); more than twelve species of snakes

[1] Iyengar's *Life in Ancient India*, pp. 23-27.

[2] See also *Atharva Veda*, x 4.

are named in the Atharva Veda Samhitá as creeping amidst grasses of which five species are named in R. V. i 191, 3. There was also the sharply-stinging scorpion (A. V. xii, 1 46; vii, 56, 6, 8); worms of various kinds born in the rainy season (A. V. xii 1, 46) and the sharply-biting mosquito (A. V. vii 56, 3) are also mentioned.[1]

The following extracts are taken from the Atharva Veda:[2]

"Together, together let cattle flow (stream), together horses and together men, together the fatness that is of grain; I offer with an oblation of confluence."[3] This is meant for safety and increase of kine.

"The eagle discovered thee; the swine dug thee with his snout: smite the dispute, &c."[4] The object discovered by these animals is the root of a plant that is meant for victory in disputation which, for example, "Indra put on his arm in order to lay low the Asuras."

"Let the falcon lead hither from far the one to be called, living exiled in other's territory."[5] The falcon is thus a guide of the King to be restored.

"He who gives a white-footed sheep[6] commensurate with his world, he ascends unto the firmament, where a tax is not paid by a weak man for a stronger." By this offering of a white-footed sheep one is released from the payment otherwise due to Yama's councillors on admission into the other world. [Commensurate—(1) proportioned in value to the place in the heavenly world that is sought by the giver, (2) analogous with the world of light that is aspired to.]

"Both thy (two) eyes and thy mouth, O tiger,[7] we grind up; then all thy twenty claws. * * * Ruined are the teeth of the beast; crushed in also are its ribs." This hymn is against wild beasts and thieves.

"The draft-ox[8] sustains earth and sky; the draft-ox sustains the wide atmosphere; the draft-ox sustains the six wide directions; the draft-ox hath entered into all existence. * * With his feet treading down debility, with his thighs extracting refreshing drink—with weariness go the draft-ox and the plowman unto sweet drink."

The hymn offers an example of that characteristic Hindu extollation, without any measure or limit, of the immediate object of reverence, which, when applied to a divinity, has led to the setting up of the baseless doctrine of henotheism.

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[1] Iyengar's *Life in Anc. Ind.*, p. 60.

[2] Harvard Oriental Series.

[3] Vol. 7, p. 66.

[4] Vol. 7, p. 67.

[5] Vol. 7, p. 68.

[6] Vol. 7, p. 136. See also the verses accompanying the gift of a bull, and the offering of a goat (Atharva ix 4, 5).

[7] Vol. 7, pp. 148-9.

[8] Vol. 7, pp. 164-166. For the extollation of the cow, see Atharva Veda x 10; and of the ox again, ix 7.

"With milk, with ghee, I anoint the goat,[1] the heavenly eagle, milky great; by it may we go to the world of the well-done, ascending the heaven, unto the highest firmament. * * * In the eastern quarter set then the head of the goat; in the southern quarter set his right side. In the western quarter set his rum; in the northern quarter set his other side; in the upward quarter set the goat's backbone; in the fixed quarter set his belly; midway in the atmosphere his middle. Do thou envelop with cooked skin the cooked goat, brought together with all his limbs, all-formed." The verses read as if the goat himself, after cooking whole, were set up in position, the head to the east.

"I have gone about the race of snakes,[2] as the Sun about the sky, as night about living creatures other than the swan; thereby do I ward off thy poison."

The birds of ill omen[3] against which incantations are used in the *Atharva Veda* are such "winged missiles" as the dove, the hawk, the owl. For the success of the horse in a race, we have the following verse: "The quickness, O courser,[4] that is put in thee secret, also that went about committed to the hawk, to the wind—with that strength do thou, O steed, being strong, win the race rescuing in the conflict." We have the terms dog[5] and falcon[6] applied metaphorically to the orbs of the celestial sphere also.

According to Mr. Bal Gangadhara Tilak, "of the various figures we may make out of the star in the constellation of Orion, *one* should be of an antelope's head."[7]

In the chapter on a picnic in Ancient India, Dr. Rajendralal Mitra[8] refers to the buffalo-meat and game birds as *piece de resistance*: "In the time of the Rig Veda the meat was cooked with milk, and there is a passage in which Vishnu is described as carrying away the broth made of a hundred buffaloes and a hog (VIII 66, 10). Elsewhere it is said (VI 17, 11): 'For thee, Indra, whom all the Maruts, in concert, magnified Pushana and Vishnu cooked a hundred buffaloes.'. * * * In the *Grihya Sutra* of Aswalayana, partridges (*tittiri*) are recommended as appropriate for infants just beginning to take solid food, and ducks, doves, pigeons, and ortolans were formerly in common use."

(c) *Maurya Fauna.*

Mr. Manomohan Chakravarti has studied the rock-edicts and pillar-edicts of Piyadasi,[9] with special reference to the animal-lore contained therein.

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[1] Vol. 7, pp. 169-72.

[2] Vol. V, p. 289.

[3] Book VI, xxvii—xxix.

[4] Atharva Veda, VI, 92. See also XIX. 25. "Be thou an up-carrier uphill."

[5] *Ibid*, VII, 80.

[6] *Ibid*, VII, 41.

[7] *The Orion* (Bombay, 1893), p. 101.

[8] Indo-Aryans Vol. I, pp 4, 27-28. See also Beef in Ancient India, pp. 354-382.

[9] See Memoirs of the Asiatic Society of Bengal, Vol. I, 1905-1907, pp. 361-374. See also Law's *Studies in Hindu Polity* and the *Artha Sastra* of Kautilya, for the names of the fauna very familiar in Maurya times (4th—3rd cent. B. C.).

Megasthenes' account of "gold-digging ants" in India has been already referred to. His *Fragments* supplies us with more solid information about Indian Fauna.

The use of horses and elephants for the army has been described by Megasthenes also. We know of this from Strabo (XV i 50-52) and Ælian (His. Animal XVI—10).

The training of horses has been likewise referred to in the *Fragments* of Megasthenes.

The information about elephants is copious in the *Fragments*. We learn from it of the methods of capture, training, medical treatment, &c. (Arrian, XIII, XIV; Ælian XII—44. XIII—71).

Some of the wild Fauna of the 4th century B. C. are to be known from Strabo's account (XV i 47) as well as that of Ælian, Pliny, &c., derived from the *Fragments*.

The generic names of the Inscriptional Fauna are: (i) Jīvāni, (ii) Prāna-sata-sahasrāṇi, (iii) Bhūtānam (iv) Jātāni, (v) Pasu-cikicchā.

The following classes of animals are mentioned in the Rock-Edicts: (i) Dupada-catupadesu pakhi-vālicalesu, (ii) Catupade, (iii) Macchè.

By Edict No. I Asoka, the benevolent Cæsaro-papist of India, forbade the general destruction of life both in his own kitchen and in his empire. Two animals are specified: (1) Peacock (morā, majurā, majulā), (2) Deer (mago, mrugo, mige).

By the Edict No. V the slaughter of the following born beings was prohibited:

(1) Parrot (suku).
(2) Starling (sālikā).
(3) Alune (unidentified).
(4) Ruddy goose (cakavāke).
(5) Goose (hamse).
(6) Nandi mukhe (unidentified).
(7) Gelate (unidentified).
(8) The bat (jātukā).
(9) White ant (ambā papilikā).
(10) Female tortoise (dādi).
(11) Boneless fish (anaṭhika macche).
(12) Veda veyake (unidentified).
(13) Gamgapuputake (unidentified).
(14) Skate fish (samkuja macche).
(15) Tortoise porcupine (kaphaṭa sayake).
(16) Squirrel (pannasase).
(17) Simale (Sansk. *Srimara*)
(18) Bull (samdake).
(19) Okapinde (godhās?)

(20) Rhinoceros (alasate).
(21) Pigeon (seta kapote).
(22) Goat (ajake).
(23) Sheep (edake).
(24) Pig (sukali).
(25) Fowl (vadhikukute).
(26) Elephant (nâga-vanasi).
(27) Cow (gone).
(28) Horse (aswasâ lakhane).

(*d*) *The Fauna in Hindu Folk-lore.*

The intimate familiarity of the people of Hindusthan with the topics generally treated in Descriptive Zoology or Natural History is also borne out by the existence of innumerable legends, both secular and religious, with animals playing a prominent part as *dramatis personæ*, and as narrators, or forming the subject matter, which entered into the curriculum of studies in ancient and mediæval India. We have already noticed the indebtedness of Europe to India in this branch of literature in connection with the legends of precious stones and metals.

The following extracts from Fausboll's *Indian Mythology* give a short account of such stories: "India has long been looked upon as the *cradle of fairy tales and legends*, and such is indeed the case, for beside numbers of short folk-stories, such as *Vetâla-panchavimsati* (25 Tales by a ghost), *Sukasaptati* (70 Tales by a parrot), *Simhâsana-dwâtrimsati* (32 Tales by Images on Vikramâditya's Throne), and, beside those found spread throughout the Mahâbhârata and Râmâyana and in fact in all Indian literature, we have the following important collection of fables, fairy stories and tales: (1) The *Jâtaka* books concerning the Transmigration of soul from about 477 B.C., (2) the *Panchatantra*-book in 5 chapters by Visnu Sarmâ from about 530 A. D., (3) *Hitopadesâ*,[1] the Benefical Instruction by Nârâyana, (4) *Kathâsaritsâgara*, the Lake of the Legend streams by Somadeva from about 1063, (5) Kşemendra's *Avadâna-kalpalatâ*, (6) *Kathâkosa*, a Treasury of Tales.

"To these must be added from more modern times: (1) Frere: *Old Deccan Days*, or Hindu Fairy Legends; (2) Stokes: *Indian Fairy Tales*; (3) Lal Behari De: *Folk-Tales of Bengal*; (4) Steel and Temple: *Wide Awake Stories, Bombay*; (5) Temple: *The Legends of the Punjab*; (6) Knowles: *Folk Tales of Kashmir*; (7) Swynnerton: *Indian Nights' Entertainment*, or Folk Tales from the upper Indus; and from the latest date many stories communicated in the periodical: Indian Antiquary."

To this second list we have to add at least one which has been appreciated by literary connoisseurs as rivalling the merits of the *Arabian Nights*. This is the *Folk Tales of Hindusthan* by Shaikh Chilli[2] (Pâṇini Office.)

[1] See the discussion of date and authorship in Peterson's Preface to Hitopadesa in Bombay Sanskrit Series No. XXXIII.

[2] *Nom de plume* of Sris Chandra Vasu, the versatile Sanskrit scholar and Hindu philosopher.

The *Hitopadeśa*,[1] which draws considerably upon Buddhist Jatakas and Panchatantra, consists of 42 fables in four chapters, and of these 31 deal with animals. The table of contents in this book of stories gives the following topics of animal lore :—

CHAPTER I.

The acquisition of friends.

Fable I.—The story of the Crow, the Tortoise, the Deer, and the Mouse ; Story of the Pigeons.
II.—The Old Traveller and the Tiger.
III.—The Deer, the Jackal, and the Crow.
IV.—The Blind Vulture, the Cat and the Birds.
V.—History of the Mouse Hiraṇyaka.
VI.—The Huntsman, the Deer, the Boar, the Serpent, and the Jackal.
VII.—The Jackal and the Elephant.

CHAPTER II.

The separation of friends.

Fable I.—The Story of the Bull, the two Jackals, and the Lion.
II.—The Ape and the Wedge.
III.—The Thief, the Ass, and the Dog.
IV.—The Lion, the Mouse and the Cat.
V.—The Crow, the Golden Chain, and the Black Serpent.
VI.—The Lion and the Rabbit.
VII.—The Lapwing and the Sea.

CHAPTER III.

War.

Fable I.—The Story of the Geese and the Peacocks.
II.—The Birds and the Monkeys.
III.—The Ass in a Tiger's Skin.
IV.—The Elephants and the Rabbits.
V.—The Goose and the Crow.
VI.—The Quail and the Crow.
VII.—The Blue Jackal.

CHAPTER IV.

Peace.

Fable I.—Continuation of the Story of the Geese and the Peacocks.
II.—The Turtle and the two Geese.
III.—The three Fishes.
IV.—The Cranes and the Weasel.
V.—The Mouse and the Hermit.

[1] Translation by Francis Johnson (Allen & Co., London, 1848). For a comparative study of Jâtakas, Panchatantra and Hitopadesa, see Peterson's Edition of Hitopadesa, Bombay Sanskrit Series, XXXIII (1887).

VI.—The Crane and the Crab.
VII.—The Brahmana and his Goat.
VIII.—The Camel, the Crow, the Tiger, and the Jackal.
IX.—The Old Serpent and the Frogs
X.—The Brahmana and his Weasel.

The stories in the Jâtakas, Panchatantra, Hitopadesa, and other works introduce us, on the one hand, to the actual manners and morals, political and social ideals and institutions, as well as intellectual condition and educational system of the people of Hindusthan, in ancient and mediæval times. On the other hand, they furnish living proofs of the minute Nature-studies in general, and the sympathetic observation of Zoological phenomena in particular, undertaken by the scholars, *litterateurs* and educators of those days.

The importance of these stories in world's literary history is thus described by Charles Wilkins in the preface to his "Fables and Proverbs from the Sanskrit" (1787), quoted by Peter Peterson in the Bombay Sanskrit Series, XXXIII:—

"* * * These celebrated fables, which, after passing through most of the oriental languages, ancient and modern, with various alterations to accommodate them to the taste and genius of those for whose benefit or amusement they were designed, and under different appellations, at length were introduced to the knowledge of the European world, with a title importing them to have been originally written by Pilpay, or Bidpai, an ancient Brahman. Sir William Jones * * in an elegant discourse delivered by him on the 26th February, 1786, * * expresses his sentiments upon this subject in the following words:—

'Their Nitisâstra or system of Ethics, is yet preserved and the fables of Vishnu Sarma, whom we ridiculously call Pilpay, are the most beautiful, if not the most ancient, collection of apologues in the world. They were first translated from the Sanskrit (into Persian) in the sixth century by the chief physician and afterwards the Vizier of the great Naushirwan and are extant under various names' in more than twenty languages."

(e) *The Sacred Fauna.*

The consecration of animals to gods and goddesses as well as the deification of Fauna are two important features of Hindu religious system. These have left their mark on the literature, sculpture and architecture of ancient and mediæval India, and point to the copiousness as well as popularity of Zoological lore among the Hindus.

Like the stones such as Sâlagrâma, and plants such as Tulsî, Marmelos ægle, Ficus religiosa, Jonesia asoka, Acacia suma, Calotropis gigantea, &c., the animals famous in Hindu religious history and art are many.

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[1] The whole subject has been treated in Max Müller's Essay on the *Migration of Fables*. It has to be noted that both Wilkins and Jones were mistaken in considering *Hitopadesa* to be the original work translated into Persian in the 6th century, while in reality the source-book that has been a literary link between the East and the West for centuries is *Panchatantra*.

Of all animals the cow is the most sacred. It typifies the all-yielding earth. All agricultural labour depends on the ox, for no such animal as the cart-horse exists in India. There is a typical 'cow of plenty,' *Kâmadhenu*, supposed to yield all desired objects, images of which are commonly sold in the bazaars, and bought as objects of reverence; and the letting loose of a bull (*Briṣotsarga*) —properly stamped with the symbol of Śiva—in sacred cities like Benares and Gaya, that it may be tended and reverenced by pious persons, is a highly meritorious act.

Serpents, also, are divine animals; they are emblemical of eternity, and are often associated with the gods, especially Śiva. Moreover, a curious race of serpents, half human, half divine, called Nâgas, is supposed to exist in regions under the earth. They are ruled over by three principal serpents named Śeṣa, Vâsuki, and Takṣaka.

Monkeys, a whole army of which aided Râma in his conquest of Ceylon, are of course amongst the most sacred of animals. They are inviolable and never under any circumstances to be molested.[1]

The insignificant tiny creature, squirrel, whose labours of love in the construction of the famous bridge are believed to have been appreciated by Râma himself, also, belongs to the same category.

In his work on Indian Mythology[2] according to the Mahâbhârata, Mr. Fausboll gives the following account of the nâgas or serpents. "They dwell in the bowels of the earth in Nâgaloka, which is endless, aparyanta, crowded with hundreds of different kinds of palaces, houses, towers and pinnacles, and strewn with wonderful large and small pleasure-grounds. The serpent world is likewise called Pâtâla. They also live in caves, in inaccessible mountainous regions, and are even said to be found in the valleys, in Kurukṣetra, on the banks of the river Ikṣumati, in the Naimiṣa forest on the shores of the Gomati, in numbers on the northern banks of the Ganga and in the Nisadha (mountain districts). * * * They are possessed of great strength, have a big body, are frightful, very quick, very violent. They are provided with tusks full of poison. They are handsome, take many shapes and wear showy ear-rings. * * * Some have 3, others 7, and others again 10 heads, etc."

Hamsas or ganders are the animals sacred to the four-faced god Brahma,[3] whose floral emblem is a lotus; for "his chariot, vimâna, which is as quick as thought, is harnessed with hamsas."

The brother of Aruṇa, the Sun-god's charioteer, is Garuḍa (the king of birds), called also Suparṇa, because of his handsome feathers. The story of his birth is narrated in the Mahâbhârata (I, 1073). He has serpents for food, and is the sign or standard of the god Viṣṇu. From him are descended all serpent-eating birds[4] who worship Viṣṇu as their great protector. The

[1] Hinduism (1877), by Prof. Monier Williams, pp. 169-170.

[2] London: Luzac & Co., 1903.

[3] Fausboll's Indian Mythology (Luzac), p. 74.

[4] Fausboll's Indian Mythology, pp. 77-80.

serpent called Śeṣa or Ananta is also sacred to Viṣṇu, for it is his couch or bed on which Viṣṇu rests in Yoga sleep.

The animals famous in the Indra-cult are the elephant, the horse and the cow. Indra's beautiful and always victorious elephant, who stands at the entrance to Swarga, is called *Airâvata* and has four tusks. His horse *Uchchaiśravas* came forth under the churning of the ocean, and is white with a black tail. His chariot is drawn by 10,000 reddish-yellow horses. Nandini[1] or Kâmadughâ is Indra's 'wishing cow,' who grants all wishes and is the daughter of Dakṣa Prajâpati.

The Varâha or boar is the animal in whose form the god Viṣṇu had to embody himself in order to save the earth from the waters of a deluge which had completely enveloped it. The story of this avatâra or incarnation is thus given in the Mahâbhârata (III, 15826): "He thought of the shape of a boar, which animal loves to play in the water. And when he had given himself a boar's body that could speak and which agreed with the traditions of the Vedas, ten yojanas broad and a hundred yojanas long, resembling a great mountain in shape, shining with sharp tusks, thundering like a mass of clouds, and resembling a dark cloud, then the Lord descended like an offering-boar into the water, drew the earth up with one of his tusks and set it back in its place."

Among the ten incarnations of Viṣṇu adopted by Him on the occasions of cataclysms three are animal forms, *e.g.*, those of the *matsya* or *mina* or Fish, *kurma* or Tortoise and *varâha* or Boar; and a fourth is half-animal, half-human, *e.g.*, man-lion or *Narasimha*. The "horse's head-incarnation called the *aswasiras avatâra* is mentioned in the Mahâbhârata only (XII, 13478) and does not belong to the traditional list of 10 known to the latter-day Hindus. Again, according to the Mahâbhârata[2] "the Matsya-incarnation is referred to Brahmâ, and the Kurma-incarnation has no connection with Viṣṇu"

In any case, there is no doubt that in Hindu mythology the Fauna are important enough to have contributed at least three of the ten important forms for the embodiment of the Divinity in times of sore distress for mankind and creation. We have to notice, further, that Yama, the Death-god, has two four-eyed dogs, that Śiva is clothed in tiger-skins, and has, for his conveyance, a white bull with a huge body, thick neck, broad shoulders, that the goddess Durgâ stands on the lion as vâhana or bearer and overpowers the mahiṣa or buffalo, that the alligator is sacred to the goddess Gangâ, the tortoise to Yamunâ, that the six-faced war-god Kârtika rides on a peacock, that the god of success, Gaṇeśa, has the mouse for his embem, and the owl is sacred to Lakṣmi, the goddess of fortune.

Among the Vedic deities, also, we find the same recruitment of conveyances or emblems or signs from the animal world. Thus Pushan[3] is the "herdsman who drives the cattle with an ox-goad and rides on a goat."

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[1] *Ibid*, p. 82-90. The story of Nandini has been popularised in the first two cantos of the immortal *Raghuvamsam* of Kâlidâsa.

[2] Fausboll's Indian Mythology, pp. 120-122.

[3] Oppert's *Original Inhabitants of India* (Constable & Co., Westminster, 1893), p. 276.

(f) *The Fauna in Hindu Art.*

Indian art also bears impress of the animal lore of the Hindus. This is natural, since the fauna, being important elements in Hindu religion, cannot but influence the art and literature that have always been associated with it. Architecture, sculpture and painting have in all ages and climes been hand-maids to mythology. The history of Hindu art is no exception to this. Furthermore, we have to notice that art and literature have had their careers independent of religion also, both in the East and West, embodying the thousand and one feelings, sentiments, ideals, aspirations, &c., of a non-religious or secular order.[1] Indian Fauna and animal-lore have left their deep marks on both the religious and secular branches of Indian art; and this is another testimony to the Hindus having cultivated their powers of observation with reference to Natural History.

We have seen that mammals, aves, pisces, and reptiles of the Vertebrate Kingdom have all contributed to the mythology of the Hindus. As might be expected from the tendency of the Hindu mind to give concrete shape to all transcendental or spiritual ideas and embody every sentiment in images, all these phyla of the animal world have their specimens in the religious sculpture or plastic art as well as painting of Hindusthan. The animal vāhanas or vehicles and symbols of the gods and goddesses have ever been the handiworks of painters and sculptors,[2] along with their lords, in stone or bronze or other materials as the case may be.

Architecture also testifies to the prevalence of animal motif in Hindu art. In his essay on the architecture of the Hindus[3] Mr. Ram Raz, Judge and Magistrate of Bangalore, says: "In the existing treatises on Hindu Architecture, no mention is made of anything like a substitution of human figures for columns to support the entablature, but the shaft is directed to be adorned with the figures of demons and animals; yet various examples are to be met with in which human figures, as well as representations of animals, are employed in bold relief in the sides of pillars in temples and porticoes, but by no means like those found in Egyptian architecture. The antiquity of this invention in India is not determined."

The following are the remarks of Dr. Mitra[4] on the representation of animal figures in Orissan Sculpture: "The Uriyas did not prove unequal to the task. They made considerable progress in it, and displayed much tact and

[1] Mr. Vincent Smith, however, commences his monumental work on the history of Indian art with the hypothesis that "Indian art is the slave of religious tradition," though the innumerable specimens of sculpture and painting described and illustrated by him as well as other art-historians and art-critics bring out the secular aspects in no uncertain light and give the direct lie to the statement.

[2] See Fergusson's *History of Indian Architecture*, Havell's *Indian Sculpture and Painting* and *Indian Architecture*, Vincent Smith's *History of Fine Art in India and Ceylon*.

[3] Published for the Royal Asiatic Society of Great Britain and Ireland in 1834.

[4] Indo-Aryans, Vol. I, pp. 99-101.

ingenuity. In my work on Orissa reference has already been made to their life-like pictures of monkeys, and the success with which sensuous passions have been shown in them. The elephant has also been carved and chiselled with great skill. The horse at the southern gate of the Konârak porch is remarkably well-proportioned, and representations of rats, parrots, geese, goslings, deer and other animals shown in the illustration annexed to my work on Orissa will be generally acknowledged to be pretty close imitations of nature. A colossal bull in the enclosure of the Great Tower is also worthy of note as a specimen of well-finished animal carving. The lion among animals is, however, invariably ill-carved. It has everywhere a conventional, unnatural half-dog half-wolf look about it.

"* * It is generally representsd as trampling on an elephant about one-half to one-sixth of its size, crouching under its foreleg. Looking at groups like these, and the marked disparity in the size of the two animals, I am disposed to think that the lion had become extinct in Orissa when the sculptures were made, and the artists had to depend upon tradition and their imagination to produce its likeness. This inference receives some support from the fact of the lions in the Udayagiri bas-reliefs being much better-shaped; and they, it is to be presumed, were delineated when the animal was common in the country. * * Winged bulls and lions are unknown in Orissa."

Animal-life has been portrayed and perpetuated in and through the medium of other forms of Hindu art also, *e.g.*, industrial arts, handicrafts, etc., that minister to the purposes of commerce or domestic life. Such animal figures are those to be met with as decorative or ornamental devices on textile and silken fabrics, carpets, ivory carving, metallic bas-reliefs, earthen, wooden, and stone vessels, &c. In his paper on the *Religious Element in the Arts and Crafts of India* in the Modern Review for March, 1913, Prof. Radhakamal Mookerji gives a detailed account of some of these 'motives': "Among birds the most frequent are the peacock and the paroquet represented in wood-carving as well as in textiles. In the textiles the birds are placed usually head and tail in the vertical bands and in the transverse ones with each alternate bird looking over its shoulder." According to *Yukti-kalpataru*, "the prows of ships admit of a great variety of fanciful shapes or forms: these comprise the heads of lion, buffalo, serpent, elephant, tiger, birds such as the duck, pea-hen or parrot, the frog."

The following extract from Vincent Smith's[1] *History of Fine Art in India and Ceylon* gives a general account of 'animal motives' in Hindu Sculptures and Painting: "The Indian treatment of indigenous animals in both sculpture and painting is as original and artistic as that of plant motives."

"You have only," Sir George Watt writes, "to look at the plants and animals employed in the most ancient designs, to feel the strong Indian current

[1] Chapter XI, p. 888. See also the illustration of "antelope frieze" on p. 192, 'Colossal horses' on p. 195, Elephant colossus on p. 196.

of thought there conventionalised, which must have involved centuries of evolution. The treatment of the elephant, monkey and serpent is Indian, and in no way Greek. No Greeks (as few Englishmen to-day) could give the life touches of those animals seen on all the oldest sculptures and frescoes."

"These observations are perfectly true, and in all discussions of the foreign elements in Indian art we must remember that in certain respects Indian artists were not only free from obligation to the Greeks but actually superior to them. The illustrations in the work bear abundant testimony to the Indian power of delineating indigenous living forms, both vegetable and animal. The Gandhara treatment of the elephant is inferior to that of the same subject by the artists of the interior, who were more familiar with the wonderful beast, which is not easy to model or draw well."

Mr. Vincent Smith's monumental work furnishes several pictures of animal-life in Hindu art. We mention here the tortoise sacred to the goddess Yamuna. There are two[1] pieces of exquisite workmanship upon this subject which have been admired by connoisseurs. "The unsurpassed skill of the Hindu lapidaries in working the most refractory stones is best exemplified by the great jade (or ? jadeite) tortoise, found many years ago in the bank of the Jumna near Allahabad. * * * Mr. King observes that 'for fidelity to nature and exquisite finish it is worthy of the ancient Greeks.' Again, the tortoise in ivory, produced about 1830 by Gobind Ratan of Nayagarh in Orissa, is described by Sir George Watt as a "wonderful creation," which raises the artist who produced it to a position of "equality with the ivory carvers of Europe, Japan or China."

The 'Rider motive'[2] is thus described by Mr. Smith: "At Amaravati and in Gandhara a favourite subject is the departure of Gautama Buddha as Prince Siddhartha from Kapilavastu on horseback. Generally the horse is shown in profile, but occasionally is represented as emerging from a gateway, and facing the spectator, fore-shortened."

Specimens from the earliest Hindu Paintings in which animal-life has been perpetuated have been also described and illustrated by Vincent Smith. The oldest painting found in the Jogimara cave of the Ramgarh Hill in Orissa belonging probably to 2nd cent. B. C., presents before us elephants, and a chariot drawn by horses. Among the infinite subjects and decorative designs in the Ajanta Paintings (5th—7th cent. A.D. ?) in which "fancy is given full play, simplest objects of nature being pressed into the artists' service," we find panels "with animals combined with lotus, drawn with remarkable fidelity and action, as the elephant, humped bull, and the monkey; parrots, geese, and conventional birds, singly and in pairs, with foliated crests, and tails convoluted like heraldic lambrequins, showing the upper and under surface of the ornament."

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[1] See the illustrations on pp. 357 and 373 of *Smith's Hist. of Fine Art.*

[2] *Ibid*, p. 382.

The picture of fighting bulls is one of considerable interest not only as displaying the artists' command over the manifestations of life, but also as supplying a convention and motive in Indian art-history. The following is the note of Mr. Smith on the one in Ajanta Paintings: "Its treatment proves the artists' knowledge of animal form and his power of expressing vigorous action[1]. The same subject, with variations of detail, is treated in a sculpture at the ancient cave of Bhâjâ, dating from about the beginning of the Christian era, and again in a sixteenth century painting at Akbar's Capital, Fatehpur Sikri."

Three notable paintings have elicited special admiration of Mrs. Herringham:[2] "They are (1) a hunt of lions and black buck, (2) a hunt of elephants, (3) an elephant salaaming in a king's court. These pictures are composed in a light and shade scheme which can scarcely be paralleled in Italy before the 17th century. The whole posing and grouping is curiously national and modern, the drawing easy, light and stately, and the painting suggestively laid in with solid brush strokes—in the flesh, not unlike some examples of modern French painting. The animals—horses, elephants, dogs and black buck—are extremely well drawn."

Two colossal horses at Konârak in Orissa have called forth the following remark of Havell which is considered by Vincent Smith[3] as hyperbolical: "Here Indian sculptors have shown that they can express with as much fire and passion as the greatest European art the pride of victory and the glory of triumphant warfare; for not even the Homeric grandeur of the Elgin marbles surpasses the magnificence of movement and modelling of the Indian Achilles, and the superbly monumental horse and its massive strength and vigour are not unworthy of comparison with Verrochio's famous master-piece at Venice."

The "plunging horse"[4] in the famous choultry at Madura is of interest as being both a fine piece of work in bronze and also a miniature reproduction of a characteristic type of South Indian sculpture in stone.

The fish-motif in Hindu art has been thus described by Havell in *Indian Architecture*:[5] "When used to represent the aura in a sculptured or painted figure of Buddha, the lotus leaf was generally associated with the *makara* (alligator ?), a kind of fish dragon, the fish being an emblem of Kâma, the God of Love and of fertility. The fish was also a sign of good luck, for in the Indian legend of creation it was a fish that saved Manu, the progenitor of the human race, from the flood. This form of aureole, with the makara and lotus leaf combined, is still a tradition with Saivite image-makers in Southern India."

The same writer in his *Ideals of Indian Art*[6] describes the characteristic Hindu feeling of reverence and love of nature, both animate and inanimate,

[1] See illustration on p. 283.
[2] Quoted by Vincent Smith, pp. 293-94.
[3] Hist. Ind. Fine Art, pp. 195-196.
[4] *Ibid* p. 240.
[5] P. 82.
[6] Pp. 107-112.

as a spontaneous concomitant of the cult of *Bhakti* or the way of Faith (including Hope and Charity), one of the three traditionally recognised paths to salvation in Hindu metaphysics. The Hindu conception of the reciprocity of Man and Nature, the doctrine of the participation of the whole Creation in the joys and sorrows of man, the philosophy of the incompleteness of the one without the other, and the idea that Nature is not a mere background to display man in relief, that even dumb animals have a place in the heaven, are the eternal tenets inspiring every work of the Hindu—in his mythological creation of the abodes of the gods, in his literary master-pieces, and in his finest art-products. Havell illustrates the idea by the story of the faithful dog, in the Mahâbhârata, without which Yudhisthira refused to enter Paradise and care for his own salvation, the participation of all Nature—cows, elephants, lowly bush, gay birds—in the entreaties of the sorrowing citizens of Ayodhyâ on the occasion of Râma's exile, and by the invocation of Sîtâ to the spirit of the lordly peepul tree (*Ficus religiosa*) when the edge of the forest was reached, and also by the compassionate caressing of the faithful horse Kamthaka by Buddha on parting from the "noblest of steeds." We may add also the scene described by Kâlidâsa in canto XIV of Raghuvamsam where Universal Nature—the very deity of Forests—began to wail with Sîtâ when she was deserted near Vâlmîki's forest and given Râma's mandate by Lakṣmaṇa.

The theory of animal *motifs*[1] in Hindu art is thus explained by Havell: "It is not the ignorance and superstition of the primitive savage, but a firmly-rooted belief in the doctrine of re-incarnation and in the immanence of God, which makes the Indian express so reverently and worshipfully his intimate fellowship with all created things. * * * Gautama himself had passed through all forms of life, and in the tree, worm or insect, or in the beast of the field there might still dwell the soul of Buddha that is to come. * * * In the sculptures of Sanchi and Amaravati he (the artist) shows the wild elephant coming to pour libations over the sacred tree under which the Buddha sat, and all the denizens of the forest join with their human fellow-creatures in adoration of Buddha's footprints, his begging bowl or his relic shrines."

The note to plate IV in Dr. Coomâraswâmy's explanatory introduction to his *Selected Examples of Indian Art*[2] deals with a characteristic treatment of animals in Hindu paintings, and *pari passu* presents before us a peculiar tenet of the philosophy of Hindu music. According to the Hindu, modes of music, like all moral, spiritual, intellectual or physical attributes and qualities of man, are the "manifestations and perceptible forms of certain musical beings," the 'Geniuses' called Râgas (male) and Râgiṇis (female).

The tendency of Hindu genius to personify, iconise and tender homage

[1] Read in this connexion "Hindu Ideals—An Appreciation," being the Inaugural Address delivered by Dr. Brajendranath Seal, as King George V Professor of Philosophy in the University of Calcutta.

[2] Essex House Press, Norman Chapel, Broad Campden, Gloucestershire, 1910.

to the creation of religious imagination is manifest in the conception of music, as of *vidyâ* or learning, *lakṣmî* or wealth, *sakti* or prowess, and so on. The *Râgiṇî Tori* is thus described in an old Rajput book on music, with illustrations as well as descriptive verses, called *Râga-Mâlâ*, or 'Garland of Râgas,' a copy of which belongs to Mr. Gagaṇendranâth Tagore of Calcutta : "Having a shining snow-white form, white as the *kunda* flower, scented with Kashmiri camphor, Tori, embowered in the woods, charmeth the deer with the honeyed sweetness of her vînâ's sound." "The introduction of animals attracted by music," says Coomâraswâmy "is a motif found also in other Râgiṇî pictures. This orphic motif occurs also in the Lailâ-Majnun pictures, where the animals come to hear the songs of Majnun, and in Kriṣṇa pictures, where the cows are represented as rapt by the sound of Kriṣṇa's flute."

Referring to the folk-element[1] in Rajput art, especially Pâhâri Drawings, the same art-historian and art-critic remarks : "In the hill drawings, the influence of the folk appears directly in the constant emphasis laid on pastoral life, not merely in set pictures of Kriṣṇa as the divine cowherd, but in more naive sketches which reflect the everyday life and environment of peasants. Fig. 1. inscribed Sri Kriṣṇa, milkman, affords a good example of this. Another drawing represents a girl looking up at a crow perched on a roof."

The animal motifs in Rajput art have been described with illustration by Coomâraswâmy in his two series of Indian Drawings. Here we meet with cheetah attacking a deer ; frisky cows ; cow and calf ; cow with anklets, bell and plume ; lion attacking man and deer ; lynx and deer ; running elephant ; Himalyan sheep ; leopards fighting ; grasshopper ; leopard and deer ; four deer ; three lions ; buffaloes ; lion and rhinoceros ; running deer ; partridge ; the divine cowherd ; lions.

The following is taken from the *Indian Drawings* Series I (p. 18) ; "The drawings of animals are amongst the most accomplished and most perfect examples of Indian art of the 17th century. How far the tradition of animal drawing is at all Persian, and how far indigenous it is difficult to say. It is certain that we find very good and vital drawings of animals in the quite purely Hindu work of the Tanjore School, and also that, whereas in Persian paintings wild animals are regarded as creatures to be hunted rather than understood, in Indian work their own specific and even individual character is delineated as affectionately as in the case of the portraits of human beings. The elephant is drawn with special knowledge and skill. * * * The runaway buffalo has all the vitality and vigour which we find in the finest of Japanese animal drawing, while the somewhat demure satisfaction of the tame rhinoceros with bells round its neck is altogether delightful. The rendering of movement in the drawing of four running deer is particularly good ; almost equally so is the slow nibbling progress of two Himalayan sheep. * * * The little drawing of a grasshopper shows that the smaller creatures were not forgotten. The drawing of a partridge recalls the beautiful bird-studies of Durer. Some

[1] *Indian Drawings* Series, II, p. 13 (India Society, London, 1912).

of the best animal drawings are those representing the capture of one animal by another, or the set fight between two animals."[1]

(g) *Varâhamihiran Fauna.*

The *Brihat Samhitâ* of the 6th century A.D. is rich in animal-lore—the accounts of what has long been known as Natural History—and devotes several chapters to a description of the features of cows, oxen, dogs, cocks, turtles, goats, horses, and elephants. Chapter LXI begins thus: "All that Parâśarâ told Brihadratha about cows and oxen, I shall briefly state here. I shall, however, treat scientifically of the animals possessing good features"

The following enumeration is taken from Chapter LXXXVI:—"Creatures remarkable for speed, genius, strength, place occupied, merriment, nobleness of mind or good sound are strong when in their own places; the same rule applies to useful animals.

"The cock, the elephant, the peacock, the vanjula, the musk-rat, the duck and the kutapoori are strong in the east. The jackal, the owl, the hartâla pigeon, the crow, the ruddy goose, the bear, the ichneumon, the dove—are strong in the south.

The ram, the swan, the osprey, the partridge, the cat are strong in the west. The crane, the deer, the rat, the antelope, the horse, the cuckoo, the blue jay and hedgehog are strong in the north."

Varâhamihira classifies the Fauna according to habits of life thus:—

(1) The Indian cuckoo, the hog, the sasaghna, the vanjula, the peacock, the sreekarṇa, the Brahmani duck, the blue jay, the andiraka, the parrot, the crow, the dove, the skylark, the wild cock, the osprey, the vulture, the monkey, and the sparrow are day birds and animals.

(2) The jackal, the pingala, the chippika, the flying fox, the owl and the hare are night birds and animals.

(3) Horses, serpents, camels, leopards, lions, bears, inguanas, wolves, mungoose, deer, dogs, goats, cows, tigers, swans, antelopes, stags, hedgehogs, cuckoos, cats, cranes and pigeons are both day and night animals"

The various cries of animals, of both good and bad omen, have been enumerated in Chapter LXXXVIII.

In describing the methods of interpreting these cries, Varâhamihira adds the note that "birds and animals bear different names in different countries; and hence the animals shall first be identified from their names."

The omens connected with animals, regarding not only cries, but habits, habitats, features, limbs and movements, have been elaborately described in Brihat Samhitâ, and, in fact, form the subject matter of several chapters. Thus

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[1] Iyer's *Brihat Samhitâ* Part II, pp. 91-99.

[2] *Ibid* Part II, pp. 180-1.

Chapter LXXXIX is devoted to the omens connected with the dog, the next chapter begins with the statement that "all that has been said of the dog applies also to the jackal, but there are a few special points to be noted," and gives the various malefic cries of the jackal. The omens connected with wild animals are described in the 91st chapter, and those connected with the cow, horse and elephant in the next three chapters respectively. The cawing of the crow has a large chapter (XCV) devoted to it. We read that "in the case of people inhabiting eastern countries, the crow on the right side indicates good luck; but the crowing of the crane indicates prosperity when on the left side. In other countries the case is otherwise. The limits of provinces shall be learnt from a general knowledge of the country.

(h) Ayurvedic Fauna.

The medical literature furnishes abundant proofs of the intimate acquaintance of the Hindus with all the features of animal organism, internal and external, as well as the principles governing animal life

The animal kingdom has been utilised for the *Materia Medica* of the Hindus since very early times. The musk and the poisons of *cobra de capello* and of the snake-eating black cobra, are some of the animal-products used in medicine. The properties of the flesh of various kinds of animals have been discussed very elaborately in almost all treaties on Therapeutics.

The following is taken from Gondal's[1] *History of Aryan Medical Science*:

Asthi (bone) of a goat reduced to ashes, and formed into an ointment with other ingredients, is used for curing fistulæ. Cuttlefish bones are also used medicinally.

Danta (tooth) of the elephant is prescribed in leucorrhea.

Dugdha (milk) is nutritive and vitalising. Human milk ** Cow's milk ** Goat's milk ** Sheep's milk ** Elephant's milk ** Ass's milk ** Camel's milk.[2] ** The properties of milk are said to vary according to the colour of the animal and the qualities of the pasture.

Garala (poison) of snakes is used in dropsy.

Meda (fat) of camels and hyenas is considered a valuable local remedy for gouty joints.

Puchchha (feather) of a peacock is said to cure hiccough. It is also believed that snake-poison will not affect one wearing a ring made of copper extracted from peacock's feathers.

Sringa (horn) of a stag has various medicinal uses.

Gondal mentions also the medicinal virtues of cowdung, elephant's humus, droppings of cocks and goats, conches, cowries, corals, biles of fish and other aquatic creatures, nails, and urine of cows, horses, camels, elephants, goats,

[1] Iyer's *Brihat Samhitá* Part II, pp. 196-97.

[2] Pp. 119-134 (Edition of 1896).

&c., skins of snakes, cob-webs of spiders, leeches, lac, honey, &c., used by the Hindu practitioners of the Ayurveda.

The Hindu Science of Toxicology, again, as one of the eight branches of the Ayurveda, recognised by Charaka, has largely drawn upon Animal-lore. "The treatment of poisons and their antidotes comes under the head of *Kalpa*. Poisons are of two kinds (1) *Sthâvara*, vegetable and mineral poisons; and (2) *Jangama*, animal poisons.[1] * * Jangama poisons include venoms of such animals as insects, scorpions, spiders, lizards, serpents, mad dogs, foxes, jackals, wolves, bears, tigers, &c. ** Both kinds of poisons are used therapeutically by the Hindus."

In his lecture at the *Sâhitya Sabhâ* of Calcutta, Dr. Gananath Sen referred to Hindu Toxicology in the following words: This "contains the treatment

(i) of the crude poisons—vegetable, mineral and animal (including extensive chapters on snake-bites and classification of snakes, &c.), and

(ii) of the microbic poisons, which, it is said, distinctly arise out of the contamination of air, water, and soil, and immunity against which was sought and partly attained.

The practice of appointing physicians skilled in Toxicology to accompany expeditions of large armies and to take charge of the king's kitchen-room was in vogue even at the time of Susruta. So late as in the reign of the kings of Gauḍa we find the relics of the practice in the fact that Chakrapāṇi Datta, the well-known physician and author of Bengal, describes his father as physician in charge of the royal kitchen."

Gondal also describes the indebtedness of Alexander (according to the Greek historian Arrian) to the Hindu Vaidyas in curing cases of snake-bite which defeated his Greek physicians. "In face of the fact that the European Toxicologists are still in search of a specific for snake-poison, the Indian physicians who lived some 2,200 years ago might well be proud of their skill."

It may be incidentally remarked here that it is only during the last two decades or so that snake-poison has been used as an article in western Materia Medica, whereas it has been a recognised drug among the people of Hindusthan from time immemorial. In noticing this superiority of Hindus over Europeans we are reminded of the remark of Dr. Uday Chand Dutt about the diffidence and caution of Yunani practitioners in the internal administration of mineral drugs in which the Hindus had been proficient:[2] "We cannot help admiring the ingenuity and boldness of the Hindu physicians when we find that they were freely and properly using such powerful drugs as arsenic, mercury, iron, &c., while the Musalman Hakims around them, with imperial patronage and the boasted learning of the west," were bold enough only "to use them as few as possible" and consider them to be "dangerous drugs."

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[1] Gondal's Hist. of Ary. Med., pp. 155-156.

[2] Preface to *Materia Medica of Hindus* (Second Edition, 1900), pp. xiv-xv.

According to Charaka, [1] "Animals are divided into four classes (1) Jarâyuja or Mammalia, (2) Andaja or oviparous, (3 Swedaja or those produced from animal excretions, as parasites, etc., and (4) Udbhijja or those produced underground or from vegetable matter, *e.g.*, *indragopa*, a sort of red insect."

The following is taken from Part III of Dutt's *Materia Medica of the Hindus*: "Leeches have been employed by the Hindus from a very remote period. Susruta gives a detailed account of their varieties, habits, mode of application, &c. His account of leeches has been translated in full by Dr. Wise. Pandit Madhusudan Gupta had also furnished a note on the subject for publication in the Bengal Dispensatory. There are twelve varieties of leeches, six of which are venomous and six useful. The venomous leeches are found near putrid fish or animals in foul, stagnant and patrescent water. The good leeches are found in clear and deep pools of water which contain water-lilies. The middle-sized leeches are the best. * * *

"The lac insect (coccas lacca) has been known to the Hindus from a very ancient period. The *Butea frondosa* is the principal tree in which lac is said to be produced. It is used in colouring silk. * * *

"Eight sorts of honey are described by Susruta; of these varieties, *Mâkṣika* (collected by the common bee), *Bhrâmara* (collected by large black bees), *Kṣaudra* (collected by small bees), and *Pauttika* (collected by small black bees resembling ants) are described by recent writers. * *

"The *Bhâvaprakâsa* describes three kinds of musk, *viz*, Kâmarupa, Nepâla and Kâshmira musk. * * * In describing the properties of the flesh of various animals Sanskrit writers divide them into two classes, *viz.*, *Jangala* or land and *Anupa* or water animals." Land-animals are sub-divided into eight classes, and water-animals into five. Thus we get the following classification:

I.—Jangala or Land Animals:

1. Jangala—living in forest; *e.g.*, deer, antelopes.
2. Vilastha—living in holes; *e.g.*, serpents, lizards, porcupines, &c.
3. Guhâśâya—living in caverns; *e.g.*, tigers, lions, bears, &c.
4. Parṇamriga—living on trees; *e.g.*, monkeys, squirrels.
5. Viṣkira—(birds) which take their food after tearing or scattering it; *e.g.*, peacocks, quails, partridges, &c.
6. Pratuda—(birds) which strike with their beaks; *e.g.*, pigeons, wagtails, cuckoos, &c.
7. Prasaha—birds of prey; *e.g.*, hawk, falcon, &c.
8. Grâmya—domestic; *e g.*, ox, goat, horse, sheep.

II.—Anupa or Water Animals:

1. Kulechara—grazing in marshes; *e.g.*, buffaloes, yak, rhinoceros.
2. Plava—birds which swim in water; *e.g.*, geese, ducks, cranes, &c.
3. Kosastha—animals enclosed in shells; *e.g.*, conch-shells, bivalve-shells, &c.

[1] Ibid, p. 1.

4. Padina—footed animals; *e.g.*, tortoise, crocodile, porpoise, &c.

5. Matsya—fishes.

The classification of Fauna adopted in the *Hârita Samhitâ* [1] in the chapters on flesh (XX—XXII), which enumerate and describe several species of animals, is as follows :

I. Chatuspada or Quadruped.

1. Ena.
2. Chitrânga.
3. Chhikkara.
4. Rohita.
5. Sukara (or boar)
6. Sasaka or hare.
7. Sallaka.
8. Salyaka.
9. Godha.
10. Musaka.

II. Sthalachara or Land Animals.

1. Lavaka.
2. Tittira (partridge).
3. Nîlamayura (peacock),
4. Dwitiya mayura.
5. Kukkuta (jungle fowls).
6. Kapota (pigeon).
7. Chakora.
8. Suka (parrot).
9. Sâri.
10. Krauncha (dove).
11. Kokila (cuckoo).
12. Vivritâksa.
13. Grihachataka.

III. Jalachara or Aquatic Animals.

1. Water-Birds.
2. Makara (alligator).
3. Matsya (fish).
4. Kachchhapa (tortoise).
5. Kulira (crab).

Regarding the knowledge of the Hindus about the internal morphology of animal-organism, the following extracts may be cited :—

"The Hindus could set fractures and dislocations in men and beasts. They were perfectly acquainted with the anatomy of the goat, sheep, horse and other animals used in their sacrifices. * * * The constant wars and internecine strifes afforded ample opportunities to the surgeons to distinguish themselves in their professions and acquire considerable dexterity in their work. * *

"In order to acquire dexterity in surgery the preceptors made their pupils practise different operations on various substances. * * Evacuating was practised on the urinary organs of dead animals; [2] scarification on the fresh hides of animals on which the hair was allowed to remain; venesection was practised on the vessels of dead animals; application of caustics and the actual cautery on pieces of flesh. * * *

"Buddha and his followers [3] would not permit the dissection of animals. They put a stop to animal sacrifice, in which a knowledge of anatomy was indispensable and substituted models of dough."

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[1] See the Text edited by Kavirâja Binodlal Sen of Calcutta.

[2] Gondal, pp. 176-180. See Hœrnle's *Studies in Ancient Indian Medicine.*

[3] Ibid, pp. 185-186.

(f) *Fauna in Veterinary Literature.*

The very definition of the scope and province of Ayurveda[1] given by Charaka (Sutra-sthâna, Ch. XXX) "covers not only the medical science in its widest aspect including the veterinary science—specified as *Śâlihotra* and sub-divided into *Gajâyurveda* and *Aśwâyurveda*, but also certain phases of Psychology and Ethics on which long philosophical and instructive discourses are found in ancient Ayurvedic works."

The importance and antiquity of veterinary science in the secular literature of the Hindus have been noted by Gondal[2] also: "Hindu medicine was at the acme of its glory in the time of Râmâyana and the Mahâbhârata. To the court of every chief, great or small, was attached a physician. There were Army Surgeons and Court Physicians. * * Veterinary science seems to have been highly cultivated long before that period. Nala, a remote ancestor of the Pândavas, is described as a most accomplished horse-trainer, and as possessing a thorough knowledge of all matters relating to the horse. Nakula, one of the five Pândavas, was an expert in the veterinary science on which he has written several works, his *Aśwachikitsâ* being still extant. The science of treating elephants, bullocks, and other domestic animals, was and is still known in India. * * * Buddha established hospitals for men and beasts all over the country; and the institutes of Pinjrapoles (Animal Hospitals), so peculiar to India, owes its origin to him."

The existence of treatises in Hindu literature, specially addressed to the needs of the animal creation, is the strongest evidence of Zoological studies in ancient and mediæval India. It is quite natural that a veterinary science should have come into being as a differentiated and specialised branch of the general Ayurvedic literature of those days, since agricultural live-stock, draught cattle, cavalry, camel-corps, elephant-corps, &c., were the common features of the domestic, economic and political lives. Some idea of the secular activities and 'nature-studies' of the Hindus will be obtained from an account of their treatises on elephants and horses.

(*A*) *Pâlakâpya or the Science of Elephants.*

Treatises on elephants are known to be *Gajachikitsâ*,[3] *Gajavaidya*, *Gajâyurveda*, *Hastyâyurveda*, *Hasti-vaidyaka*, &c. The sage Pâlakâpya is by tradition known to be the originator of this science, which is not infrequently named after him. The antiquity of these works is to be inferred from the following note in Prof. Aufrecht's *Catalogus Catalogorum*, Vol. I (1891).[4] "Pâlakâpya is quoted

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[1] Lecture delivered by Dr. Gananath Sen on *Medical Science in Ancient India* at the Sâhitya Sabha of Calcutta in 1906.

[2] *Hist. of Ancient Aryan Medicine*, pp. 187-189.

[3] A fanciful name is *Gudhaprakâśikâ*. See Aufrecht, I, 140.

[4] P. 336.

by Kṣiraswâmin on *Amarakoṣa*, Hemâdri in *Vratakhanda*, *Sârangadharapaddhati* (p. 99),[1] and Mallinâtha."

The volume of literature on the subject would be apparent if we mention the various manuscripts referred to in the above 'alphabetical register[2] of Sanskrit works and authors.' The following account is based on that work.

A work called *Gajachikitsâ*, or 'Treatment of Elephants,' is to be found in the Catalogue of Manuscripts belonging to the late Pandit Radhakrishna of Lahore, who was famous not only for his enlightened views, but also for his great knowledge of Sanskrit lore.

Gajadarpaṇa and *Gajasâstra* are quoted by Hemâdri, and Dinakara respectively on Raghuvamsam. *Hasti-vaidyaka* is a work by Virasena,[3] quoted by Bhattotpala on *Brihajjâtaka*.

Gajaparikṣâ is the name of a work in Oppert's List of Sanskrit MSS. in Private Libraries of Southern India (Vol. II, Madras, 1885). *Gajalakṣaṇa* or 'Characteristics of Elephants,' attributed to Brihaspati, is also to be found in Oppert's List, as well as in the Catalogue of Sanskrit MSS. in the Library of H. H. the Maharaja of Bikaneer compiled by Râjendralâl Mitra,[4] and in the Catalogue of Sanskrit MSS. existing in Oudh compiled by Pandit Deviprasad.[5] A copy of *Gajâyurveda* is to be found in the Supplementary Catalogue of Sanskrit works in the Saraswati Bhandâram Library of H. H. the Maharaja of Mysore, signed by F. Kielhorn. Aufrecht[6] mentions also such names of treatises on elephants as *Gajadâna*, *Gajaddnapaddhati*, *Gajanirâjanavidhi*, *Gajaśânti*, *Gajârohaṇa-Prayoga*, *Gajâvarta-lakṣaṇa*, to be found in the catalogues of Lahore, Benares, Madras, Tanjore and other places.

Treatises named after Pâlakâpya, the first promulgator of the science, the Charaka of Hastyâyurveda, are to be found in the following catalogues:

(1) Report on the Search for Sanskrit manuscripts in the Bombay Presidency during the year 1880-81 by Kielhorn.

(2) Catalogue of MSS. in the Library of the Benares Sanskrit College—published as a Supplement to the "Pandit" Vol. III—IX (Benares, 1864-74).

(3) Catalogue of Sanskrit Mss. in the Library of H. H. the Mahârâja of Bikaneer—compiled by Dr. Râjendralâl Mitra[7] (Calcutta, 1880).

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[1] Aufrecht's analysis of the work in Vol. 27 of the Zeitschrift of the German Oriental Society. Pâlakâpya has been quoted in *Agnipurâṇa* also (Chapter CCLXXVI). See Sivadatta's Preface in Ânandâsrama Edition.

[2] First volume published at Leipzic in 1891, Second volume in 1896. Third volume in 1903.

[3] Aufrecht, I, p. 765.

[4] Published in Calcutta, 1880.

[5] Vol. XVI (1883).

[6] Vol. I, p. 140.

[7] On the merits of Mitra's works Prof. Aufrecht says:

"The copious extracts are very useful, and enable the attentive reader to judge of the contents of a work, even where he is deserted by the English Text. The indefatigable industry of the Editor deserves every kind of commendation."

(4) Catalogue of Sanskrit MSS. in the Private Libraries of the N.-W. Provinces (Allahabad, 1877-86).

(5) A Classified Index to the Sanskrit MSS. in the Palace at Tanjore, by A. C. Burnell (London, 1880).

(6) Detailed Report of operations in search of Sanskrit MSS. in the Bombay Circle (1882-87).

(7) *Suchipustaka* or a list of the MSS. of Fort William, the Asiatic Society in Calcutta, etc. (Calcutta 1838).

The second volume of Aufrecht's monumental *Catalogus Catalogorum* mentions (1) a *Gajaparikṣâ* in Peterson's Fourth Report on the Search for Sanskrit MSS in the Bombay Circle (1894), (2) a *Gajâyurveda* or *Hastyâyurveda*, (3) a *Gajâyurveda* printed at Poona in 1894 by the Ânandâsrama Publishing House, (4) a *Gajendramokṣaṇa*, said to be taken from the Sântiparva of Mahâbhârata (where, however, it is not found) in the Catalogue of Sanskrit MSS. in the Library of H. H. the Maharaja of Ulwar, and also (5) a *Hastyâyurveda* by Pâlakâpya in the last list.

The third volume of Catalogus Catalogorum published in 1903 adds to the above list the following names :—

(1) *Gajavaidya*, with a commentary in Telugu, in the collection of MSS. belonging to the modern Sanskrit literature presented to the Library of the India Office by A. C. Burnell.

(2) *Gajendramokṣaṇa* in Reports on Sanskrit MSS. in Southern India by Hultzsch.

(3) *Hastyâyurveda* by Pâlakâpya in the catalogue of printed books and MSS. in Sanskrit belonging to the Oriental Library of the Asiatic Society of Bengal, compiled by Pandit Kunja Vihari Nyâyabhuṣaṇa, under the supervision of Mahâmahopâdhyâya Haraprasâda Sâstri.

The information contained in these treatises is more or less the same as given in such works of modern times as *Elephants and their Diseases*,[1] by Lieut.-Colonel G. H. Evans, Superintendent, Civil Veterinary Department, Burma, as a cursory glance at the table of contents in the *Hastyâyurveda*[2] published by the Ânandâsrama, Poona, would indicate. This work, attributed to Pâlakâpya Muni, has been edited by Pandit Sivadatta of Jeypore, Professor of Sanskrit in the Government Oriental College, Lahore. In the Sanskrit Preface to his edition Sivadatta says that those branches of Ayurveda concerning elephants, horses and other lower animals which were created by such master-minds as Pâlakâpya, Sâlihotra and others, have become almost extinct and are remembered only by the frequent quotations of latter-day commentators, and that no other Sanskrit treatise on elephants has been printed and published before his.

[1] Published by the Superintendent, Government Printing, Burma, 1910.

[2] No. 26 of the Ânandâsrama Sanskrit Series, Sivadatta's *Pâlakâpya* (1894, Poona).

The work before us is based on four MSS.: two belonging to Jaypore, one to Poona, and one to Calcutta. It is a huge treatise consisting of 721 pages of royal octavo size. It is divided into four books and contains 12,000 ślokas. Book I is divided into 18 chapters, and is called the *Mahârogasthâna*; Book II is divided into 72 chapters and is called *Kṣudrarogasthâna*; Book III called *Salyasthâna* (surgery) is divided into 34 chapters. The last book has 36 chapters.

The work has been composed in the form of a conversation between King Romapâda of Champâ in the Anga territory and his preceptor, the sage Pâlakâpya. The first four chapters of Book I may be taken to be introductory to the whole work. We are told how the king of the Angas wants to have the elephants of the forests tamed for his state, how the animals are brought from the quarters of the country indicated by Louhitya River (Brahmaputra) and placed under the care of Pâlakâpya, the expert in the theoretical as well practical sciences regarding elephants, who condescends to live with the king and be his 'guide, philosopher, friend' in the training and management of elephants. The fourth chapter gives a preliminary survey of the subject matter treated in the whole book.

Besides all topics connected with anatomy,[1] physiology, surgery, food, medicines, diseases, treatment, poisons, &c., the work deals incidentally with the relations between teachers and pupils in Book I, chapter vi, toxicology in Book II, chapter vi, the seasons in Book IV, chapter xv, the leeches in Book IV, chapter xxxiv, the superstitions and religious observances in Book IV, chapters xxxv and xxxvi. In the 4th chapter of Book I there is a distinction[2] drawn between exclusively theoretical and exclusively practical knowledge in *Hastyâyurveda*, and the advice to rulers is that they should appoint such men only, in charge of the elephants, as combine both theoretical knowledge and practical experience, for each alone is quite useless.

(*B*) *Śâlihotra or the Science of Horses.*

Treatises on horses are known to be *aśwachikilsâ*, *aśwasâstra*, *aśwavaidyaka*, *aswâyurveda*,[3] &c. The father of the science of horses and the first promulgator of the veterinary art concerning them is the sage Śâlihotra, after whom also all these treatises are generally named. It has to be remarked that Śâlihotra stands often for all the veterinary sciences of the Hindus, not necessarily those relating to horse-life. In fact Śâlihotrasâstra is divided into two branches (1) Gajasâstra and (2) Aswasâstra.

We have seen that, besides Pâlakâpya, tradition ascribes treatises on elephants to one Virasena and to Brihaspati. Similarly, besides Śâlihotra, Hindu tradition knows of several authors[4] of works on horses, *e.g.*, Nakula,

[1] Book III, Chapters 9, 29.

[2] V. 106-122.

[3] A fanciful name is *Siddhayoga-saṃgraha*. Cf. Aufrecht I, p. 34.

[4] Aufrecht I, pp. 34-35. See the useful Sanskrit Preface to *Aswavaidyaka* by Pandit Umeschandra Gupta Kaviratna, Librarian, Sanskrit College, Calcutta (1887).

Bhojaraja, Jayadatta, Garga Rişi, Gana, Jayadeva, Sârangadhara, Nalaraja, Vahada, Dipamkara and others.

The antiquity of treatises on horses is to be inferred from the following facts. The work of Jayadatta, called *Aswavaidyaka*, has been quoted in *Sârangadharapaddhati*[1]. Sâlihotra has been quoted by Hemâdri in *Vratakhanda*. The *Hayalîlâvati*, also a work on horses, has been quoted by Mallinâtha.[2]

The volume and importance of Hindu literature on horses would be evident from a glance at the references in the three volumes of *Catalogus Catalogorum*. The first volume[3] mentions :—

(1) *Aşwachikitsâ* or *Aswavaidyaka* by Jayadatta in Oppert's lists.

(2) *Aşwachikitsâ* or *Aswasâstra* or *Sâlihotrasâstra* by Nakula in notices of Sanskrit MSS. by Râjendralâl Mitra (1871-90), Kielhorn's Catalogue of Sanskrit MSS. in the C. P. (Nagpur, 1874), the Catalogue of Sanskrit MSS. contained in the Private Libraries of Gujrat, Kathiawad, Kach, Sindh and Khandes compiled under the superintendence of Buhler (1871-73, Bombay), Mitra's Bikaner Catalogue, the Catalogue of Pandit Radhakrishna of Lahore, Deviprasada's Oudh Catalogue (vi, xviii, xix), Catalogue of N.-W. P. (V) and Burnell's Tanjore Catalogue.

(3) *Aswadâna* in Oudh and Burnell.

(4) *Aswadânapaddhati* in Radhakrishna and Peterson.

(5) *Aswadânaprayoga* in Burnell.

(6) *Aswadânavidhi* in Oudh.

(7) *Aswalakşaṇa* in Oppert.

(8) *Aswalîlâvati* or *Hayalilâvati* in Oppert II.

(9) *Aswavaidyaka* by Jayadatta in Mitra's Notices (1871-90), and Oudh (VI, XI, XVIII).

(10) *Aswasâstra* in Burnell.

(11) *Aswasâra* in Buhler.

(12) *Aswâyurveda* or *Siddhayogasamgraha* by Gana, son of Durlabha, in Weber's Berlin Catalogue (1853) and in Peterson; by Garga Rişi in Kielhorn.

(13) Nakula's *Aswachikitsâ* quoted in *Sârangadharapaddhati*.[4]

(14) *Sâlihotra*, "the general name for veterinary art,[5] ascribed to Sâlihotra Muni, for whom Nakula creates a father, Aswaghoşa (Turangaghoşa)," in

[1] Aufrecht I, p. 199. *Vide* also Pandit Gupta's Sanskrit Preface, p. 6, where he discusses the identity of Jayadeva.

[2] *Vide* Gupta's Sanskrit Preface, p. 2.

[3] Pp. 34-35, 278, 644.

[4] Aufrecht's analysis of the work in Vol. 27 (1878) of the Zeitschrift of the German Oriental Society, p. 48.

[5] Aufrecht, I, p. 644. *Vide* also Pandit Gupta's Sanskrit Preface to *Aswavaidyaka*.

Benares Catalogue, Radhakrishna, Oppert II, Dr. R. G. Bhandarkar's Report on the Search for Sanskrit MSS. in the Bombay Presidency during the year 1883-1884.

(15) *Sâlihotrasâra* in Radhakrishna.
(16) *Sâlihotronnaya* in Burnell.
(17) *Hayalilâvati* (quoted by Mallinâtha) in Bodleian Sanskrit MSS. (Oxford 1136)

The second volume[1] of Aufrecht mentions

(1) *Aswachikitsâ* by Nakula in Stein.
(2) *Aswadâna* in Oudh (XX, XXI).
(3) *Aswaparikṣaṇa*, attributed to Nalarâja in Dr. R. G. Bhandarkar's Lists of Sanskrit MSS. in Private Libraries in the Bombay Presidency.
(4) *Aswavaidyaka* by Jayadatta in Peterson.
(5) *Aswâdiguṇâh* in Peterson.
(6) *Aswâyurveda* by Gaṇa.
(7) *Aswâyurveda-sârasangraha* by Vâhâda, son of Vikrama, in Stein.
(8) *Sâlihotra* "veterinary art," ascribed to Muni Sâlihotra in eight *sthânṣa*. These are called unnaya, uttara, sariraka, chikitsita, kisorachikitsâ or śiśubhaisajya, uttarottara, siddhisthana and rahasya" in Stein.
(9) *Aswavaidyaka* by Jayadatta in Ulwar

Aufrecht's third volume[2] mentions

(1) *Aswachikitsâ* by Nakula in Burnell's collection presented to India Office, in Dr. R. G. Bhandarkar's Report (1887-91); by Sâlihotra in Bhandarkar.

(2) *Aswavaidyaka* by Jayadatta in Hrishi Kesha Sastri and Siva Chandra Gui's Descriptive Catalogue of Sanskrit MSS. in the Library of Sanskrit College, Calcutta (1898); by Dipamkara, son of Nanakara, grandson of Nidanakara, in Haraparasâda Sâstrî's Report (1895-1900).

(3) *Aswâyurveda* by Gaṇa in Harapra-sâ-da Sâstri.

The Hindu treatises on horses treat of almost the same topics as are dealt with in modern works on the subject, *e.g.*, Lieut.-General Sir F. Fitzwygram's *Horses and Stables*,[3] Hayes' *Training and Horse Management in India*,[4] *etc.* The 68 chapters in the *Aswavaidyaka* of Jayadatta and 18 chapters in *Aswachikitsâ* of Nakula, both edited by Pandit Umeschandra Gupta, Librarian, Sanskrit College, Calcutta, for the *Bibliotheca Indica* (1887) deal among other things with their anatomy, the good and bad signs, as indicated by their colour, feathers, &c., age, growth and development, the classification according to mettle, their movements, paces &c., and usefulness as draught-animals or as cavalry &c., embryology, articles of food and nourishment according to seasons, the various ailments and remedies, &c.

[1] Pp. 7, 153, 188.
[2] P. 8.
[3] Longmans, Green & Co., London, 1911.
[4] Longmans, Green & Co., London, 1905.

The origin of the science of horses is thus described by the editor in the Sanskrit Preface on the evidence of Nakula's treatise. The winged horses of Indra could not be controlled. So Sâlihotra was requested by Indra to lop off their wings. This was done, but the poor animals waited in deputation upon the powerful sage who had brought them to this plight. He was moved and the result was the composition of treatises to heal the wounds of the horses and minister to the needs of their proper development.

APPENDIX B.

(*j*). *Zoological Taxonomy of the Hindus.*

See Dr. Seal's notes on the subject in Appendices.

SECTION 4.

The Sukra Fauna.

The authors of the Sukra Cycle were well-read men, their culture was widely varied, and their scholarship adequately deep. The Mineralogical and Botanical data in their work call up before us the large range of their studies, as they unmistakably point to their thorough grasp of the scientific literature of their times. Further, the brief and fragmentary survey of the Zoological lore of the Hindus we have given in the preceding section (i) indicates not only the character of the literary atmosphere in which all Sanskrit works were composed in ancient and mediæval India, but (ii) also suggests to a certain extent the curriculum of nature-studies or the courses of scientific instruction which undoubtedly formed an integral part of the liberal education of the *Brahmachâris* of yore.

The words of Mark Pattison that the appreciation of Milton's poetry is the last test of consummate classical scholarship, apply with equal force to the *Nitisâstra* of Sukrâchâryya, since in this work the authors have summed up the whole encyclopædia of Hindu learning, literary, scientific as well as technical, according to the conception and standard of those ages. *Sukraniti*, from its scope and subject matter, is, as we have already noticed in the chapter on Mineralogy, the embodiment of comprehensive Hindu scholarship, its achievements and limitations, its processes and products, its methodology and contributions—not, however, in the interest of an abstract, academic, intellectual gymnastics, but solely to subserve the practical ends of Hindu socio-economic and socio-political life, in accordance with the actual requirements of some of the epochs of Indian culture-history.

This, however, is unfortunately the main reason why it is difficult to realise the local or epochal characteristics of the work. The analysis of the internal evidences does not carry us very far. The fallacy of *argumentum ex silentio* and the existence of floating or conventional ideas are the eternal agencies that circumscribe the range of 'wide solutions' that may be possibly attempted. Besides, it is not always easy to estimate the value of the findings or data from a work; for (1) they are not sufficiently copious, (2) their comparison and contrast

with standard texts are not in many cases possible, because of the want of many such texts of approved authenticity, and (3) their comparison and contrast with the physical and sociological conditions are, if anything, really vague, indefinite and inconclusive, because of the epitomic and almost universal or uniform character of the Indian world, in both its physical and human aspects.

Thus with regard to the Sukra Fauna, it is not possible to achieve even the tentative character of the results we have arrived at in our treatment of the Botanical data. For our authors have drawn upon the animal world of their country and the Zoological lore of their people in a very general manner. It is not safe to assign a specific character to their references to animal-life, as we have been able to do in the case of their botanical knowledge.

The animal world has been portrayed by the Sukra authors mainly as a store-house of analogies, illustrations, &c. for the truths of the moral world. This treatment is more or less conventional, and, while it indicates a familiarity of the authors with the habits, habitats, &c, of animals, it does not supply us with a positive *terra firma* or a reasonable ground for presuming any geographical limits, and does not seem to prove anything beyond a mere acquaintance with the lore on the subject, through fables or adages.

Besides these illustrative references, there are in Sukranîti some toxicological ideas dealing with the sensitiveness of certain animals to poisons. Now Toxicology is a science as old as the Ayurveda. We meet with it in all medical treatises from Charaka downwards. Pâlakâpya also deals with the subject. The *Arthasâstra* of Kautilya, the work of the 4th century B.C., utilises the current ideas in its chapter on the management of the royal household.

Thirdly, the agricultural live-stock and domestic cattle have been referred to in Sukranîti, but the references are not very exhaustive. Anything like detailed treatment of the animal world is to be met with in the chapter on the Animal-corps of the state. But here, also, we miss, as we should, not only the comprehensive character of *Pâlakâpya* and *Aswavaidyaka*, &c,—treatises devoted exclusively to elephants and horses,—but also the elaborate details that we expect in handbooks meant for officers of the state. Such an exhaustive account of the military live-stock, however, we get from Kautilya's *Arthasâstra*, which has drawn upon the veterinary literature of the country to a more considerable extent.

Thus the whole subject of cattle, their maintenance, protection, medical treatment &c., treated in the second chapter of Mr. Law's work based on the *Arthasâstra*, is entirely lacking in *Sukranîti*. Similarly, the geographical, technical and other aspects of fauna, wild, domestic, agricultural or military, which are to be met with in Sivadatta's edition of *Hastyâyurveda* and Umeshchandra's edition of treatises on horses by Jayadatta and Nakula, have been treated by Kautilya, but neglected by the Sukra authors. To quote Mr. Law,[1] "As in regard to horses, certain ceremonies were observed to propitiate

[1] P. 58.

unseen agencies for the welfare of elephants. Thus *ârati*, or waving of lights, was performed thrice daily in the rainy season and at periods of conjunction of two seasons. Sacrifices to *Bhûtas* were also performed on new moon and full-moon days, as also to Senâni or Kârtikeya, the god of war." Ceremonies like these have been described in the last two chapters of Pâlakâpya, Book IV.

A reference to the Zoological works in Hindu literature would demonstrate the depth and width of the learning displayed by Kautilya in his compilation of the *Imperial Gazetteer* of Maurya India, and would substantiate the truth contained in the following words with which Mr. Law concludes his account of the Department of Live-stock in Chandragupta's Government: "We have seen the comprehensive character of its scope and work touching the welfare and growth of such important animals as the cow, the horse or the elephant, on which depended, to a great extent, both the economic prosperity and political security of the country."

The paucity of Zoological information supplied by *Sukranîti* would be evident from another consideration also. In the case of the Flora, the enumeration of trees in two lists gave us scope wide enough for the application of the ecological and literary methods in order to find out its *locale*. But the authors have not presented us with any taxonomy of animals, scientific or unscientific, or any register of the fauna to be kept in Zoological gardens or hunting forests, or the like. We do not read in the Sukranîti of any system of classification or enumeration like that we find in the *Artha-sâstra*, for example. The following list of Kautilya, though very poor, does at any rate furnish us with a positive record of the fauna in the Royal Gardens or State Forests of the Empire ruled from Pâtaliputra, the historic city of Eastern India in the post-Buddhistic ages. The animals[1] that were exempted from capture, molestation and slaughter, and maintained in the *Abhaya-vanas*, or 'Forests of safety,' are :—

(1) Birds, deer and other animals living in the forests under state protection, as well as fishes in the ponds therein.

(2) Those birds, fishes, deer, and other animals that do not prey upon life.

(3) Calves, bulls, and milch-cows.

(4) Ocean animals resembling elephant, horse, man, ox, or ass.

(5) Fishes in rivers, lakes and canals.

(6) A few game-birds, specially named as follows: cranes in rivers, lakes and canals, ospreys, sea-eagles, gallinules, swans, flamingoes, &c., Brahmany ducks, pheasants, fork-tailed shrikes, partridges, cuckoos, peacocks, parrots, *Turdus salica* (maina).

(7) Those birds and beasts that were regarded as sacred (*e.g.*, those enumerated in Asoka's Rock-Edict V).

[1] Law's *Studies*. pp. 32-33. The protection of birds in agricultural countries is a necessity as worm-eaters. *Cf.* the wretched condition of French agriculture as a result of the indiscriminate destruction of birds.

Even such a list, if we had it in Sukranîti, would not have been sufficient for the purposes of finding out the *locale* of the Fauna and of the authors who described it; for (i) a study of the Zoological geography[1] of India would indicate that these are more or less uniformly distributed throughout the country, and (ii) the commercial history would show that fauna have been imported to long distances from their native habitats as articles of commerce.

But Sukranîti refers to animals only incidentally as it were; the natural preaumption being that the nature-studies in it, as far as the fauna is concerned, are not probably the result of any direct local or personal experience, but are derived from the perusal of works on the subject or the store-house of floating Zoological literature. If, again, personal or local experience be admitted, no conclusive evidence as to the home of the authors can be secured, since the animals may be brought from place to place for purposes of sale.

The existence of camel-corps in the army seems to be a special feature of Sukranîti and might point to the locality where camels abound.[2]

But camels have been important in Indian economic life since at least the days of *Arthasâstra*. Thus, among the duties of the superintendent of pastures[3] in Chandragupta's Empire, was the regulation of the grazing of cattle. "As to the kind of animals that were allowed admission into the grazing grounds, we have information from two passages. The first passage mentions that a herd may be of cows, buffaloes, goats, sheep, asses, camels, horses or mules. The second passage, which appears in a different context, refers to cows, horses, and camels as being the animals which flourish on pastures and are the source of power to the king."

If camels be recognised to be a 'source of power to the king' by the Prime Minister of the first Empire-builder in India, it is not difficult to see that the camel-corps should have been a regular institution in the war-establishment of Hindu kings of any importance. Even if their territory did not include areas specially fit for camel-life, rulers would find no difficulty in importing them as articles of commerce for purposes of conveyance, peaceful or military. It may be observed that, as marketable commodities, animals, though less mobile than metals and precious stones, are more so than flora; the 'market' for them is therefore wider and more extensive.

As for the habitat of camels, it has to be noted, that they are "nowhere found in a wild state."[4] Again, to quote from Blanford's *Mammalia* in the *Fauna of British India*, "It is unknown in the wild state, and although Bactrian camels have been found wild by Prejvalski and others in the deserts east of Yarkand, there is but little doubt that these wild individuals are descended from tame ancestors."

The result is, that camels are to be seen wherever there are people rich enough to need and have a 'demand' for them. The mention of camels

[1] Chapter V, *Indian Empire* Vol I, in the *Imperial Gazetteer* of India.

[2] As Prof. Yogeshchandra Ray suggests in a footnote to *Ratnapariksâ*.

[3] Law's *Studies*, p. 27.

[4] *Natural History of Indian Mammalia* by Sterndale (Thacker, Spink & Co., Calcutta, 1884), p. 518.

and existence of camel-corps, therefore, do not necessarily point to the natural habitat of these animals, but solely to the power, prosperity and importance of the persons who command them.

Just as in the case of minerals we could not come to any reasonable conclusion as to the locale of the Sukra authors, so also here we have to confess inability to point to any geographical environment which might leave its stamp on the work. We proceed now to give an account of the various species of fauna referred to in Sukranîti.[1]

SECTION 5.

Mammals in Sukranîti.

Reserving for subsequent treatment the agricultural live-stock and animal-corps, we notice here the various orders of fauna treated by the Sukra authors.

(*a*) *Primates.*

The monkey[2] is one of the animals whose sensitiveness to poison should be availed of in the detection of deleterious and malefic ingredients in the king's food. The test is supplied by the fact that at the very sight of poisoned food, monkeys pass stools.

The Sukra authors have recorded also the tradition of monkeys being followers of the hero of the Râmâyaṇa. "There has never been a virtuous king like Râma, of whom even monkeys[3] accepted service." Again, "Fate was certainly unfavourable to Râvâṇa, when he met with discomfiture from even one monkey[4] on the occasion of *Vanabhanga*."

(*b*) *Carnivora.*

There are three families of this order in Sukranîti—Cats, Dogs and Bears.

i. Felidæ,

The Felidæ or Family of Cats is represented by (1) the Lion, (2) the Tiger, (3) the Fishing cat.

In *Sukranîti*, the lion is the embodiment of strength[5] and prowess. The authors have illustrated the strength of unity by drawing the analogy of the union of threads. "The unity of opinion possessed by the Many is more powerful than the king. The rope that is made by a combination of many threads is strong enough to drag the lion."

The lion is the king of animals, and hence is used by all Sanskrit authors for comparison with the ruler of men. Lion-cubs are like princes;[6] in the section dealing with the management of princes we are told that "even when well-governed, if they get a slight opening, they forthwith kill the protector, as lion-cubs kill the elephant at the first opportunity."

Lions were tamed[7] in those days. The taming of lions has supplied an

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[1] 1889-91, p. 558.
[2] Sukra IV, vii, 838-39.
[3] Sukra II, 35-37.
[4] Sukra I, 653-57.
[5] Sukra V, 114-15.
[6] Sukra I, 111-18.
[7] Sukra IV, i, 48-49.

illustration in statecraft. "One should bring friends and foes to bay by appropriate methods, just as snakes, elephants and lions are tamed."

The tiger[1] is one of the animals with which the king is advised to sport in the forests, and which is to be used by him for extirpating the undesirable, *i.e.*, seditious or intriguing,[2] relatives in the interest of the state's prosperity.

Tiger-hunting was certainly one of the adventurous feats of both rulers and men; among the general rules of morality we have the advice that one should not go alone to attack snakes, tigers[3] and thieves.

The tiger is known to be inferior in position to the lion. It is also stated that the king should promote the soldiers' strength and valour by organising hunting excursions against tigers[4] and big game.

Thus we read that, just as even the tiger[5] and the elephant cannot govern the lion, the king of beasts, so all the councillors combined are unable to control the king, who acts at his own sweet will.

The tiger is also known to be untamable, hence the advice, "Association with tiger,[6] fire, snake, and other ferocious animals is not good. Even when served, the king and these things can never be friends to any body."

It has to be remarked that Sukra authors know of the lion and the tiger as animals belonging to the same tribe, the Felidæ. In the section on construction of images of gods and their *vâhanas* (vehicles or conveyances or symbols), we have the following rules: "The tiger[7] has the form of a cat, yellow colour, black marks (stripes), huge physique and no manes. The lion has a thin waist, large eye-brows, big eyes, a young appearance, manes, grey colour and black marks. The difference between the lion and the tiger is only in manes and marks, not in appearance." The fact that these animals belong to the same family is known by the proverb common enough in India that the cats are aunts of these animals.

The tiger is one of the animals that have supplied emblems and seals of state. Thus, on the authority of the Tamil classic, *Pattinappâli*, Mr. Aiyangar says in *Ancient India*[8]: "They did not forget in those days to maintain a regular customs establishment, the officials of which piled up the grain and stored up the things that could not immediately be measured and appraised, leaving them in the dockyards carefully sealed with the tiger signet of the king."

The cat[9] is the animal the lustre of whose eyes has supplied the name for the moving rays of a gem, called Vaiduryya. The habits of the fishing cat are well-known to the Sukra authors. In the supplementary chapter dealing with the political morality of rulers, Sukrâchâryya advises the king always to be on the look out for opportunities. "One should wait guardedly like the cat[10] and

[1] Sukra I, 665-66.
[2] Sukra II, 55-56.
[3] Sukra III, 323.
[4] Sukra IV, vii, 880-81.
[5] Sukra IV, iv, 831-35.
[6] Sukra IV, vii, 34-35.
[7] Sukra III, 518-519.
[8] P. 66.
[9] Sukra IV, ii, 92.
[10] Sukra V, 8-9.

the fowler, and by creating confidence extirpate the enemy whose soul has been ruined by vices."

ii. Canidæ.

The Canidæ or the Dog-Family is poorly represented. There are no references to jackals, foxes or wolves. Only the common dog has been mentioned. It stands for a contemptible miserable creature in the following Burns-like ultra-socialistic statement of Sukrâchâryya : "Does not even the dog [1] look like a king when it has ascended a royal conveyance ? Is not the king justly looked upon as a dog by the poets ?"

The idea is that the king does not look magnificent unless he is attended by the retinue of officers and the regal insignia as well as the paraphernalia. The king alone is no more than a dog, *i.e.*, cannot command awe and reverence of the people. Truly,

"The rank is but the guinea's stamp,
The man is the gowd for a'that.
* * * *
You see you birkie, ca'd a lord,
Wha struts, and stares, and a' that ;
Though hundreds worship at his word,
He's but a coof for a'that."

iii. Ursidæ.

The Ursidæ or Bear-Family is likewise not important in Sukranîti. One species has been mentioned and that only once. The timid horses are known to be those that have snake-like tongues and the colour of bears.[2] Evidently the black bears[3] are referred to, which are covered with long coarse hair, inhabit some of the hottest parts of India, are generally very timid and are easily tamed.

(*c*) *Rodentia.*

Only one Family of this order has been mentioned in Sukranîti, *e.g.*, Rats and Mice.

The Muridæ or Rat-Family is represented by common rats. Their sensitiveness to poison has been mentioned by the authors as one of the tests for examining the food of the king. At the very sight of poisoned food the rats[4] become excited."

(*d*) *Ungulata.*

"To this order belong elephants, horses, rhinoceros, tapirs, oxen, antelopes, goats, sheep, deer, camels, and swine, besides several generic forms not now found in India. Some of these, however,—for instance, a species of giraffe and hippopotamus inhabited the country in past times. All the most valuable domestic animals are ungulates."

From this statement of Blanford it might be naturally expected that the ungulates should be copiously represented in Sukranîti. In fact it is so ; and

[1] Sukra I, 745-46.
[2] Sukra IV, vii, 330.
[3] Indian Empire, Vol. I, Chap. 5, p. 228, in the Imp. Gazet. Series.
[4] Sukra I, 854-57.

whenever there is a general reference to animals or an enumeration of several species, we may take it to imply the ungulates. Reserving the agricultural and military live-stock, *e.g.*, the elephants, horses, camels and bulls for separate treatment, we mention below the various contexts in which the other families of the ungulates have been referred to by the Sukra authors.

i. Capridæ.

The Capridæ or Goat-Family has been well-represented in Sukranîti. Of course the distinction between goats and antelopes cannot be traced in it. Among the references to cattle, without any specification, goats are to be understood as belonging to them. And in those passages where one or two animals have been mentioned by name and the others are referred to by an "etc.," goats should certainly be counted.

Some of the officers in the Department of Live-stock in Hindu States are in charge of goats,[1] sheep, cows &c. Only such persons are to be appointed as are skilful in tending and nourishing them and who have love for those animals.

The goat is known to be a very stupid animal. The stupidity of a man, vain through possession of wealth, is thus described: "The man who is proud of his wealth does not know of his own infamy, just as the goat[2] uses his urine to wash his own urine-scented mouth or face."

The comparative prices[3] of sheep, goats and cows are given below:

Ordinary:

She-goat = ½ cow [= ½ silver *pala* (= Rs. 4)]

She-sheep = ½ she-goat = ¼ cow [= Rs. 2]

Extraordinary:

Cow = 8 or 10 silver *palas* = Rs. 64 or 80.

She-goat or she-sheep = 1 silver *pala* = Rs. 8.

The Public Finance of Sukrâchâryya recognises goats and other animals as important national resources to be tapped in the interest of the state. The king should realise one-eighth of the increase of goats,[4] and one-sixteenth of the milk of she-goats. The payments are to be in kind, it appears.

ii. Ovidæ.

The Ovidæ or Sheep-Family has received the same treatment in Sukranîti as the Capridæ. We have seen in connexion with goats the rules about the appointment of officers for the management of the royal live-stock. The prices of sheep also have been given above in the comparative statement. The wool[5] derived from the fleece of the sheep is, like silk, an important article of the royal household; and trained men have to be appointed to look after these stuffs.

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[1] Sukra II, 297-8.

[2] Sukra III, 179-180.

[3] Sukra IV, ii, 188-192. The History of Indian Prices will be dealt with in the chapter on the *Data of Ancient Indian Economics*.

[4] Sukra IV, ii, 239-240.

[5] Sukra II, 307-308.