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III. SCIENCE OF THE NINETEENTH CENTURY 26
Science plays a prominent role in the social and political life of a nation is viewed as a factor eminently suited to bring out social changes, economic growth, political development and modernisation. This belief in the value of science is shared by almost all scientists, international experts and national policy-makers. Science is a powerful instrument for national development and it can act as an instrument for industrial and social change and transform of the existing conditions of any given country, thus provides opportunity for development.

The development of science is related with the history of man. The civilization, as we know it today be impossible without science. The spread of scientific ideas has been decisive factor in remoulding the whole pattern of human thought. Especially we do find in the conflicts and aspirations of our time a continual and growing involvement of science. Men live in fear of destruction by the atom bomb or biological weapons, in hope of living better lives through the application of science in agriculture and medicine.

The march of events brings before us even more insistently, problems about science such as proper use of science in society, the militarisation of science, the relation of science to governments, scientific secrecy, the freedom of science, the place of science in education and culture. These problems must be solved and will be answered in practice in the process of finding the way of using and developing science most harmoniously and with the best results for humanity.

In natural science and specially in physical science, the idea is firmly held that current knowledge takes the place of and supersedes all the knowledge of the past. It is admitted that future knowledge of the will in turn make
present knowledge obsolete, but for the moment it is the best available knowledge. All useful earlier knowledge is absorbed in that of the present what has been left out are only the mistakes of ignorance. For example the report on plague in Bombay is at present a useful document for further research. By this document the scientist can know the reason and the methods used for controlling at that time. This will become a future research project.

However, experience by itself is not enough and indeed it can never operate alone. Consciously or unconsciously it is bound to be guided by theories and attitudes drawn from the general fund of human culture. In so far as it unconsciously, this dependence on tradition will be blind and will lead only to the repetition of attempted solutions that changed conditions have made unworkable. In so far as it is consciously, it must involve a deeper knowledge of whole relation of science to society for which the first requirement is the knowledge of science and of society. In science, more than in any other human institution it is necessary to search out the past in order to understand the present and to control the future. But in natural and also in physical science, the earlier knowledge is essential for future research.

No doubt science is the means by which the work of our civilization is rapidly being transformed. Now science is growing not as in the past, steadily and imperceptibly, but rapidly, by leaps and bound, for all to see. The fabric of our civilization has already changed enormously in our own life times and is changing more and more rapidly year to year. To understand how this is taking place it is not sufficient to know what science is doing now. It is also essential to be aware of how it came to what is it, how it has responded in the past to the successive form of society and how in its turn it has served to mould them.
I. ASPECTS OF SCIENCE

The science is so old, it has undergone so many changes in its history, it is so linked at every point with other social activities, that any attempted definition and there have been many, can only express more or less inadequately one of the aspects, often a minor one, that it has had some period of its growth. So that the question ‘what is the purpose and meaning of science’ receives quite different answers at different times and from different sorts of people.

Science may be taken (1) as an institution; (2) as a method; (3) as a cumulative tradition of knowledge; (4) as a major factor in the maintenance and development of production and (5) as one of the most powerful influences moulding beliefs and attitudes to the universe and man.

By listing these different aspects of science, I do not intend to imply that there are as many different ‘sciences’. The word science or scientific has a number of different meanings, according to the context in which it is used. The tradition of knowledge passed on from parent to child, from master to apprentice, is the very root of science, existing from the earliest age of man and long before science could be considered as an institution, or could have evolve as method distinct from common sense and traditional lore.

I. SCIENCE AS AN INSTITUTION

Science as an institution in which hundreds of thousands of men and women find their profession is a very recent development. It is only in the profession of science, in the twentieth century, that science has come to compare in the importance with the far old professions of church and the law. It is also being recognised as something distinct from, though allied to, those of
medicine and engineering, which are themselves becoming at the same time less
developed and dependent on tradition and more permeated by science. Its growing
association with the specialized professions has tended to accentuate the
separation of science from the common avocations of society. Science appears
to be an activity carried on by a sort of people, the scientists.

The institution of science as a collective and organized body is a new
one, but it maintains a special economic character that was already there in
the period when science was advanced by the separate efforts of individual.

In earlier times science was largely a part-time or separate-time occupat-
on of people of wealth and leisure, or of well-off members of the older professions.

The function of the patron, whether a wealthy individual, university, corp-
oration, or a department of state, is to provide the money on which the scientist
must live and which will enable him to carry on his work. The patron will in
return want to have something to say in what is actually done, especially if
his ultimate object is commercial advantage or military success. In general
the scientist has to 'sell' his project to the patron, but he is unlikely to
do so unless he can count on at least the tacit support of some of his fellow
scientists, through the various institutions and societies to which they belong.
These bodies have the duty of maintaining the intellectual status of science, but
they don't and can not except where science is planned, exercise such initiative
in determining the fields of science that are to be suited, nor how much or how
little work is to be done in them.

Any full understanding of science as an institution can come only after it
has been studied from its origins in earlier institutions. It will be necessary
to study the changes that it has undergone, especially in recent years, and to show how as an institution it interacts with others and with the general working of society.

3. THE METHODS OF SCIENCE

The institution of science is a social fact, a body of people bound together by certain organizing relations to carry out certain tasks in society. The method of science is by contrast an abstraction from these facts. It is belived by the whole history of science, with its continual development of a multiplicity of new methods. The method of science is not a fixed thing; it is a growing process. The method of science is made up of a number of operations, some mental, some manual. Each of these, in its time, has been found useful, first in the formulation of questions that seem urgent at any stage and then in the finding, testing and using the answers to them. In the past questions to which rational answers could be given were mostly in the fields of mathematical sciences and astronomy. In other fields there were only particular results found by experience and guaranteed by technical usefulness. Later, the scientific method came to be applied and modified in the field of agriculture, industry and medicine, useful to solve the problems of society.

(A) OBSERVATION AND EXPERIMENT

The methods used by working scientists have evolved from a separation of methods used in ordinary life, particularly in the manual trades. First we have a look at the job and then we try something and see if it will work. In more learned language, we begin with 'observations' and follow with 'experiments'. Now everyone, whether he is a scientist or not, observes; but the important things are what to observe and how to observe them. It is in this sense that the scientist differs from the artist. The artist observes
in order to transform, though his own experience and feeling, what he sees into some new and evocative creation. The scientist observes in order to find things and relations that are as far as possible independent of his own sentiments. This does not mean that he should have no conscious aim. As the history of science shows, some objective, often practical one, is almost an essential requirement for the discovery of new things.

B. CLASSIFICATION AND MEASUREMENT

Two techniques, classification and measurement, both are much older than conscious science, but they are now used in quite a special way. Classification has become in itself the first step towards understanding new groups of phenomena. They have to be put in order before any thing can be done with them. Measurement is only one further stage of that putting in order. Measuring is counting the number of a standard collection that balance or line up with the quantity that is to be weighed or measured.

The active aspect of science is 'experiment'. It is only trial and early experiments indeed were full-scale trial. All experiments boil down to two very simple operations: taking apart and putting together again, or, in scientific language, 'analysis' and 'synthesis'.

C. APPARATUS

In order to carry out these operations, scientists have, over the course of centuries, evolved a complete set of material tools of their own—called the 'apparatus' of science. The apparatus is simply the tools of ordinary life turned to very special purposes. In turn, the apparatus of the scientist often comes back into practical life in the form of useful instruments or implements. For example, since the modern televi-
sion set was the cathode-ray-tube, a purely scientific piece of apparatus devised to measure the mass of the electron.

D. LAWS, HYPOTHESES, AND THEORIES

From the results of experiments comes the whole body of scientific knowledge. Before these results can be of any use, it is necessary to tie them together in bundles, to group them and to relate them each other and this is the function of the logical part of science. The arguments of science the use of mathematical symbols and formulas, in early stage merely the use of names, lead to the continuous creation of the more or less coherent dif-

E. LANGUAGE

In the process of observation, experiment and logical interpretation, there has grown up the language. This scientific language helped the scien-
tist to discuss more clearly and briefly but had the disadvantage of build-
ing up a series of special languages that effectively and sometimes deliv-
erately kept science away from the ordinary man.

F. THE STRATEGY OF SCIENCE

This is primarily a method of solving problems and being reasonably sure that the solutions are satisfactory. The essential feature of a stra-
tegy of discovery lies in determining the sequence of choice of problems to solve. The efforts of scientists, generation after generation, are con-


Viewed in the perspective of evolutionary history, science marks a conscious elaboration of the experience provided by the sensory and motor organs of the body. It extends consciously and socially the unconscious processes of learning, common to all higher animals. An animal can learn by experience; man in using science goes beyond this and experiences to learn. In the same sense the scientific method itself, with its codified processes of comparison, classification, generalization, hypothesis and theory, is an extension of mechanisms of the brain, which had already evolved in the higher mammals and capacity of dealing with highly complex reality situations, such as those involved in hunting. The essential difference between these animal performances and the achievements of human science is that the latter is no longer an individual but a social achievement. It arises from the co-operative effort of work and is coordinated by language.

G. SCIENCE AND ART

The major grounds for the distinction of the scientific aspect are that it concerned primarily with how to do things; that it refers to a cumulative mass of knowledge of fact and action and it arises first and foremost in the understanding, control and transformation of means of production -that is of techniques for providing human needs.

The first of these distinctions can be expressed by saying that the mode of science is 'inductive', in that it can indicate or show people how to do what they want to do. In itself, the scientific mode does not attempt to make people want to do one thing rather than another. The artistic mode, a mode equally social, one of whose functions it is to generate first the wish and then the will for specific action; these two modes are related to each other. In the purely scientific asp-
tells how to carry out certain things. If we want to do these on the other
hand, artistic aspect is a work of art something that merely moves or pleases.
The ideal pure science -the pursuit of truth for its own sake. Science is not
a matter of thought alone, but of thought continually carried into practice.
In the history of science we shall repeatedly see new aspects of science aris-
ing out of practice and new developments in science giving rise to new branch-
es of practice.

3. THE CUMULATIVE TRADITION OF SCIENCE

The feature of sciences is their cumulative nature. Science is an of
sequences of the reflections and ideas, but even more of the experience
and actions of a great stream of thinkers and workers.

There is a profound difference between the tradition of the sciences,
particularly of the natural sciences and those of the liberal arts or religion.
The latter is arbitrary in the sense that their final court of appeal is a
revelation or judgement handed down by oral or written tradition. In so far
as they lay claim to a rational justification, it is one of idealist logic.
On the other hand tradition of science and with it that of technology, from
which it arose, is one which can be directly checked by reference to varifi-
able and repeatable observations in the material world. However old or new,
each acquisition of science can be subjected at any determination time to tests
on determinate apparatus. The truth of science is the success of its
application to material systems, whether inanimate as in the physical sciences,
living organisms as in biological sciences. It is only in so far as in the
last of these there is little or not experiment that it has not yet gained the
status of a true science. The scientific biology of real use to medicine was hardly to appear before the nineteenth century.

A. THE PATTERN OF SCIENTIFIC AND TECHNICAL AFFAIRS

In the first place, history shows a definite succession of the order in which regions of experience are brought within the ambit of science. Roughly it runs: mathematics, astronomy, mechanics, physics, chemistry, biology, sociology. The history of techniques follows an almost inverse order: social organization, hunting, domestic animals, agriculture, pottery, cooking, cloth making, metallurgy, vehicles and navigation, architecture, machinery, engines. The reason for this is easy to see. Techniques must first arise men's concern with his biological environment and only gradually pass to the control of inanimate forces. The actual order of the development of the sciences, on the other hand, is not so easy to explain. It is only partly conditioned by internal difficulties. In fact, as their histories show, the science of the more complex parts of Nature, such as biological and medical sciences, were derived directly by study of their subject matter with little help and often much hindrance from the sciences of the simpler parts such as mechanics and physics. The time sequence of the sciences fits even more closely the possibly useful applications which were in the interest of ruling or rising classes at different times. The regulation of the calendar - a priestly function - gave rise to astronomy. The need of new textile industry - the interest of rising manufacturers of the eighteenth century. This textile industries gave rise to modern chemistry.
4. SCIENCE AND THE MEANS OF PRODUCTION

All the aspects given in the preceding paragraphs may serve to describe science - as an institution, as a method, as a growing and increasing organized collection of experiences - however by themselves they cannot explain either the major functions of science today or the reasons why science originally arose as a specialized kind of social activity. This explanation is to be found in the part that science has played in the past and plays today in every form of production. The history of the elaboration of man's means of control over his inorganic and organic environment shows that this has taken place in stages, each marked by the appearance of some new material technique. A technique is an individually acquired and socially secured way of doing something; a science is a way of understanding how to do it in order to do it better.

Science has had a history of remarkable unevenness; great bursts of activity are followed by long fallow period until a new burst occurs, often in a different country. But the where and when of scientific activity are anything but accidental. Its flourishing periods are found to coincide with economic activity and technical advance. The track science has followed - from Egypt and Mesopotamia to Greece, from Islamic Spain to Renaissance Italy, thence to the low countries and France, and then to Scotland and England of the Industrial Revolution - is the same as that of commerce and industry. In earlier times, science followed industry; now it is tending to catch up with it and lead it as its place in production becomes clearly understood. Science was learned from the wheel and the pot; it created the steam engine and the dynamo. However between the bursts of activity there have been quite times periods of degeneration such as that of the later Egyptian dynasties or of late classical times or of the early eighteenth century.

Now the observation of the close association between science and the
technical change does not in itself explain the origin and growth of science. We still need to know the social factors determining the technical changes themselves. The converse relation of technical factors in society is obvious enough. Nor could be the modern urban civilization arise until the combination of agricultural and industrial improvements made it possible to maintain a majority of the population away from the land.

The changes in technique are not so simply determined by social organization. When the productive relations are changing rapidly, as when a new class is rising into a position of power, there is a particular incentive to improvements in production which will enhance the wealth and power of this class and science is at a premium.

5. NATURAL SCIENCE AS A SOURCE OF IDEAS

Though the practical utilization of science is both a perennial source of scientific advance and the guarantee of its validity the advance of science is something more than the continual improvement of techniques. An equally essential part of science is the theoretical framework which links together the practical achievements of science and gives them an ever-increasing intellectual coherence.

Indeed over many periods of science the main direction of work was conditioned by the proving, or, even more often, by the disproving of theory. For example, biology in the late nineteenth century with the proving of the Darwinian theory of evolution etc. The conventional view of science describes it law and theories as legitimate and even logical deductions from experimentally established facts. The laws, the hypotheses, the theories of
Science have a wider bearing than the objective facts they claim to explain. Most of them necessarily reflect in large part the general non-scientific intellectual atmosphere of the time by which the individual scientist is inevitably conditioned. The result is that the phenomena of nature and of the manual arts are interpreted in social, political, or religious terms. For example, Newton's theory of inertia came from the prevailing rational interpretation of religion and Darwin's natural selection from the current concept of the natural justice of free competition.

The general character of theoretical controversy inside science is, however, not new. As clear from the study of the history of science, a sometimes latent, sometimes active struggle has been going on ever since the dawn of science between two main opposing tendencies: one formal and idealistic.

The struggle between idealist and materialist tendencies in science has been a persistent feature in its history from earliest times. For example, idealism of Plato is in some sense an answer to the materialism of Democritus, the founder of atomic theory.

6. INTERACTIONS OF SCIENCE AND SOCIETY

Science and society have, in fact, interacted in a great number of different ways, and the tendency to insist on one or other of these has been the cause of much of the recent controversy as to their mutual relations. It is usual to begin with the influence of science on society. For example, electromagnetic waves, being first of all theoretically predicted, then detected in scientific laboratories, next tried out on an engineering scale and finally, as radio, becoming part of every day life.
Science influences history in two ways: firstly by the changes in the methods of production that it brings about; and then by the more direct but far less weighty impact of its findings and ideas on the ideology of the period. It was the first of these that led to the emergence of science from technique on the one hand and religion on the other.

In less obvious ways scientific knowledge and scientific method are affecting, to an ever-increasing degree, the whole pattern of thought, culture, and politics. Science is now becoming a great human institution, distinct from, though closely linked with, all the older human institutions.

II. DEVELOPMENT OF SCIENCE

I. THE ORIGINS OF RATIONAL SCIENCE

The different kind of knowledge acquired by primitive men—those from implements and tools, from fire, from animals and plants, and from the rituals and myths of society—were not, at their first winning, at all distinct wherever they existed, they blended into one common culture. To understand the genesis of science out of such a culture it is not sufficient to describe its development in terms of the existence of the men of those times. It is also necessary to examine it in the light of modern science. We have to assess the range of what was known at any period and in any field of experience in comparison with the relative complexity of what there is to know. A fully rational and usable science can arise only where there is some hope of understanding enough of the inner workings of a part of the environment to be manipulate it at will to human advantage. Now objectively, the animate world is simpler than the animate and much simpler than social, so that it was intrinsically that the rational and ultimately the scientific control of the environment should follow that order.
By making and using implements, man was transforming Nature according to his deliberate will. This was the origin of rational 'mechanics' — the laws of the movement of matter in bulk expressed in the practical handling of the trap, the bow, the bola. Even without such an understanding of the working of Nature it was still possible for men to take advantage of any portion of the environment in which there was any sign of regularity. It was only necessary for men to know what to expect, without any need to bring things about himself, and to be there to take what Nature gave. This is the observational and descriptive sciences, such as are the basis of the arts of hunting and of gathering fruits in their season.

The interest of primitive man were in any case severely limited and practical. They were confined to the provision of the necessities of life — food, animals and plants — and the materials for tools and equipment together with other things, such as heavenly bodies or features of the landscape deemed to have something to do with their abundance. If the area of the rational and the excepted was small, it was still very large part of what actually interested primitive man.

The beginning of the rational is built into the structure of the physical universe and of the sensory-motor mechanism that had been evolved by animals in the course of thousands of millions of years in such a way that stage they make the use of it. In the first place it derives directly from the visual-manual elements in the human body itself — the inherited eye-hand co-ordinations that gave man such advantage over other animals, especially when he became a social animal. To put it another way, the possibility
of rational thought for man begins in his relation to his physical environment with a very simple device like a lever. For example, it is possible to know in advance what is going to happen at one end and when you move the other. It was on the basis of this eye-hand co-ordination that the rational science of mechanics first grew up. It was in this field alone that it was possible to see and feel intuitively how things worked. This was enormously reinforced by the knowledge acquired in early techniques. The roots of statics and dynamics are to be found in the shaping, making and using of implements. Thus it was that long before any other science could exist, man had already achieved an inner and essentially mathematical logic in the physical handling of definite and discrete objects. As science advanced it was this physical aspect that always retained the lead in rationality over other aspects of science.

2. THE ORIGINS OF AGRICULTURAL SCIENCE

About 10,000 years ago there began a revolution in food production that was to alter the whole material and social mode of existence of man. This was mainly, if not altogether, a result of the crisis in hunting economy. The difficulties that men had to face at that time led to an intensive search for new or even old and despised kinds of food, such as roots and the seeds of wild grasses. This pursuit was to lead to the invention of the technique of 'Agriculture', ranking with the utilization of fire and power as one of the three most momentous inventions in human history. Like all great transformations it was not a single act but a step by step accumulation of interlocked inventions all subservient to the essential achievement — the cultivation of seed giving grasses. In essence this was a transformation of society from the exploitation of the wild-
ate environment to its control, the first step in the achievement of a fully productive economy.

The precise origin of agriculture is and will probably remain conjectural. The limitation of the plants and animals used in agriculture to a very few closely related kinds - edible seed grasses, horned cattle - points to it having arisen in a definite period in some limited area, probably in the Middle East. It is not even certain whether the growing of crops and the domesticated animals were always associated or were the results of the coming together of purely agricultural and purely pastoral cultures. Originally animals may have been attracted by the extrafodder left by the grain - growers and tamed. The growing of crops is in many cases a more far-reaching invention than the domestication of animals; for without supplies of fodder, it is usually impossible to keep an adequate number of animals in a restricted area. Further the marked for meat, skins, and wool, provided by the townsman is essential to an extensive pastoral economy.

The cultivation of grain may however have arisen without any violent break in culture in a well-stocked region where wild grain was abundant enough to be plucked by the women and kept in baskets in permanent settlements. The invention of agriculture is probably little more than a sufficiently clear understanding of this accidental occurrence to justify the practice of sowing grain as a deliberate sacrifice of good food for a more ample return in the next season.

The origin of agriculture led to an essentially new relation between men and society: nature. Man ceased to be parasitic on animals and plants
once he could grow in a small area as much food as he could hunt or collect over a wide range of country. In practising agriculture he controlled animate Nature through a knowledge of its laws of reproduction, and thus achieved a new and far greater independence of external conditions. The first agriculture may well have been a mere scratching of the ground for garden culture carried out in patches temporarily cleared and then abandoned—a kind of nomadic agriculture which is still practised by many tribes today. But even at this low level the practice of agriculture had an explosive effect on human material and social culture.

Agriculture itself involved a set of new techniques in the growing of crops and the preparing of food from them, such as sowing, hoeing, reaping, threshing, storing, grinding, baking and brewing. With them came a whole set of ancillary techniques, either, like pottery and hut-building, arising from the possibilities and needs of permanent occupations.

The very indirect relation of work to its reward that agriculture introduced led to a further extension of the concept of cause and effect which was to become the basis of a rational and conscious science. For example, the whole life history of animals and plants now came under interested observation. It was necessary to know how they bred and grew, not only how to catch the one or gather the other. Similarly, the new techniques that came in with agriculture introduced new mathematical and mechanical concepts. Weaving is clearly a further adaptation basket-making and both of them involve regularities, first of all actually practised and then thought about, which are at the basis of geometry and arithmetic. The forms of patterns produced in weaving and the number
of threads involved in producing them are essentially of a geometrical nature leading to a deeper understanding of the relations between forms and number. Spinning was with the possible exception of the bow drill, the first industrial operation involving rotation and may well in turn have led to the use of the wheel, which in the next period was to revolutionize mechanics, industry and transport. Pottery-making, on the other hand, was the first indirect application of fire and demanded far greater control of it than did lighting, warming and cooking. The use of pottery was in turn to extend the range of cooking operations and was to make the smelting of metals and early chemistry possible.

3. THE ORIGINS OF QUANTITATIVE SCIENCE

The wide scope of operations and the large quantities of materials and the large quantities of materials and services involved in operations of the city temple provoked this qualitative change which marks the beginning of conscious science. In the first place, when they could no longer trust to their memories, the priests were obliged in some way to record the quantities of goods received and handed out. This implied the use of measure, first as a mere convenience - baskets of grain, jars of beer, pieces of cloth - but then, in order to make them comparable, some standardization was necessary. A set of definite temple or royal measures was adopted and gradually, for the benefit of foreign trade, partly co-ordinated between different cities. Probably later, but still very early, is the measure of weight implying the use of balance with its incalculable consequences for science. The balance must be a city product; in village economy there is nothing that can not or measured - a shoulder of mutton, a load of wood. It is in the first place required for valuable metal which can not be measured and where a 'piece' is too
indefinite so that weights are needed. The balance, the only way of comparing
weight, bears all the marks of being a scientific invention. Its prototype was
probably the pole and basket load carrier balanced on the shoulder. It needed,
however, considerable reduction in scale to be really useful for weighing
precious metals.

A. MATHEMATICS

The manipulation of the signs for objects (as simple symbols) meant
that it was possible for the first time to perform the elementary operations
of addition and subtraction without counting the real objects in the fi-
eld. For this it was a matter of matching one collection of objects against
another. First came the standard collection, the ten fingers of the two hands
the digits of arithmetic, the origin of decimal system. In a pyramid text the
soul of an Egyptian pharaoh is challenged by an evil spirit to show that he can
count his fingers and triumphantly pass the examination. For more complicated
counting and for adding and subtracting stones (calculi) could be used, which
gave us the term for all our calculations. Later they were replaced by beads
arranged in tens, tens on wires, making the first and still very useful cal-
culating machine, the abacus. The introduction of measure made it possible to
extend adding and subtracting to quantities. The more complex addition and division
come when shareable quantities were involved, particularly quantities connected
with public works - the digging of canals, the building of pyramids.

The operation of building itself also contributed, probably even before
land survey, to the foundation of geometry. Originally, town buildings were
simply village huts made of wood or reeds. In cities, with a restricted space
and danger of fire; houses of pine or reed and were a great improvement. The next step was to have even greater consequences: the invention of the standard moulded block of dried mud—the brick. The brick may not be an original invention but a copy; in the only material available in the valley country of the stone slabs that came naturally to hand for dry walling in the hills. Bricks are difficult to fit together unless they are rectangular and their use led necessarily to the idea of the right angle and the use of the straight line—originally the stretched line of the cord—maker or weaver.

The practice of building in brick, particularly of large religious buildings of pyramid form, gave rise not only to geometry but also to the conceptions of areas and volumes of figures and solid reasonable in terms of the lengths of their sides. At first only the volume of rectangular blocks could be estimated, but the structural need for tapering or battering a wall led to more complicated shapes like that of pyramid. The calculation of the volume of a pyramid was the highest flight of Egyptian mathematics and foreshadowed the methods of integral calculus.

Also from building came the practice of plan to scale. Such a plan for town together with the architect's rule is, for instance, shown in the statute of Gudea of Lagash. With these mathematical methods, an administrator was able to plan the whole operation of brick or stone building in advance. He could estimate accurately the number of labourers wanted, the amount of materials and food were readily extendable from the city to the country in the layout of fields, the calculation of their areas, and the estimate of their yields for revenue purposes. This is the origin of mapping and surveying. It was this practical use of later gave rise to
the term of geometry - land measurement. Mathematics, indeed, arose in the first place as an auxiliary method of production made necessary and possible by city life.

B. ASTROLOGY

The ability to count and calculate, derived from practical needs of the temple administration, was of immediate use to them in another of their capacities: the making of calendars and the development of astronomy. Early men must have paid some attention to the sun, moon, and stars, but was apt to be more concerned with the violent performances of heavens, such as thunderstorms, than with the completely reliable and regular phenomena of day and night. Such a calendar as he needed was provided by the moon around which had collected such ritual and myth, but which at first made little call on mathematics or astronomy.

The practice of observation carried out in the temples of all the ancient civilizations, including those of America, extended far beyond the needs of the calendar. The sun, as the regulator of the year, the bringer of the harvest, came to be worshipped as a god. The moon, though ousted from the primacy that it had in the time of the hunters, was not neglected and observations were extended to the brilliant erratic stars, the planets, that acquired minor divinities of their own.

Astronomy was finding several uses. Its study was, from the start, linked with religion. It dealt with the sky-world in which the spirits, particularly those of sacred kings, lived after death. At first the sky-world was pictured very much like the world below. The Egyptians thought of it as a flat cover, resting on the hills, through which flowed the celestial Nile - the Milky Way. The Babylonians at first pictured it as the inside of a vast four-square tent
from which the stars hung like lamps. It was only after the invention of the wheel that the turning of the sky on its axis round the pole could be accurately imitated. Chinese astronomy seems to have started from this idea of rotation. This is shown by the antiquity of the 'pi' a wheel-like object representing heaven which can actually be used to fix the position of the stars of the Plough. Chinese astronomy retained the dominance of the circumpolar stars rather than the ecliptic for many centuries.

The idea of regular rotation of the heavens led to a great emphasis on the movements of the heavenly bodies. It was argued, that if these regular recurrences in the heavens affected nature and brought about the seasons, they must equally affect the condition of man. At first it was only the divine king who was an artisan with the skies; but ultimately the privilege became more common, and every individual who could pay might regulate his behaviour by the stars. The seven planets were completely domesticated and still preside over the days of the week. Even their order - Sun, Moon, Mars, Mercury, Jupiter, Venus - was originally astrological. Astrology was always intimately connected with astronomy and in spite of its essential fallaciousness it was the major reason why men occupied themselves for millennia with observations of the stars, which had they not believed in astrology would have seemed very remote and ineffective.

C. MEDICINE

The other occupation that shared with astronomy the distinction of being an upper class profession was that of medicine. But here, although the prestige was probably as great, the real success because of the essential complexity of living systems was bound to be much less. There was in fact practically nothing that a
doctor of those times could do except deal with some obvious wounds, dislocations and fractures, and try to prevent the patient from killing himself or his relations from killing him by unsuitable treatment or diet, where the doctors could succeed, however, was in diagnosis. They had in the city enough cases to enable them to compare one with another and such comparisons, extended by conversation and codified by tradition, are themselves a beginning of science. Doctors, long before writing, carried on their traditions orally first in closed clans which could then be widened by teaching and adoption. From the noticing of diseases and even the recording of them - for we have some extraordinarily interesting examples in early Egyptian papyri - arose the sciences of anatomy and physiology.

Prognosis - knowing how the disease is likely to end - was specially important in early times because the laws, at least of the Babylonians, show that an unsuccessful doctor was likely not to be prosecuted but even to have his eye put out if by any mistake he destroyed the eye of his patient. It is therefore not surprising that many of the descriptions of cases in an Egyptian papyrus end with the words 'case not to be treated'.

Official medicine codified the plants and mineral substances knowledge of which had been handed down traditionally from the medicine men and wise women of primitive cultures. Some of these had been chosen for their manifest action as purgatives or emetics; others because in a more obscure way they had been found beneficial in some diseases as it had been found that quinine for malaria but the majority were probably pure magic based on resemblances such as that of the mandrake to the human body. The city doctors, however, could call on a far larger area for their drugs and could organize their production. It was from this source, rath-
or than agriculture, that arose the science of botany and the first botanic or herbal garden.

D. CHEMISTRY

Chemistry never rose to the rank of a recognized science in the Bronze Age or even till near the end of the Iron Age. Nevertheless its basis was being well laid in the multiple observations and practices of the metal-workers, jewelers and potters. The process of smelting ores, of purifying metals, of colouring them, of adding enamels - all involve complex chemical reactions that had to be learned by many trial, mostly unsuccessful. The good results were embodied in recipes which had to be carefully handed down and scrupulously followed.

They were acquainted with at least nine of the chemical elements - gold, silver, copper, tin, lead, mercury and iron, as well as sulphur and carbon - and were using and distinguishing the compounds of others like zinc, antimony and arsenic. They also knew a variety of reagents, dry and liquid, including alkanis like potash and ammonia and alcohol as beer or wine. Their apparatus was limited to pottery and metal vessels; they had no stills and could not cope with spirits or gases.

One powerful impulse was to turn their method of work in the direction of a rational and quantitative science; namely the scarcity and value of materials they dealt with. From the beginning precious metals had to be weighed and accounted for as the proportions used in alloying recorded and adhered to. Chemical analysis or assaying, involving the separation of metals already
alloyed or mixed in ores, arose naturally out of the necessity of recovering the most precious metals and guarding against adulteration.

The ancient chemists show in their products that they were acquainted with the general principles of oxidation and reduction and could introduce or remove non-metals, such as sulphur and chlorine.

As they were mainly concerned with making ornaments they understood particularly well how to produce colours; and since it was the appearance that mattered, they gauged the result by what it looked like. In trying to make copper look like gold, they produced 'brass'; in trying to make the blue turquoise or lapis, they origin of 'glass'. The fact that they were masters of many startling transformations led them to consider that nothing was impossible to their art. This healthy scientific optimism was to degenerate later into the mystical superstition of 'alchemy'.

The early chemists never thought of themselves as such, but as metal-workers, goldsmiths and jewellers. They were highly valuable technicians, closely associated with the priesthood and the court, but they were hand-workers at a particularly dirty trade. Their knowledge could not be presumed to be a science on a par with astronomy, mathematics and medicine; it was an art, but the black art with great magical possibilities.

III. SCIENCE OF NINETEENTH CENTURY

The eighteenth century the curious and far-sighted became aware of the arrival of mechanical industry. By the mid nineteenth century its effects could not fail to be noticed by the most unobservant in every part of the world.
Simply by increasing the scale and range of the earlier inventions a complete
transformation had been worked in the lives of the ten million living in the
newly industrialized countries. Beside the growth of industry, radically new
means of transport had been developed, the railways, which linked up the centres
of industry and the steamships, which collected its raw materials and distrib-
uted its products far and wide. Indeed, where the eighteenth century had
found the key to 'production', the nineteenth was to find that to 'communi-
cation'. No comparable change had ever occurred in human conditions with such
timeliness and rapidity. Whenever industrialism spread the old feudal social
relations were destroyed. The mass population became wage labourers. All econo-
ic and political initiative belonged to the new class of capitalist entrepre-
ners.

Wealth had never been accumulated so easily, misery had never been so
widespread and undigested by social defences; with all new triumphs of engineer-
ing went to sordid dirtiness, drauness and ugliness which no previous civiliza-
tion could have produced. It was in this environment that science approach-
ed its present scale of activity and importance. It was recognized by the 1830s
that a transfer of power from rank to wealth had occurred, even that it might
have been necessary.

All that was necessary was once more, as in the middle of the seventeenth
century, to separate the concepts of science from its social implications; to
create an idea of 'pure science' and so, by making science respectable again
to enable it to flourish and even better, to become really profitable. This
transformation was largely effected by the utilitarians, emasculated followers
of the philosophers of eighteenth century. The enormous burst of productive
activity that went on without any but minor set-backs, from 1830 to 1870. Science was to have a small but vital and growing share.

This was the period of the hey-day of capitalism, with its extravagant wealth and grinding poverty. Capitalism had indeed already, as Marx predicted in 1848, brought into existence the dispossessed working class whose eventual power was to bring capitalism's rule to an end. But that day was still far off, and although the fight for better conditions never ceased, increased production and expanding markets did for long enable the capitalists to make timely concessions to the standard of living of the working class.

The mid-nineteenth century was not a period of radical technical transformation that can compare with the eighteenth. It was rather one of steadily improving manufacturing methods operating on an ever larger scale. Though rivals were the beginning to enter the field, the advantages Britain had won in the Industrial Revolution were retained and even improved on. For a while Britain was literally the workshop of the world. The cheapness of the goods, prevalent by the textiles produced by the new machinery, extended the markets in a way that seemed for decades unlimited. That market could be met by simply multiplying and steadily improving existing types of machinery. There was no violent urge for new devices in production. There was, on the other hand, an ever increasing need to spread up 'communication' and 'transport'. The 'telegraph' was the first practical and large-scale application of the application of the new science of electricity. Materially more important was the application of power to transport in the 'railway' and 'steamer'. Here science was only in an ancillary role.
There were directly the product of the new profession of mechanical engineers and were made possible by the availability of cheap iron now smelted with coal. The appearance of the modern engineer was a new social phenomenon—he is not a linear descendant of the old military engineer but rather of the millwright and the metal-worker of the days of craftsmanship. All these proceeded to deal with them as their predecessors had by trial and error and to superimpose an evolutionary technical development on the revolutionary innovation that had come directly from science. Their the reciprocating steam-engine, in spite of nearly 200 workshops of Boulton and Watt in 1785.

The railway were originally the product of coal-mining. The great innovation of putting an engine on wheels to make it an 'locomotive' also was most successfully attempted in the mines. The railway age covered Britain within its network in the thirteenth and forties and spread to the rest of the world throughout the century. It also led to an enormous increase in the world older—civil engineering which carried on the tradition of the eighteenth-century builders of canals, roads and bridge. A new interest in geology came from the making of canals and railways, which revealed the structure of the rocks in cuttings and tunnels while at the same time it provided in the profession of surveyor a new source of income to the geographical and geological sciences.

By the fifties science was already paying dividends. A new chemical industry was rising based mainly on the need of the expanding textile industry for soda and sulphuric acid and the discovery of aniline dyes assured the future of organic chemistry. A beginning was being made to enlist science,
particularly chemistry, in the improvement of agriculture through the use of artificial fertilizers. Biology was also beginning to find new use outside the traditional field of agriculture. The chemist, Pasteur (1822-95) was finding means of improving the manufacture of beer and wine and was making his first successful attack on a disease, not of man but characteristically valuable silkworm.

Here, for the first time, was the possibility of a scientific, a distinct form of tradition, control of living processes. Even medicine was beginning to move with the times and to accept rather gurglingly such gifts as anaesthetic from the new chemistry. Actually, thanks to poverty, overcrowding and laissez-faire economics, generally, the health of the people in industrial countries was probably worse than it any other period in history. Disastrous epidemics of oriental cholera, brought in through the new facility of transport, continued to occur until their very virulence and the threat they offered to the middle classes themselves, led to the understanding of the need for sanitation and put some check on the practices of slum landlords.

Science was to remain for many years the monopoly of a selected part of the middle classes - the liberal intelligentsia as they were known in Europe and inevitably continued to limited and coloured by their world outlook. In the middle of the nineteenth century did not scorn utility. They were interested in the great individual movements of their time. They believed firmly in the inevitability of progress, but they repudiated all responsibility for any of its unpleasant and denurious results. Nevertheless, though advancing in wealth and authority, their relative political and economic status had fallen. Industry
and finance had advanced in power far more rapidly than science; while in the eighteenth century the leading scientists were on dining and merrying terms with the captains of industry. Relatively few could - or seriously wanted to - reach the seats of wealth and power in the nineteenth century.
PART
2
ANNOTATED LIST
AGRICULTURE

AGRICULTURE, CHINCHONA


Presents a detailed account of the introduction of Chinchona cultivation into British India during 1860-1880. The description also contains the notes on (A) Caoutchouc cultivation in British India, (B) Introduction of the cultivation of Peruvian cotton into British India, (C) Introduction of Cusco Maize and Quinva into British India, (D) Bibliography of the chinchona genus. The description is well illustrated and contains folded maps and appendices.

AGRICULTURE, COTTON


Describes the cultivation of cotton in the Bombay Presidency. This description is prepared from the government records and other authentic sources in accordance with a resolution of the government of India. The description also contains folded map.


Contains an account of the experiments made by the EIC.

East India Company up to the present time on the cultivation and
marketing of cotton in India and elsewhere. The work is illustrated and contains fronts, charts and appendix


Brief account on the history of cotton, dealing with its cultivation, trade and manufacture in the Belgaum and Keladgi districts of the Bombay Presidency. The work is illustrated.


Outlines of the cotton cultivation in the Madras Presidency, exhibiting the principal contents of the various public records and other works connected with the subject in a condensed and classified form, in accordance with a resolution of the Government of India. It contains map, plates and appendices.

AGRICULTURE. CONFERENCES


Presents information on Revenue and Agriculture system in India, as discussed in the Agricultural conference held in the Department of Revenue and Agriculture during 6th to 13th Oct. 1890 and 2nd to 7th Oct., 1903 at Simla.

A detailed account of the food grains with wood cuts available in India. Description contains notes on cultivation and morphology of food grain. The description also contains illustrations.


Contains detailed account on the cooperative study of the crops of 1865-66 and 1873-74 of Bengal. This description is based on the informations from official papers, compiled under orders of Government of Bengal.


A list of field crops, grown in the Central provinces.

Deals with fruits, their cultivation, habitat and morphology, mostly found in Agra and Oudh. It includes names of the species of the fruits and showing their quantities and availability.

Names of the field and market garden crops and of the principal fruit and timber trees of the U.W.P. and Oudh. Allahabad, Indian Press, 1895. 80p. (Agricultural series).

Describes the cultivation of garden crops; their habitat, area of cultivation and principal fruits and timber trees found in U.W.P. and Oudh.


Descriptive account on the fibrous plants of India, which are fitted for cordage, clothing and paper. It contains detail information on cultivation of these fibrous plants and also preparation of flax, hemp and their substitute from these fibrous plants.
AGRICULTURE, FOREST.


Corkison. 1862. 358 p.

Descriptive account of the timber trees, methods of their cultivation and protection. It also contains notes on timber and fancy woods available in the Indian forests of Eastern and Southern Asia.


522 p.

Contains descriptive account of the salient features, cultivation, distribution and qualities of Indian woods, specially timber.

15. Minchin, A.A.F. The sal forests of Canjar, South India. Madras. Govt.

Press. 1920. IV. 156 p.; illus. map (fold).

Contains description on sal trees, their habitat, cultivation, qualities and economic important found in India. The work is illustrated and contains folded map also.

AGRICULTURE, FOREST.


1884. IX. 1409 p.
presents a comprehensive account on the forestry in southern India. The description includes the details of the fauna and flora found in the forest of southern India, with their salient features and economic importance.


This detailed description on the forestry in the British India. The descriptive provides the information on fauna and flora found in the forests of British India, with their salient features and economic importance.

References: JARDE III


Contains descriptive account of flowers, fruits, and vegetables, soils and cultures and gardening; operations in India, specially Bengal. v. the flowers and fruit gardens, with twenty six coloured designs for flower beds. v. the kitchen gardens.


Contains detailed description on gardening; for Western India. It serves as a manual or guide book of gardening; for western India. Second and revised edition.
AGRICULTURE, GLOSSARIO


Presents description on Rural and Agricultural glossary for the N.W. Provinces and Oudh. Thus provides all the terminology used in Rural and Agricultural field of N.W. provinces and Oudh.

AGRICULTURE, LAND AND LABOUR


Contains brief account on the land and labour its history and mode of conducting certain agricultural enterprises in India.

AGRICULTURE, ADVERTIS


Describes the agricultural poverty in India. Emphasis has been given on the danger arise due to the poverty of Agriculture. The description is based on the official and public comments.
AGRICULTURE, INDIA


Provides information on the principles of rational agricultural applied to India and its staple products such as cotton, jute etc.


An account on the reform of agriculture system. Gives suggestions for improvements of the existing systems.

AGRICULTURE, VENUE

5. India. Department of Revenue and Agriculture. Notes on land transfer and agricultural indebtedness in India. Revenue and Agricultural Department, 1894.

Gives rules and regulations essential for the land transfer and agricultural indebtedness in India.

AGRICULTURE, REPORTS


Contains the descriptive account of the Shibpur experimental farm.

Contains description on the improvement of Indian Agricultural conditions with an appendix, containing the resolutions of the Govt. of India on the proceedings of the Agricultural conference of 1893 and 1895-96. It is a report of Mr. John Augustus Voelker, consulting chemist to the Royal Agricultural Society of England. Folded maps are enclosed.


John Augustus Voelker was consulting chemist to the Royal Agricultural Society of England. Description deals with the improvements made in agriculture field of India, containing folded maps and appendices.


A brief report on the wheat production, their geographical distribution and varieties, found in India.

AGRICULTURE. RESEARCH.

30. Bonavia, Emmanuel. The cultivated oranges of lemons, etc. of India and Ceylon with researches into their origin and the derivation of their names and their useful information, with an atlas of illustrations. London, W. & D. Allen, 1890. XIX, 384 p., illus.
Contains translation of the chapters on the citrus in the flora of Amboyna by Rumphius besides information which may be useful to planters and commercial people in India and to future investigations of the natural history of the citrus.

**AGRICULTURE. TEA**


Detail account on the cultivation and manufacture of tea. Third edition, enlarged and corrected edition of the previous work. It also serves as the manual of tea in India.

**ANIMAL HUSBANDRY**


Describes training and horse management in India, information is also available on the care of the horses and their diets etc. It further also contains Hindustanee Vocabulary and C.T.C. weights for age and class.

Contains description on Beast and man found in India. It gives a popular sketch of Indian animals in their relatives with the people with illustrations.


An account of Indian cattle and sheep. It also contains their breeds, management and diseases. It is second edition, which is illustrated with also appendix.


Contains description of the diseases of the elephant. Information also available on elephant management and uses.


Detail description on cow-keeping in India. It is a simple and practical book on their care and treatment. It also contains their various breeds and the means of rendering them profitable with forty illustrations.
ASTRONOMY

ASTRONOMY, ECLIPSES


Descriptive account of the expeditions organised by the British Astronomical Association to observe the total solar eclipse of 1898. Jan. 22. It contains fronts, plates and illustrations.


Gives a descriptive account of moon eclipses in India.

ASTRONOMY, HINDU


An outline of the astronomical aspects of Hindu and contains thirteen illustrations with numerous diagrams.


Presents brief account on the Hindu astronomy with notes and an appendix, containing additional notes and tables, calculations of eclipses a stellar map and indexes. The work is assisted by the Committee of Publication of the American Oriental Society.
BOTANICAL SCIENCE

BOTANICAL GARDENS


Deals with botanical sciences. v.1. The species of Ficus of the Indio-Malayan and Chinese countries; Pt. I. Palaeomorpha and πρωτοειδης by George King; Pt. II. Appendix. v.2. The species of Artocarpus Indigenous to British India; the Indio-Malayan species of quassia and contantopsis by George King. v.3. missing. v.4. The annonaceae of British India by George King; Pt. I. Text, frontispiece and index; Pt. II. Plates: stelechocarpus to Anacarone. v.5. Pt. I. Century of India Orchids, by Sir J.D. Hooker; A century of new and rare Indian plants by G. King, to which is prefixed a brief memoir of William Roxburgh, by Dr. G.King; Pt. II. a century of new and rare Indian plants by P.B.Bruhl and G.King. v.6. missing. v.7. The Bambuseae of British India. By J.S.Darwin. v.8. The orchids of the Sikkim Himalaya by Sir George King and Robert Batting. Pt. I. Letter Press. Pt. II. Plates of Malvaceae; Pt. III. Plates of Liliaceae, Odontaceae, Ophryaceae and Cyperaceae. v.9. missing.

42. Volgt, J. C. A catalogue of the plants which have been cultivated in the East India Company's Botanic Garden, Calcutta, and in the Serampore Botanical Garden, generally known as Dr. Carey's Garden, from the beginning of both establishments (1780 and 1800) to the end of August 1841; drawn up according to the Jussieuan arrangement and mostly in conformity

Contains detail description of natural system of Botany, specially plants which have been cultivated in the Hooghly East India Company's Garden, Calcutta and the Serampore Botanical Garden (Dr. Carey's Garden) from 1786 to 1841. It also contains indexes: 1. Index of orders, genera and species. 2. Index of the Bangalee names of plants.

**BOTANICAL OBSERVATIONS**


A descriptive account on Duckweeds Lemnaeaceae, their habitat, morphology and physiology. It contains nine plates and one text figure with illustrations.

**BOTANICAL LIFE**

44. *Hooker, Joseph Dalton. Notes of at our in the plains of India, the Himala and Borneo*. London, Reeve, Benjamin and Reeve, 1848-49. 2 pts. (57 p; 160 p).

These notes have been extracted from the private letter of Dr. Hooker and written during a government botanical mission to those countries. These notes are chiefly devoted to the botanical sciences. The work is divided into two parts.
BOTANICAL SURVEY


Contains valuable records of botanical sciences. V.1 no. 1 Report on a botanical tour in Kashmir, by J.F. Duthie - No. 2
Report on a botanical tour in Sikkim, by J.A. Connell - No. 3

BOTANICAL TRAVELS


Contains descriptive account on the collection of Chinchoa plants and seeds in South America and their introduction into India. This description is made by Sir Clements Markham during his travel in Peru and India. Descriptions contains folded maps and plates.
B. BOTANY.

47. Bose, Hirish Chandra. A manual of Indian Botany. Bombay, Bladon, n.d. XV, 368 p., illus. (Col.)

Serves as a guide book of Botany. It gives the essential information on habits, habitats and morphology of India plants. The classification systems are also have been discussed in this text. It contains appendices (A). Tabular view of Engler and Prantl's system of classification, with few deviations. (B) Analytical key to the orders, carried out in some cases of Genera.


Contains brief description on the study of India plants. It serves as an introductory book, describing the habit & habitats, morphology & physiology of the plants found in India. It further contains illustrations also.


Description on Posthumous papers bequeathed to the Honourable the East India Company. These papers are printed by order of the Government of Bengal arranged by John H. Lleland, V. Itinerary notes of plants collected in the Chasah and Bostan mountains 1837-38 in Afghanistan and neighbouring countries 1839 to 1841. It also contains illustrations.

Deals with habit, and habitats and salient features of plants found in India. The description on morphological and physiological aspects also have been given. Thus it provides all the essential informations about the plants of India. The description is well illustrated & contains appendix also.


Contains description on fauna and flora found in Himalaya and Cashmere. It deals with the natural history of these fauna and flora and completes in two volumes, contains one one hundred plates and fronts.

**BIBLIOGRAPHY**


A list of various plants in Punjab and Sind regions. It also added some other plants, those from their present geographical proximity, may be found here after to occur in Punjab. This list (catalogue) provides brief information on the plants of that period in Punjab and Sind areas.

A list of vegetable production of Botany presidency, generally useful for medical purpose. It also contains lists of drugs, which are originated from vegetables and are sold in the bazar of Western India. It is second edition and containing index in the end.

BOTANY. DICTIONARIES


A dictionary of vegetable kingdom. The description is assisted with numerous wood-cuts, by Fitch and branston and steel engravings, by Allard. It is revised edition and containing supplements.

BIOLOGICAL FERNS


Contains detail account on Album of Indian Ferns. These are reproduced in Chromolithography from original water colour drawings. It further contains seventeen plates.

Contains figures and description of ferns from all parts of British India, exclusive of those figured in the ferns of Southern India and Ceylon. The description deals with the salient feature, morphology and physiology of the Indian ferns with their uses. It contains plates also.


Contains descriptive account on the Ferns of Madras Presidency. It contain two hundred eight plates, showing the photographs of the Ferns, available in Southern India.


Deals with habitat, morphology etc of the Ferns found in British India, Ceylon and Malay. It contain three hundred illustrations and fronts also.


Brief account on the Ferns which are supplementary Ferns of Southern and British India. It also containing revised list of all the Ferns of India, Ceylon, and Birmah with brief account of hither to unfigured species. It contain three hundred ninety plates also.
BOTA. IV. FLORA.


It containing quarto plates of all the principal timber trees is accompanied by a botanical manual with description of every known tree and shrub and analysis of every genus figured in the plates.


Contains brief account on all the indigenous plants hitherto discovered in or near the Bombay Presidency together with a supplement introduced and naturalised species. The description deals with habits, morphological and physiological aspects of indigenous plants.


Serves as guide to all the following plants hitherto, described as indigenous to the continent of India. Description has been provided on the habits and salient features of the flora, found in India with some information on morphological and physiological aspects. The full descriptive has been divided into two volumes.

Contains brief account on the flora of British India.

This work has been assisted by several botanists. The book is divided into seven volumes.

V.1. Ranunculaceae to Olygales.
V.2. Sabiaceae to Comaceae.
V.3. Carpophyllaceae to Apocynaceae.
V.4. Asclepiadaceae to Amaranthaceae.
V.5. Chenopodiaceae to Orchidaceae.
V.6. Orchidaceae to Cyperaceae.
V.7. Cyperaceae, Gramineae and general index. It is published under the authority of the Secretary of State for India in Council.


Provides the essential description on habitats, habitates, morphology and physiology of the flora indica. It is reprinted literatim from Carey's edition of 1832.


A brief description of the plants found in the peninsula of British India, arranged according to the natural system without any botanic order.

Presents outlines of the forest flora of India. Thus serves as a manual of India forest botany. It describes the salient features of the flora, generally found in the forests of India with their economic importance.


Description on the forest flora of British Burma. It provides information on habits, habitat, and salient features of the flora found in the forest of British India. The work is divided into two volumes. V.1 Ranunculaceae to Comaceae. V.2. Caprifoliaceae to Ulmaceae.


Descriptive account of the forest flora of North-west and Central India. The description is commenced by late J. Lindsay steward, continued and compiled by Dietrich Brandis drawn by Valler Fitich. It contains seventy plates also.


A hand-book, contains description on the indigenous trees and shrubs of North-west and Central India. This book was prepared at the herbarium of the Royal Garden, Kew. This hand-book is published under the authority of the Secretary of State for India in Council.

Detected description of the grasses of the southern Punjab. It also contains the photolithographs of some of the principal grasses found at Hissar, with short descriptive letter press. It further contains thirty eight coloured plates.

71. Illustrations of the indigenous fodder grasses of the plains of North, Western India. Roorkee, Thomason Civil Engineering College Press, 1886, VIII, 35 p.

Deals with the Indigenous fodder grasses found in North-western Indian plains, particular reference to suitability for animals. The description contains thirty five plates.


It listing the grasses of Bombay and present the description on the habits, habitates, morphology and economic importance of the grasses, found in Bombay.


Gives a detail account on salient features with quality and usefulness of grasses found in India peninsula with sixty two plates.

Descriptive account on palms of British India, arranged by John M'Clelland. These are posthumous papers bequeathed to the Honourable the East India Company and printed by an order of the govt. of Bengal. It contains three hundred sixty three plates and appendix also.

BOTANY ALONE


Descriptive account on plants, their habits, habitat, and morphology of Kochima and Moneypore. It serves as guide for plants of Kochima and Moneypore. The diagrams of these plants are also given in the text. It is extracted from the Linnean Society's Journal. Botany. v.25.


Presents detail description on the various useful plants mainly in commerce, medicine and arts, found in India. It is second edition in which several additions and corrections have been made.


Contains a systematic account with description on the indigenous flora and notices of the value and uses of their products in commerce, medicine and arts, found in Sindi.
emphasis has been given on the plants which are useful in medicine or drug.


Detail description on the flowering plants of Western India. The description deals with the habits and habitats, and also on morphology and physiology. It contains indices:
1. Latin and Englished. 2. Native names.


Descriptive account on the plants, comprising botanical and vernacular names and uses with economic value, growing within the province of Punjab. It serves as a hand-book for officers and residents in the Punjab.


Contains description on the selected extra tropical plants, which are readily eligible for industrial culture or naturalisation with indications of their native countries and some of their uses.

[REVIEW]


Contains detail description on the Indian species of Cyperus with remarks on some others, that specially illustrate the sub-division of the genus. This is extracted from the Linnean Society's Journal Botany. Volume 21. It further contains four plates.
82. King, George. *The species of myristica of British India.*

Calcutta, Bengal Secretariat Press, 1801. II, 331 p.

Deals with the salient features of the species of myristica of British India, specially illustrated the sub-division of the species. It contains one hundred seventy four plates.


Contains a descriptive account of habits of growth and process followed by Kakyens in preparation of Caoutchou of Ficus Elastica. It also accompanied by a map, showing the geographical distribution of the tree in Assam and Burma proper.


Deals with the early history of the factory at Surat of Bombay and subordinate factories on the Western Coast from the earliest period until the commencement of the eighteenth century. The description is drawn from authentic work and original document.
85. ________ ______. 2d ed. rev.


Contains three lectures delivered at the Royal Engineering Institute, Chatham in July 1872, which deals about the India and Indian Engineering.

ENGINEERING COLLEGE


Contains descriptive account of the professional papers on Indian Engineering. Papers deals with the Engineering advancement in civil made in India with illustrations.

88. Medley, Julius George, Comp. The Roorkee treatise on Civil Engineering in India. Roorkee, Thomason College Press, 1873. 2 V. illus.

Presents detail information on the development of civil Engineering in India, specially construction material, their properties and uses in construction work. Descriptions is well illustrated, contains charts, fronts, plates, folded plans and appendices.

Deals with the professional papers, describing advancement made in engineering, specially engineering material, their strength and suitability for different equipment etc. used in construction. Work is fully illustrated contains folded maps, charts and plans with fronts also.

EIVIEELIIL, CORPS

30. Smith, J.T. ed. Reports, correspondence and original papers on various professional subjects connected with the duties of the corps of Engineers, Madras Presidency. 3d ed. Madras, Scottish Press, 1899. 3v. illus.

Gives detailed information about the duties of the Engineers of the corps. These duties have been assigned from time to time by their officers. The description is based on the correspondence and original papers on various, professional subjects related directly or indirectly with the duties of the engineers of Corps. It contains illustrations and charts.

31. Smith, J.T., ed., Reports, correspondence and original papers on various professional subjects connected with the duties of the corps of engineers, Madras Presidency, 3d ed. Madras, Graves, 1893. 344 p. illus.
Deals with the various duties assigned time to time to the engineers of the corps, in Madras Presidency. The description is based on reports, correspondence and original papers on that subject and contains illustrations and charts.

**DRAINAGE**


Contains survey report on drainage project of Madras town and contains detail information on drainage. It also contains illustrations, folded maps and plans.

**FIELD WORK**


Contains descriptive account on instruments best suitable for engineers in field work in India and its colonies.

**INDUSTRIES**


A descriptive account on the Industries in India, describing the historical development of the Industries, specially during British period in India.

Contains description of the Scinde Railway and its relations to the Euphrates valley and other routes to India with illustrations, maps, statistical tables. The description is written from the official sources.


Contains an outline of the policies pursued by Indian Railway specially for the improvement over the existing systems and future plans also.


Deals with the history their rise, progress, and construction of Railways in India. This account is written with the aid of the records of the India Office and contains folded maps and plates.

Contains the historical development on the Rajghat Plateau, Benares. The description has been devoted to the needs of Railway bridge and details of the work done for the bridge and also labours employed during the work.


Contains descriptive account on the bridge over the coral river on the Coelundo extension of the Eastern Bengal Railway with an abstract of the discussion upon paper, edited by James Forrest, by permission of the Council. It except minutes of proceedings of the Institution of Civil Engineers. It is v-34 and session 1871-72, and contains illustrations also.


Gives detail of the work on the working of steep gradients and sharp curves on railways. It also include an abstract of the discussion upon the paper edited by James Forrest, by the permission of the council. The description is based on except minutes of proceedings of the Institute of Civil Engineers. V.36 session 1886-87.

Contains description on the Khost coal mines of Baluchistan in the form of report with Appendix.

102. India, Royal Indian Marine. Administration report of the Royal Indian Marine, for the office year 1895-96. 52 p.

Contains brief account of the Bombay dockyard, Kidderpore dockyard, Royal Indian Marine ships and vessels as well as the marine survey of India for 1896.


Contains description on Damascening on steel or iron as practiced in India, with thirty two full page illustrations, containing one hundred and four designs, photo-chromo-lithographed by W. Strigge from water colour drawings by Yurli, Nan Lal, Chajulal, Ram Gopal, Jivan and other Indian Artists. The work is divided into two parts.


A report submitted to the Bench of Justice of that city, dealing the system of water supply of Bombay. It also deals
with the method of water purification and its supply.

**References**


Deal with work constructed on the Canvey, Kistna and Godavery rivers for the irrigation of the provinces of Tanjore, Cumbum, Masulipatam and Rajahmundry, in the Presidency of Madras.


Describes the functions performed by municipality in town and villages of India, containing outlines on sanitation, general municipalities, towns and villages.


**Geological Sciences**

**Geology, General**


Book containing brief account on the geological aspects
The description is based mainly on the observations made by the Geological survey of India, Calcutta. There are two volumes. V.1 A manual of the geology of India: Peninsular area. V.2. A manual of geology of India: Extra Peninsular area. These volumes were published by the order of the Government of India.


Contains description on geology of India. The description is chiefly compiled from the observations of the geological survey. It serves as stratigraphical and structural geology. It is published by an order of the Government of India. It is illustrated contains folded maps, and front also.

GEOLGY. BIBLIOGRAPHIES


Contains list of books and papers, relating to the geology of British India and adjoining countries, published previous to the end of 1897 A.D.

GEOLGY. EPILOGUE

111. The earthquake in Bengal and Assam; reprinted from the "Englishman". Calcutta, S.M. Benerji, 1927. 330 p.

Presents an account of the Earthquake of Bengal and Assam, particularly.

Deals with geological structure, more emphasis on economic geology showing some precious stone available and other earth material of India. This work is published by an order of the Govt. of India.

**Geology, Minerals**


Contains description on the chemical and physical study of Indian minerals. It serves as a guide to the minerals collection of the geological museum, Calcutta.

**Geology, Precious - Stones**


Describe the history and romance of Diamond (Precious stone) and collected from official, private and other sources during many years of correspondence and inquiry. The MS. of the 'Khoi-i-nur' graciously read and approved by majesty. The Express Eugenie. The description is edited and annotated by Joseph, Hatton and Ash, Keane. It also contains appendix.
GEOLGY, SERIAL-PUBLICATIONS


Contains the latest developments of researches occurred during the voyage of H.M.S. Beagle in the field of natural history and geology in those countries where he visited, round the world under the command of Capt. Fitz Roy.

GEOLGY, STRUCTURAL


Description on the geological structure of the Khasi hills. It also contains observations of the meteorology and ethnology of that district.


Contains detailed description on stratigraphical and structural aspects of the geology with illustrations and maps.

GEOLGY, CURVES


Contains the enquiry concerning the site of ancient Aliobothra etc. It is complete set in four parts. Part. - 1. wanting part. - 2. has sub-title, containing a journal kept
during a survey of the river Chandan, conjectured to be the
Bramabas of the Greeks, from the town of Champapur, near
Bhagalpore, to its sources in the vicinity of Deoghar,
including an account of the present state of the Junglerry
with a map, views and section 1714-14. Part-3 containing
a continuation of the journey from frontiers and from thence
to Soorey Bharra on the ranges through the Currituckpore
hills. Part-4 containing a tour from Bhagalpore to
under from thence to Currituckpore and a circuit of the hills,
with an account of the site of the ancient city of Jay
Bhaur and some remarks on the Jayno workshop, made during
the months of December and January, 1811-19, with a map of
the route views, etc.

119. Mc Clelland, John. Some enquiries in the provinces of
Kemono, relative to geology and other branches of natural
sciences. Calcutta, Baptist Mission Press, 1839, W.,
384 p., illus.

Descriptive account on geological structure of Kemono
and also a brief account of natural sciences of their place.

MATHEMATICS

121. Bhaskara Acharya : Colebrooke's translation of the lilavati.
Calcutta, Trotter, Pinka, 1833. 178 p.

Descriptive account on the Mathematics and contains the
notes by Chandra Beneji.
MEDICAL SCIENCES

MEDICAL BOARDS


Contains report describing in brief medical topography and statistics of the ceded districts. This report is compiled from the authentic records of the Medical Board office.

MEDICAL COMMITTIES


Report containing brief description on medical geographical and agricultural. It is a report of a committee appointed 1816 by the Madras Government to enquire into the causes of the epidemic fever which prevailed in the provinces of Coimbatore, Madura, Dindigul and Tinivelly during the year 1809, 1810 and 1811 of which Dr. R. A. Ainslie (President), T. A. Smith (Second member), Dr. J. Christy (3rd member).

MEDICAL DEPARTMENT

Deals the historical record of thirty five years service in Indian, China, Egypt and the Sudan, with an introduction by W. Eyton Blake. The work is well illustrated and contains frontts.

MEDICAL HISTORY


Contains the general description of the provinces, its meteorology and climate, political division, of the country. It also deals with their influence on the population and census statistics with special reference to the medical history of Rajputana, includes insanity, epidemics and the conditions of the people and sanitation.


Contains outlines of the medical history of the native army of Bengal for the year 1863. The account is extracted from the annual returns from the reports of regimental medical officers and from the inspection reports of deputy inspectors general of hospitals. This work is compiled in the office of Inspector general of Hospitals, Indian Medical Department (Bengal), by Surgeon major, J.T.C. Ross.
MEDICAL SCHOOLS


Containing detailed account of the past as well as present history of the Hyderabad Medical School. It is published at the request of the Nawab Mooshtur Salar Jung Bahadoor.

MEDICINE


Describes the essential medical as acts of life, the description is chiefly based on the principals described in The 'Elements of Medicine' by Late John Brown. In this description an attempt has been made to correct more important errors of that work. The description is chiefly selected from the records of their price at the general hospital, at Calcutta. It is also subjected as a treatise on the action of mercury upon living bodies and its application for the cure of diseases of indirect debility and a dissertation on the source of epidemic and pestilential diseases, in which it is attempted to prove by a numerous induction of facts, that they never arise from contaminations but always produced by certain states or certain vicissitudes of the atmosphere, by Charles Maclean.
MEDICINE. ABCESS

128. Payer, Joseph. Tropical dysentery and abscess, malarial coxyzia, insolation with other forms of European children and others in India. London, J. and A. churchill, 1891. XI. 404 p., illus.

Contains descriptive information on tropical dysentery and abscess, malarial coxiezia, their insolation with other forms of European children and others in India.


Deals statistical account on pathology of the abscess in the liver found in East Indies. It is a brief account on the causes of the liver damages.

MEDICINE. CONTAGIOUS-DISEASES

130. East India (Contagious diseases). Return to an address of the honourable the House of Commons dated 7th June, 1888. London, Eyre and spottis wood, 1888. 91 p., illus.

A report on the contagious diseases act, present in the House of Commons. It is copy of the minutes of dissent by certain members of the council of India from the despatched addressed by the Secretary of State to the government of India regarding the contagious diseases Acts, by J.A. Godley, under Secretary of India, ordered by the House of Commons, to be printed, 13 June, 1888.
131. India. Report of the special commission appointed to enquire into the working of the cantonment regulations regarding infectious and contagious disorders. India, Government Central Office, 1873. 41 p.

A report deals the working of the cantonment regulations, regarding infectious and contagious disorders. It is minute report of the special commission appointed to enquire in this matter. It also contains appendices.

**INDIA. CHOLERA**


Contains a descriptive and statistical account of the disease as derived from the published official reports of the several government during that period and mainly in illustration of the relation between cholera activities and climatic conditions together with critical observations on the causes and nature of cholera.


Deal with the salient feature of epidemic cholera, causes and their treat a.e.t. It is a statistical report of 1872 in northern India on the cholera epidemic.

Contains detail information on the cholera, its historical and spreading aspect. This description also contains notes on symptoms and treatment.


Descriptive account on the cholera. This account is based on the enquiry made by Doctors Kelvin and Gibbes and translations of a Committee, which is convened by the Secretary of State for India in Council in 1835.


Contains detail account on the history of the contagious cholera, with facts, explanatory of its origin and laws and of a rational method of cure.


Presents description on the cholera epidemic. The description is based on the enquiry made by the commissioners on cholera epidemic of 1861 in Northern India, under the Presidentship of Sir John Strachey.

Provides details account on the cholera. The description is mainly devoted to historical aspect, from the earliest period to the year 1817 with its causes and treatments.


Contains brief description on asiatic cholera. It gives information on the history since beginning up to July 16, 1892. It also contains notes on its symptoms and treatments.


Contains detailed report made on the epidemic cholera as it has appeared in the territories subject to the presidency of Fort St. George. The report is drawn up by order of the Govt. under the superintendence of the Medical Board by William Scott.

Gives detail account on the chloroform, its history, manufacturing processes. Description also includes its uses in medicine etc. The description is based on the enquiries made by the chloroform commission of Hyderabad and contains suggestions made by this commission. The preface is written by Sir Asman Jah.

MEDICINE, THERAPY


Presents descriptive account on the De Quaile, its origin from the beginning to up to date. It also contains description on its symptoms and treatment with observations on the epidemic, which prevailed in Bombay during the year 1871-72.

MEDICINE, THERAPY


Contains description with Remarks on the dysentery and hepatitics of India, with Appendix.


Contains selected evidences of a successful method of treating fever and dysentery in Bengal.
MEDICINE, FEVER


The first detailed account on the climate and fevers of India. The account is based on the Croonian lectures delivered at the Royal college of physicians in March 1832, by Sir Joseph Fayer.

MEDICINE, FUTURE-DISEASES


Contains description on the fungous diseases of India, gives salient features and their treatment. It further contains illustrations and appendix.

MEDICINE, HEALTH AND HYGIENE


Descriptive account on the methods by which the health of European soldiers can be maintained. This work is printed by Mr. P.M. Crerenburgh.

Presents outline of the Hygiene, specially adopted by King's Madras. It serves as a manual of the Hygiene of King of Madras. This is revised edition with rearranged and the great part of the work is rewritten and contains illustrations and fronts.

MEDICINE, HEMP-DRUG


Deals in Hemp-drugs: their manufacture, properties and uses in different treatment. It is a useful report on Hemp-drugs and description is based on the text of the Hemp-drug Commission of 1893-94, under the chairmanship of W. Mackworth Young.

MEDICINE, KALA-azar


It is a report dealing in detail on the nature of Kala-azar in India and also includes its history, symptoms and their treatments. It contains charts also.

MEDICINE, LEPROSY


A report on the leprosy in India with a survey of the areas in which leprosy was found. It is statistical report of 1810-91 on leprosy.

Contains descriptive account on leprosy, its origin, laws and treatment in India.

MEDICINE: MALARIA


Deals brief about the malaria and causes of its most intense in hot climate. It is an enquiry into the nature and causes of the so called Marsh poison with remarks on the principles to be observed for the preservation of health in tropical climates and malarious districts.


Report dealing with an investigation of the epidemic of malarial fever in Assam. It is also called Kala-Asar and contains appendices.


Contains detailed and comprehensive account on malaria. It includes its causes and effects of malaria. It also contains the injuries of the spleen during malaria. The description is based on the analysis of thirty nine cases.
MEDICINE. MATERIA MEDICA


The spine title is anaisie materia medica of Hindoostan It is published by the special permission of 'Government of Madras'. Appendix, Pt. I A table of the names of Diseases in the English, Tambool, Dughanee in the English, Tambool, Dughanee and Belinoo languages, pt. II. A list of books (chiefly medical) in the Tambool, Persian, Arabic and Sanskrit languages. Pt. III. Remarks regarding the Nerulam Cottay pt. IV. Account of the preparation of Tapioca. It also contains indices: 1. English index. 2. Tambool index. 3. Latin index.


This work is chiefly compiled from standard Sanskrit medical works. It contains author's account on the mineral medicines and on Indian plants useful for medicines. It also describes the modes, in which they are prepared for use, their chemical composition and principal combinations in which they are used in different diseases. The book contains glossary of Indian plants.


Listing of Botanical drugs in their local nomenclature with a brief account on history of each drug and its uses.
Names of these drugs also have been provided in Sanskrit, Arabic and Persian languages in the historical summary.


Contains descriptive account of native medicines of Patana on their nature and properties, their effects upon the living system, the theory of their action and their application to the treatment of morbid affections.

MEDICINE. OPIUM.


A report on opium, its salient features, & evidences.
Description is collected from the papers of Royal Commission on opium.

MEDICINE. PHARMACOGRAPHIA


Contains detail description on history, its origin, nature and important of the principal drugs originated from vegetables, found within the British India.


Deals the historical details of the principal drugs of vegetable origin found in Great Britain and British India.

Contains informations on drugs of India useful for doctors. The work has been prepared under the authority of her Majes-
try's Secretary of State for India in Council.

MEDICINE: PLASQUE


This commission was set up by the Bengal Government under the Chairmanship of Mr. W. H. Risky. This commission was
made to enquire about the Plague, its origin and spreading nature. Several methods of controlling the plague also
has been suggested.

year ending 31st May, 1909. 405 p.

A detail account on plague in Bombay in 1909 and also
contains statistical data of mortality etc.


Report contains an account of plague with statistics
on mortality in Bombay residency from September 1906 to May
1907 prepared by W. E. Couchman.
183. Bombay, Report of the Bombay Plague Committee, appointed by
Government resolution . . . . on the plague in Bombay, for
the period extending from the 1st July 1897 to the 30th April

This commission was set up by the Bombay government reso-
lution, to made enquiry about the Plague origin, spreading
native and several methods of treatments, in Bombay Presidency.
It contains plans also.

187. Bombay, Report on the bubonic plague in Bombay by W. J. Satacra,

It is a report by the plague committee appointed under
Government resolution. This report contains detail account
on bubonic plague in Bombay during 1890-97.

170. Condon, James Knighten, Comp. The Bombay Plague. Bombay,
Education Society's Press, 1900 XV, 381 p., maps (fold).

A history of the progress of the plague spread in Bombay
Presidency from September 1896 to June 1897, compiled under
the order of Bombay Government for finding the trend of the
disease spread during that period. It contains folded maps,
showing the localities, where the plague was spread and also
contains appendix.

171. India, Home Department. The Plague in India, 1906-07. Simla,
Government Central Printing Office, 1908. IV, maps.
Contains descriptive account on the plague, its history, ill effects and preventing methods etc. in India during 1896-97. It contains also maps and charts.

173. India, Plague Commission, Minutes of evidence with appendices from 29th Nov. 1878 to 5th Jan. 1890. Calcutta, Government printing, 1890. 5v.

Deals with plague. It is minutes of evidence report of the plague commission from 29th Nov. 1878 to 5th Jan. 1890, under the chairmanship of Mr. T.R. Fraser.


Descriptive account on the plague of Madras region, particularly on the regulations and rules of Madras plague.

MEDICINE. SICKNESS-MORTALITY.


It is a statistical report, which is prepared from official documents. This report provides data on the sickness and mortality among the troops serving in the Madras Presidency. This report is printed by the order of the Government of Madras, by Mr. T. Graham Balfour. The description is extracted from the Edinburgh, Medical and Surgical Journal No. 73 and contains folded maps and charts.

Contains descriptive account on certain endemic skin and other diseases of India. Description on hot climate with notes on pellagra, clou Debiska, canecoticks and aleppo evil (with five plates) by W. Vandyke Carter etc. also included.


A report deals with the effects of artificial respiration intra-venous injection of Armonia in India and Australian snake poisoning and the physiological chemical and microscopical nature of snake poisons. The description is minutes report of the Commission appointed to investigate the subject by the Bengal Government and contains appendices also.


Contains descriptive account on the Hindu System of Medicine, deals various medicine, diseases and their treatment as adopted by the Hindu.
HEMULUS.  TOPOGRAPHY.


A report deals with medical topography and statistics of Nizam's military cantonments and army. This work is compiled from the records in the superintending surgeon's office and this reports furnished by the Medical Officers, attached to the service. The work is published under the authority of Lieut. General, J.C. Fraser and printed by D.P.L.C. Connor.


Outlines of the medical topography of Bishnath and its immediate neighbourhood. It also contains descriptive account of the diseases generally found in Assam.

MEDICINE. TROPICAL.


Deals with the tropical climatic conditions and also contains its influence on European constitutions in details. It is 6th ed. which is revised and greatly improved edition.

Contains the descriptive account on various diseases, its origin and influence on life etc., of tropical climate and contains appendices.

**METEOROLOGY**

132. Baddeley, Paul Frederick Henry. Whirl winds and dust storms of India. London, Bell and Daldy, 1880, 137 p., illus.

Descriptive account of an investigation into the law of wind and revolving storms at sea, with an addendum containing practical hints on sanitary measures required for the European soldiers in India. Description is fully illustrated by numerous diagrams and sketches from nature and a wind card for the use of sailors.


Contains brief informations on storms, climates and weather of India, Ceylon and Burmah. These informations are based chiefly on the publication of the India Meteorological department. The book is fully illustrated and contains the appendices. (i) Climatic statistics of ninety two stations, (ii) Tabular lists of storms in the Bay of Bengal. (iii) Mean, highest and lowest recorded monthly rain-fall at 114 stations, in India, Burmah and Ceylon. (iv) Directions for the use of storm signals at ports of the Bay of Bengal. (v) Notification of the Government of Bengal relative to storm signals for Calcutta and the Hooghly.
Deals with the meteorology of Bombay Presidency, gives
detail account on storm and rain fall distribution etc. in
Bombay Presidency. It contains appendix also.

SOME SCIENCE

185. Burt, Thomas, Seymour. Miscellaneus papers chiefly on
Papers deals with the subjects of science. Some are on
specific topics and others are related with other topics,
which are not scientific, these papers also give detail
analysis of scientific subjects, contains plates and appendix.

186. Hermann et al. Results of a scientific mission to India and
high Asia. London, Trubner, 1892-93. 3v.
Contains the descriptive account on the scientific mission
and its activities with special reference to India and high
Asia, during 1894 and 1895. The work is done by the order
of the court of Directors of the Honourable East India Company
by Hermann adolphie and Robert De Schlagintweit.

187. Mc Clelland, John. Calcutta Journal of natural history and
miscellany of the Arts and Sciences in India. Calcutta,
Bishop's college Press, 1892-94. 4v, illus.
Contains historical development of the nature. Papers
are contributed on arts as well as on sciences of that period in India. It also indicates relationship aspects between science and arts. These papers are fully illustrated and contains plates also.

**Review**


Contains detail description on instructions for the Cadastral survey Parties. These were employed in the combined operations of survey and settlement in Bengal. These instructions are adopted by Lieut. Col. W. Barron, from the rev. ed. of his hand book for the North-West-Province, July 1886.


Descriptive account on the operations of the great trigonometrical observations for latitude made during the period 1885 to 1900, and the deduced values of the deflections of the plumbite. This description is prepared under the directions of Lieut. Colonel S.G. Burrard and published under the orders of Colonel F.B. Longe, Surveyor General of India.

Dealing with explorations occurred during the winters of 1833 and 1834. The conditions and circumstances in which explorations occurred and the harms from the exploration have been described. Effects of the exploration life also included in this report.

191. India, Survey of India Department. General report on the operations of the survey of India Department during 1832-33 Calcutta, Bengal Secretariat, Press, 1834. 193 p., maps. (fold).

Contains description on the operations of the survey of India Department during 1832-33. The appendices, extracted from the narrative reports of the executive the officers, in charge of the Survey parties and operations. It also contains fronts, folded maps. The report is prepared under the direction of Col. T.C. De Pree.


Deals in detail with practical geometry, plane, trigonometry, the surveying chain, measurement of planes, offsets, mathematical, drawing instruments, the prismatic compass, plane tables, survey of a town and environs, practical astronomy, mapping; and levelling. The book is fully, illustrated with plates and appendix.

This book is printed by the order of Her Majesty's Secretary of State for India in Council. It presents a general view of all the surveying and other geographical operations in India from their first commencement and contains folded maps.

194. ________ ________. 2nd ed. 1873, XXIX, 491 p.


Serves as a guide to Surveyor. It contains instructions for the surveyor of Indian Department. This hand book is prepared by Lieutenant Colonel M.W. Rogers under the direction of Colonel H.R. Thullier. It contain appendix also.

TECHNOLOGY

TECHNOLOGY. DXX - DXIII


Contains the descriptive account on methods of dyeing and also the prices of material used in dyeing and printing with particular reference to Bengal. It is fully illustrated and also contains appendices.

Dealing in brief on the dyes and dyeing in the Madras Presidency, the methods of preparation and the uses of dyes and dyeing in Madras also described.

TECHNOLOGY, COTTON


Contains detailed history of cotton fabrics and cotton industry in Burma of past, present and future. Information on the cotton fabrics and its use in production of cotton cloths, the description is with particularly referred to Burma. It is well illustrated and contains appendices.


Gives descriptive account on the cotton fabrics of Bengal. It contains information on manufacturing process and industrial aspects of the cotton fabrics of Bengal. The description is well illustrated and contains appendices also.

TECHNOLOGY, LAC


A comprehensive account on the Lac, including description on production, manufacture and trade of lac. It is revised edition.
TECHNOLOGY, LEATHER


A brief account on the leather industry of Panjab during 1891-92. The description gives detail information on the raw materials, instruments and process adopted for leather industry specially in Panjab. It serves as a guide book for leather industry of Panjab.

TECHNOLOGY, POTTERY-GLASS

302. Monograph on the pottery and glass industries of the Panjab, 1890-91. Lahore, Civil and Military Gazette Press, 1893. 30 p., illus.

Descriptive account on the pottery and glass industries of the Panjab, during 1890-91. Description deals with the raw materials, process of manufacturing of pottery and glass materials. It also serves as a guide to the pottery and glass industries, contains illustrations.

TECHNOLOGY, PRINTING


Contains description on waterproofing, stereotyping, electrotyping, book binding, photography and basket making methods in India.

Describes the ornamental printing type, which mostly used in Central government printing office for the printing of book.

TECHNOLOGY, SALT


Contains descriptive account on the common salt. It serves as a handbook of common salt. It is a second revised and enlarged edition.

TECHNOLOGY, SILK


Detail description on the silk production with particular reference to Assam. Description includes notes on silk culture and the use of silk for the production of the silk cloths.


A guide book on silk fabric, produced in the North-Western Provinces and Oudh. The description deals with the silk culture,
production of silk fibres and their use in silk cloth production as practically followed in the North-Western Provinces and Oudh. It further contains appendices.

TECHNOLOGY, SPIRIT


Contains the detail studies on the manufacture of spirit of Turpentine and Colophony with special reference to French method. It also includes the description of the material used and process of manufacturing of spirit of Turpentine and Colophony.

TECHNOLOGY, TEXTILE


Presents detail information on the manufacturing of textile. The various steps involved in textile manufacturing also included. The customs as adopted for textile manufacturing by the people of India. The description is well illustrated and contains plates also.
TECHNOLOGY. WOOLEN


Deals with the woolen fabrics in detail, including the processing and manufacturing of woolen fibres and their use in the woolen goods/adopted in Bengal. It is illustrated description.

ZOOLOGICAL SCIENCE

GENERAL


Deals the outlines of zoology, thus serves as a guide book. It is designed for the use of forest officers in India. This book is prepared by the Forest Department of India.


Detail account on the Indian fauna, their salient features, morphology and physiology with plates chiefly selected from the collection of major-general Hardwicke.

ZOOLOGY. ANIMAL

Deals in brief about Rats, Mosquitoes, lizards, Crows, Rats, Bees, Wasps, Spiders, Ants, and Birds found on the cop of mango, poultry yard and at the tank. Description also contains, illustrations, fronts and plates.


Contains the descriptive account on habits, habitats, morphology and physiology of the animals, which are not much in extant.

Contains description on animals which are found in India, their habit and habitats with particular characteristics. It also contains a map, seventy two plates in colour. Seventeen in live and eighty six in half tone.

**ZOOLOGY. BATS**


Presents the detail account on the chiroptera found in Asia. The various species of chiroptera have been discussed. A list has been provided. Listing the species of bats found in the Indian Museum, Calcutta.

**ZOOLOGY. BIRDS**


Deals with the various type of birds, found in the Bombay Presidency. Description includes their characteristics, resting and other features related with habit and habitats.

219. Hume, Allan Octav ao. The game birds of India, Burmah and Ceylon. Calcutta, A Acton (1879-1881), 3 IV.

Contains a detail account with habitat and behaviour on the game birds of India, Burmah and Ceylon; containing coloured plates and appendix.

A descriptive account on the breeding, their salient features and nesting; and eggs of the birds, found in India.


Containing detailed description on nests and eggs, their salient features of the India birds. The fronts also included.


Contains detailed account on a natural history of all the birds known to inhabit continental India, with descriptions of species, genera, families, tribes and order and also brief note of such families as are not found in India.


Deals with the salient characters of the eggs, and their hatching of the birds found in India. Description on a Clender of the breeding season of the birds also included in plates.

Describes the mammals and birds of Assam. This catalogue is communicated to the committee of Science and Correspondence of the Zoological Society of London by Thomas Horsfield, and printed in the proceedings of October 23, 1839.


Contains a systematic account with description of all the known species of birds inhabiting the Island. It also contains the observations on their habits, with tables of their geographical distribution through in India.


Presents a systematic account with descriptions of all the known species of birds inhabiting British India. It also contains observations on their habits etc., tables of their geographical distribution in Persia, Belochistan, Afghanistan, Sind, Panjab, I. E. Provinces and the Peninsula of India generally with wood cuts, lithographs and coloured illustrations.

Contains descriptive account on the edible and game birds of British India with its dependencies in Ceylon with woodcuts, lithographs and coloured illustrations.

ZOOLOGY. FISHES.


Describes characteristics, peculiarities of species of fresh water fishes known at present. It serves as a guide to students and district officers.


Descriptive account on the natural history of the fishes known to inhabiting the seas and freshwaters of India, Burma and Ceylon. Volume 2, Containing Atlas with one hundred eight plates.


Contains detail account on the various fishes, their habits and habitats, importance with salient features, which are found in Malabar.
231. Day, Francis. One hundred and ninety eight plates to illustrate
Francis Day’s work on fishes of India. n.p. n.pub., 1869. 11 p.

Provides the diagrams of one hundred nineteen eighty eight on fishes,
which are found in India, as states by Francis Day. The description
contains the work of Francis Day, done on fishes of India.

232. Day, Francis. Report on fresh water fish and fisheries of India and

A report providing detail information on habits, habitats of
fishes of fresh water found in India and Burma. The historical
development on the fisheries in India also has been dealt. It also
contains appendices.

233. Hamilton, Francis. An account of the fishes found in the river

A descriptive account of the fishes found in the river Ganga
and its branches describing their salient features, morphology
and economic importance with plates.

n.pub. n.d.

Presents the diagrams of the various types of fishes found
in the Ganges. These plates showing the salient features of the fishes
and contains thirty nine plates.

Gives description of India insects, species and habitats; deals particularly with the collection of Late H.S. Atkinson, Rhipalocera, by William C. Hewitson; Heterocera (Sphingidae - Hepialidae, by Frederic Moore, with an introductory notice, by author Irote.


Descriptive account of all the known species of rhopaloverous Lepidoptera inhabiting the region with notices of allied species occurring in the neighbouring countries along the border with numerous illustrations. Illustration drawn by Behari Lal Dass, the wood engraving by George Pearson, the autotype plates by the Autotype Company of London, the chromolithographs by Messrs. West, Newman and Company.


Deals in insects found particularly in Indian homes. A descriptive account of insects with their habits, habitats and salient features, with illustrations.
ZOOLOGY. MAMMALS

John Whaldon, 1874. XXI, 35 p.

Descriptive account on the natural history of all the animals, their salient features of the mammals with morphology and physiology, found in India.


Contains brief account on natural history of the mammals of India and Ceylon. It also contains notes on (a) Family Nyctidactylus - the Dormice. (b) Osteology - of the skull of Rataniista Canestica. (c) Notes on some of the foregoing species. (d) Notes on skinning the mammalia and the preservation of skins, by Geo. F. Butt, Naturalist to the Royal family. The description contains one hundred seventy illustrations, by the author T. W. Wood and others, with fronts and appendices.

ZOOLOGY. MOLLUSCA

Calcutta. Calcutta, trustees, 1878-84. 2 v. (xv, 338 p., 306 p.).
A list listing numerous mollusca, present in the India Museum, Calcutta, made by hand. Description on the salient features on mollusca.

**ZOOLOGY, REPTILES**


Contains description on reptiles, their habits, habitats salient features, morphology and physiology of British India with twenty six plates.


Deals systematic account on all the species inhabiting the province and also with a table of their geographical distribution in Persia, Beloochistan, Afghanistan, Punjab, North-West Provinces and the Peninsula of India. It contains coloured illustrations with wood cuts, lithographs also.


Presents brief information on reptiles of British India and thus deals with the general study of herpetology in India. It listing the reptiles, found in British India with appendix.
ZOOLOGY. SHELLS:


Contains brief account on Conchologia Indica. It further contains illustrations of the land and fresh water shells of British India, describing their salient features with ninety-nine plates.

ZOOLOGY. SNAKES:


Contains detail study of the poisonous snakes, their salient characters, habits and habitats, found in India. It contains plates.


Gives brief description of the venomous snakes of the Indian peninsula, with an account of the influences of their poison on life and a series of experiments with coloured plates and appendix.

Descriptive account on the snakes found in India and adjoining countries with coloured illustrations


Contains brief account on the physiological effects of poison of the Cobra and various other snakes. The relative power and properties of the poisons of India and other venomous snakes. It also discusses the nature of snake-poisoning, like its prevention and treatment.

ZOOLOGY. VERTEBRATES


Descriptive account on the life activities, salient features of the animals, birds and mammals found in the forests of North Canara on the West Coast of India, with illustrations and fronts.


Contains a systematic account with description of all the known species of mammals, birds and reptiles inhabiting the province, with observations on their habits etc. It also
contain tables of their geographical distribution in Persia, Beloochistan and Afghanistan, Punjab, North-west Provinces, and the Peninsula of India. It is illustrated with coloured illustrations and with wood cuts, lithographs also.
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