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NATIONAL INSTITUTE OF ADVANCED STUDIES

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Modern Slave
and
Beyond
B. V Subbarayappa's Manuscript

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Modern Science and Beyond

A Historical Introduction

Preface.
Acknowledgments

1. Man in the Universe - An overview
2. Pre-Modern Science: A Perspective
3. Modern Science: Its origin and growth
4. Characteristics and Limitations of Modern Science
5. Values, Science and Religion
6. Humanism and Science
7. Science and Indian Religions - A historical survey
8. Globalization and Tradition in Indian Contexts

Supplementary Notes

Bibliography.

Preface

History of human progress —
folklores - Archaeological inscriptions
Literary sources.

{ History of Science — No friction.
astronomical knowledge.
Mathematical knowledge - medicine - technology
Babylonian, Egyptian, Indian, Chinese, Greek
Greek, Roman, Islamic.
Similar manner.
Records impressive - in Arabic in Sanskrit
Mutual influence, exchange

* Nature and pathways of transmission of
8th - 12th century CE

Emergence of Islam 7th Century - Caliph of Baghdad.
Arabic had become the language of Science
{ Works of Plato, Hippocrates, Aristotle, Euclid
Ptolemy - of Hellenistic school of Alexandria
Greco-Roman medical thinkers - Hellenistic School
of Alexandria. Astronomy, medicine, mathematics in
Sanskrit for India
Translated to Arabic.
Baghdad and Cordova in Spain —
Aristotle's ideas well known in Arab land

Aristotle's Concept of matter and motion

India had evolved its mathematical astronomy - trigonometric and computational excellence

Surya Siddhanta, Samkhya, Nyaya-Vaisheshika - all dealt with motion and matter

No explanation for freely falling bodies even by Aristotle - (Heaven does not fall - A)

Renaissance Period - Letters and Arts in Southern Europe

Concept of Impetus for motion - momentum

The Maragha School - centre in observation of Planetary motion - Tusi Circular, Linear motion ?

14th Century

Ibn Shatir of Syria - innovation in Ptolemaic System retained geocentric idea

Copernicus - Helio Centric

Later half of 16th Century - Galileo - Refuted Aristotelian ideas

Mathematical Explanation } by Newton
+ Gravitation }

[Indian, Islamic, Chinese Contribution in the Renaissance period not given Credit

pto

To what extent is Modern Science
Europe Centric?
How the Indian, Islamic and Chinese Contribution
Ignored Much Correct be done in the
Calc of Arts,

The Scope of the book outlined

Man in the Universe Our World
13.7 billion — Homo Sapien 50,000
Earth 4.5 "
Evolution of Life forms
Cro-Magnon — Homo Sapien
Neanderthal Man — disappeared in Neanderthal in Gorham
Stone age period 4500 — 1,50000 yrs
No evidence of remains of human life in the age
Using Stone tools
Harappa - Mohenjodaro Indus Valley Civilization
4,000 BCE onwards - Indian Gods and Goddesses Worship
" Linear order in Nature How Can be the Scientific
Universe

Greek Ideas different from Vedic Idea
Relation between Man and Universe

Plato Pythagoras Socrates — Mathematics
Forms are Static
Aristotle is Plato's pupil

Ether & 5th element

Baghdad - Arabic Scholars

New ideas - Post Renaissance 13th - 15th Century

Galileo - Kepler

16th - 19th Century - Astronomy did not obtain laws
until Newton, Chemistry and Biology

Cosmology - Early part of 20th

{ Creation - gases, leptons and electrons —
quarks, leptons, electrons

hydrogen can not explain age.

The universe does not fit Cloud

But in extreme cases - one of the theories

Entirely Lack Answers

Purpose of Universe ?

Anthropic Principle

is so facto - ipso facto

Time Space-Time ideals -

PTO

SEC 2

Section 2

Pre-Modern Science page 27 onwards

- early times to Renaissance

Neolithic - beginning of settled life
Control and know how 7th BC
domestication of animals
information available only after 4000-5 BC.

early Civilizations - Egypt, Mesopotamia, India
Mesopotamia (Babylonia) / China
Home of Scientific ideas
All sciences
germs of theory. - fire, boat.

14th - 16th CE - foundation of Science

Man - Spirit - Cosmos vision
holistic view of Order and Unity.

Chinese and SA Mayas - Incas
knowledge of Celestial Bodies - astronomy.
Calculation - Mathematics, Number Scaling
Reading Weather, Study of Growth

Astronomical observations in Babylon
3000 BC

Systematic Division of time
Path of the Sun into 12 divisions
Babylonian – Intricate – Eminent Rex
Periodicity of observed cycles
Egyptian Astrology – not as advanced as B.
Astronomical observation of pyramids
Egyptian architecture and geometry.
More knowledge in Medicine than B.
embalming of dead bodies – structured knowledge. Thus lost from Sciences.

India

Indus Valley – 2750 – 1500 BC.
1500 – 1600 later Sky.
Mohenjo-daro, Harappa } 1.3 million Sq. km.
* Cause & type- city in 1920-24
town planning, drainage system, bath.
terracotta
Script form on various objects
not deciphered yet
Vedic Thoughts Conclusion from Harappa

Vedic Times - 1500 - 700 BC.

Brahmanas and Upanishads
(Manuals) (Philosophy)

Universe - can extend here can not
Caption - Jita

* Concept of Visva - Jyoti - Unmanifested
Cosmic Light - energetic ensemble
Manifested and Colored Light - Stars, Sun, Moon
etc - manifestation of Cosmic energy
Rg Veda - Red is ONE
Nasadiya Sukta

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* Five Elements
Panchabhuta Concept - Earth, Jala, Tejas
Vayu, Akasha
Started Meta Physical → Physical (Sublimation)
Creation
Chandas - the five elements
Indras Prithivi - Nose
Ap - tongue
Tejas - eye, vision
Vayu - Skin
Akasha - Ubiquitous - Ear

the four elements in the stars such
Etc. etc.
Provided Satisfactory explanation by the elements - Considered.
Provided Concept Same for Ayurveda
Constitution of the elements - important.
Panchakosha Concept important for Sanskrit
Nyaya Vaisheshika, But it a limited
extent to Jaina, Buddha.

* Vedic Astronomy and Mathematics. (pg 34)

Sacrifices to be performed at the
proper time
Moon became the obvious choice
for measuring time (Nakshatra)
Vedanga Jyotisha - 5 year Cycle (Yuga)
{ 27 Nakshatras. — Bharani
In Vedic Texts - Krittika.

Beginning of Sidereal days.
Early Mathematics - { Sulba - Sutra
Squares and triangles

Pythagoras Theorem known to
Vedic Astronomers

Sulba-Sutra " The diagonal of a rectangle produces by itself both the areas produced by the sides separately by its sides"

Sulba Sutra - Squaring of circles, irrational numbers.

Pascal's triangle - in 16th century.

Aryabhata - 6th Century. - mathematical astronomy.

Sridhara, Bhaskara Ubya

*(Interesting details about - Indian Math)

- Roots of Ayurveda

* Chinese Ideas: Chinese Thought Structure is Not as old as the earlier Mesopotamia, Egyptian or Vedic Culture.

God does not figure in Chinese Thinking

Confucianism discard all forms of Superstition - Concentrate on human life came as obstacle to progress of Study.

Taoism - opponent of Confucianism →

Meditated upon that Cause & he known as Tao of Nature. They from experiments & in area like alchemy, medical Chemistry

But along side they have esoteric in the tradition of ancient Chinese

Shamanism and magical practices.

> Objective effect & the study of nature eluded them

* Still Taoism believed in the unity of Nature and interrelated eternity

Theory of five elements, Yin-Yang polarities (Water, Fire, Wood, Metal and Earth)

Air was not one of them

Element - Emperor relationship

*Yin-Yang Theory → two fundamental forces that constituted the universe

Yin = Darkness (Female)
Yang - Light (Male)

Chinese had developed Astronomy.

- Chinese Indian Ideas -

Principle of Systematic Organisation Li
Chi = Conjunction of matter and energy
Li and Chi inseparable
Chinese ideas did not play a role during Renaissance.

Greek Ideas

History of Science starts with Greeks
(No God, No Supernatural force)
Ionians (Yavanas) - Asia Minor
Asiatic Greeks in the coastal regions (islands) of Asia Minor
East-West - Mesopotamia Culture
North-West - Egyptian
Ionians traders reached as far as India

Greek Science ; (i) Pre-Socratic - Socrates
600 - 400 BCE
(ii) 4th Century. Plato and Aristotle
(iii) Hellenistic period (300-100) BCE
Alexander the Great
(IV) Greco-Roman 100 - 500 CE
decadent period of Greek Science

- Ionians

Thales of Miletus (624 - 585 BCE)
predicted Solar Eclipse in 585 BCE

Thales - Anaximander Anaximenes,
Heraclitus Leucippus, ~~pythagoras~~
pythagoras (b 582 BC)

Each thinker saw the Universe in a different way, but no overarching divinity

Matter + motion

four elements - Earth Air Fire Water.
altering - transformation

Leucippus + Heraclitus → Atomic Doctrine of Matter

Democritus (Contemporary of Socrates)
He "All things have made of Solid Constant atoms together with Space a ~~void~~ between them"

** He emphasized that the void had as much claim to be primarily real as the atoms themselves"

(themselves)

Epicurus (342-270 BC) of Samos elaborated on the Corpus of Atom.

Lucretius (95-45 BC) – a Roman and Epicurean – origin of the universe an intention of atom

Even oriental philosophy – atomic.

" Greek Atomism remained dormant for 1500 years till Resurrected by Gassend Gassendi in France Robert Boyle and Newton in England in the 17th Century

Lucretius Nature of Evolution. Plant - Animals for later & higher forms.

Pythagoreans distinguished Ionian – Basic Principle of Math. Numbers as basic elements. Pythagoras Theorem.

Ether as the 5th element.

5th Century BC – Skeptic & Atheists

Medicinal Ideas:

Hyppocrates of Cos (b430 BC)
transformed the religion and superstitions
medical practice into a Science by the
search of disease to be found first.

* altered the course of medicine.

Setback due to Socrates (5th Cent BC)
who ridiculed emerging Scientific method.

- Depressed new thinking down. Plato
  knowledge

Socrates - deeply concerned with Ethics

Plato. - Aristotle

Plato (427-347) BC

Plato - also concerned on Ethics -
passionate about mathematics -
especially geometric forms

=> knowledge - a living organism with body
(cosmos) and Soul.

Doctrine: { ONLY in idea world separated
from soul.

Reality = Forms - Geometrical forms

Thales — Reality of Matter

Plato and Pythagoras: Reality of Forms

Aristotle: Most outstanding disciple of Plato

Influenced human thinking for 1500 years.

Speculative in Content.

Many of his ideas had to be demolished to bring in supremacy of Science.

exponent of inductive method, opposed to deductive

Alexandria

Alexander was a pupil of Aristotle.

Archimedes, Geometry, —

Aristarchus — Contemporary of Archimedes — Solar Centric System, began Copernican

Euclid — geometry

light travels in straight line.

Archimedes — Relative densities

lever, pulley, hydraulic screw

New trend in the technological thinking of that time

Ptolemy's views —

Decline of Alexandria

Alexandria - Alchemy and Astrology
bizarre practices
Ptolemy advocated astrology

* Around 4th Century the intellectual climate in the West started deteriorating
People of Christian dominion developed distaste for investigating the physical world - lead given by St Augustine.
"Go Not out of doors. Return to Myself. & the inner man dwells truth"
Theology began to reign supreme
Europe groped in dark 400 - 1000 CE
Mysticism was taking its roots.

* In 415 AD Hypatia the only known mathematician of antiquity who had free/light on algebra of Diophantus and who had her own school was murdered by Christian fanatics.

The Orient — Indian and Islamic Area

The future at this stage for Science was not in the West, but in the E.C.A. Byzantine Persian Empire and India.

4th - 16th Century – India hellenized

"intellectual effervescence in Literature, philosophy, astronomy, mathematics, medicine and technology"

The Siddhantic Astronomy – less observational and computational.

Aryabhata I (b 473 AD), Brahmagupta (7th)

Bhaskara II (12th), Lalla (8th) ...

decimal place value

Indeterminate equations – Solutions

Ayurvedic texts: Charaka (2nd), Sushruta (4th), Madhava (7th), Vagbhata (6th)

Islam emerged in the 7th Century

"Go out in Search of Knowledge"

Apogee of Astrology

Islamic Savants played a Savant
Played an important role in Emergence
/Scientific pursuits.
Arabic became the language of Science
All important texts in the language rendered
into Arabic.
"House of Wisdom" in Baghdad.

Nestorian Honian ibn Ishaq (809-873)
was the noted leader of the translation
movement.

P52 Hindu Numerals and decimal
place Value, — after learning
/Sanskrit — translated to Arabic. —

India given the first place in Scientific
achievement — Compared to Greek, Roman and
Persia — Three Indian in Delhi

10th Century } Islamic Savants Greater
12th " } Ptolemy's Tables.
Greek postulates
Replaced by Copernican planetary System

* Spanish Muslim of 12th. Century Averroes or Ibn Rushd:
He did not believe in Single Creator. But a Prime Mover who has Constantly providing it — Ilaaf khalq.

The Maragha School

Maragha hills in North West Part of Persia (1259) → Ulugh observatory a- Samarqand (15th. Century)
Jai Singh observatory in 18th Century.

* Maragha School influenced Co-pernicus later
Copernican model identical to that of Ibn Shatir of Maragha School

* In India the Kerala Astronomer Nilakantha had developed a planetary model around 1500 — Outer and inner planets revolved around the Sun, and the Sun along with them revolved around the earth.

New Awakening

Intellectual Rejuvination in Europe by translating Arabic Scientific texts to Latin (13th - 14th Century)

Name like Realgar, alkali, alcohol, antimony, Zircon, alcohol, aldehyde, alkali, Betelgeuse, Vega, Nadir, Zenith, azimuth, thiodolite, theodolite, almanac — Lan Jutand

Indian Invention — Sunya, jya, ko-jya

became Zero, Sine, Cosine

Early European Awakening began by Joseph Black, Henry Cavendish, Willian Scheele, John Priestely and Lavoisier, — Discovery of Oxygen and other elements

Number System and Numerals

(Vedic Tales) of deep forest

Modern Science

pb5 12th - 16th. Century Arabic → Latin
Translation. Latin → Arabic

* Revival of Scholasticism in which thought of Aristotle received pattern of attention → to Renaissance.

* Matter and Motion - New Insight
Matter = weight.
How did a projectile continue after motion?
Motion of falling bodies?
Aristotle's long view

French Thinker Jean Buridan
- Impetus theory for Continued motion did not explain falling bodies

Celestial motion - Copernicus
Ptolemy's 80 Spheres - Structure intensify

(1543) De Revolutionibus - Copernicus

- Persistent question regarding the motion of the Earth itself
  If the earth rotated its parts would fly away. —

Tycho Brahe's observation — Kepler

*GALILEON REVOLUTION

Galileo: (1564-1642) Pioneer of Mechanical Sci
mind of a genius
Leaning Tower of Pisa (exp)
Why did a falling body travelled faster and faster as it fell.
(No watch or clock)
devised water clock.

1604 —
1609 - Telescope
Kepler (1571-1630) - Lens
Aristotlean Astronomy lead to rest

Kepler - Platonic Ideas -
Sacred Figure of equal sides and angles

p76 1642-1727 ~~15~~ 125 yrs?

- Newton ((1602)-1727)

Magnum Opus { Philosphiae Naturalis Principia 1678

Determinism - Laplace

" Boy on the Seashore -

Matter or Form (debate fm. Plato's time)

Form = Gravity how height?

Form can change but not matter

Newton — esoteric alchemy - theology.

(p77)

- Rene Descartes and Francis Bacon

(France) (England)

✓(1596-1650) (~~1506~~-1626) ✗

(121 yrs?)

1561 — 1626

Bacon emphasized on inductive method to be pursued with vigor

Descartes laid down the principles of Scientific Methodology — omit nothing pertinent to truth

Mind = Consciousness

Cartesian duality — mind / matter.

He believed in the Creation of the Universe by God. It is infinite

Bacon: Rang the Bell that Called Brits together

Locke adopted the atomic hypothesis — minute parts as the source of all qualities.

Heat and Light:

imponderables - weightless substances

18th Century Physics → "fluids" Caloric (squeezed)

heat — Caloric found to squeezed out

1592 - Galileo - Thermoscope forerunner of thermometer

1701 - Newton — on thermometer

1715 - Mercury thermometer by Fahrenheit

Joseph Black in 1728-29
Latent heat idea.
1850's Conservation of Energy
Convertibility of one form to
another

(80)

Light- Newton's Corpuscular thy
(1690) Huygens - wave thy
explained refraction
Young last support - interference.
Velocity of light problem - in a medium
Fizeau, Foucault - 300 000 km/s

Magnetism and Electricity

William Gilbert (1546-1603)
Physician. Earth's magnetism
properties of lodestone

Electricity - Static Electricity known for a long time
Coulomb (1736-1806) - Torsion Balance
Volta (1745-1827) - passage of electric
current.

Electro-Chemical Methods for Separation of elements – Humphry Davy (1778-1829)

Oersted (1777-1851)

Electric current deflects a magnetic needle

Ampere } coil of wire behaves like a magnet
Arago }

Michael Faraday (1791-1867)

Induced Dynamo.

Clerk-Maxwell (1831-79) EM theory.

- Concept of Energy – Conservation

Chemical, Mechanical, Electrical, EM

Joule – Relation between heat and work

Joule = ~~Amount of~~ The amount of work needed to heat one pound of water by one degree Fahrenheit.

Living Force = Energy

" Living Force (vis viva)

Nothing is ever lost

1852 - Lord Kelvin (Thomson)

Lavoisier - Law of Conservation of mass

Joule - " " of Energy

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p85 Chemical Synthesis

Alchemy, Metallurgy -

Ceramics, glass, dyes, pigments,
Cosmetics and Perfumery

Medical Chemistry -

Paracelsus (1493-1541) - Mercury, Sulphur, Salt

- Mercury → involved ideas of
- Nature of all metals
- Sulphur → Nature of Combustibility Inflammability. Change.
- Salt → fixity Resistance to fire

Helmont - Classified gases Liquid, Solid, gas
Acid, Alkali, Bases.

Idea of affinity

Cavendish (1731-1820)
Priestly (1733-1804)
Scheele (1742-1786)
} Study of gases

CO_2, H_2, Ammonia, Nitric acid
hydrogen chloride, Chlorine, SO_2

properties studied in detail.

Lavoisier (1743-94) became a landmark. 23 elements recognised.

Berthelot (1748-1822)
(French) named as per chemical composition

* End of 18th Century Chemistry
{ attained the status of Science with
Idea of element, chemical efficacy,
Law of Conservation of mass
Lavoisier - Founder of Chemistry.

Dalton's

Proust Hypothesis (1755-1826)
Law of Definite Proportions → atomic theory

Dalton (1766 - 1844)

Air is Compsd of the same proportn of Oxygen, Nitrogen with traces amts of CO_2, Water vapour

Dalton - Diffrnt minute particles of diffrnt size constitute air

Avogadro hypothesis. (1811)

Berzelius (1779 - 1848)

Electro - Chemical aspect

Meyer (1830 - 95) } Periodic Table
Dmitri Mendeleev (1834 - 1907) }

emphasized fore-telling of elements not discovered.

(8Q) Structure of the Universe

Paris Obscurity (Louis XIV - Commd)
(17th Century)

Charles II in England.

Greenwich Obscurity.
possess of 20,000 Stars

Halley Comet first 1682,
75 1/2 yr. Cycle.

Herschel - Nebulae.

Celestial Mechanics.
Study of Solar System (Wollaston)

Fraunhofer (1787-1826) attached a telescope to a prism to examine Solar Spectrum in detail.
Spectrum Analysis & Nature of Matter
(Kirchhoff (1824-87), Bunsen (1811-99))

Cesium and Rubidium discovered.

Doppler Shift.

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Terrestrial Investigations.

Earth: Shape of the earth
Terrestrial Magnetism Gauss (1777-1855)
Magnetic observatories established all over the world - aim is to find external and internal Strum of the earth - Geology
Paleontology - Study of Fossils
Geological Surveys - GB and India (1851)

Volcanoes Mineralogy
Concept of 'Gondwanaland' –
India - Arabian Nights

Biological Inventions 17 - 19th Centuries

Microscope became an important tool.
Microscopists – Marcello Malpighi (1628-94) Bologna
Robert Hooke (1635-1703)
Nehemiah Grew (1641-1712)
Van Leeuwenhoek (1632-23) Delft.
* Structure and behaviour of plants and animals
* Microscopic demonstration of the channels of flow of blood confirmed the idea of Blood Circulation by Harvey (1578-1657)
Secretion, fibrilation, of muscle

Classification of Plants – Species – Genera

Early in 19th Cent – Mechanical Concept of Life – debate

Chlorophyll – in Plants

multicell organisms (Purkinje) 1787 - 1869

Protoplasm

unicellular organism - Protozoa.

Emil Fischer (1852 - 1919)

Protoplasm = mixture of ~~amino~~ amino acids

Life - Chemico-physical phenomena

(95) Evolution

Philosophically Evolution = Being → Becoming.

mid 19th. Century - Charles Darwin (1809-82)

Evolution = Development.

- Jean Baptiste Lamarck (1744 - 1829) postulated No Frontiers or Boundaries among the Species nor they have fixed and closed one.

Environment produces changes - puts pressures on organs. "Law of Use and Disuse"

Giraffe Stretching its neck → Longer neck in the Species

No direct evidence for this.

Such developments would be transmitted to the ~~offset~~ offsprings or descendents.

Malthus (1766-1834) Essay on Population — Struggle for existence

Darwin's Sea voyage: on Beagle (1831-34) — various peculiarities of plants and animals.

Voyages Culture of dish

Alfred Russel Wallace (1823-1913)

geographical variation — biologically interesting

Living organisms on the ocean floor Compared with Jungle organisms

Darwin's Book

"Origin of Species by means of Natural Selection or the Preservation of the Favoured Races in Struggle for Life" 1859

two decades of study and thinking

Wallace also had Hooker of along their lines. and had sent his MS to Darwin. for opinion.

* Darwin endorsed Wallace's MS admired their priority and published jointly account of the origin of Species in 1858 under the Title of both"
A rare gesture of academic integrity

According to Darwin
organs and instincts are slightly variable and there is a struggle for existence leading to the preservation of each profitable deviation of the structure or instinct.
Profitable deviations are inherited.

∴ it is Natural Selection than any specific plan that has determined the new species - this broad sense of progressive force. in which both Lamarck and Charles operate.

1871 Descent of Man.

exponents and opponents to Darwin's

Thomas Huxley Agnostic
But the Century continues – "Creationism"

(99) New Experiments and Bold Ideas

Kirchoff – Spectral Measurements of Black Body Radiation – father of Classical Phy.

Max Planck – Quantum Hypothesis. (1900)

(1 → 2)

Michelson – Morley Exp.
If light is wave, what is waving? Role of ether. Einstein's Phy.

X-rays (Roentgen (1845–1923)

Radioactivity Becquerel (1898)

JJ Thomson Electron (1897)

(103) 20th Century

$E = mc^2$ not $c = mc^2$

Bohr formulated the quantum theory of the structure of the atom in terms of the particles moving in the nucleus and the electrons

orbiting mixed in different quantized orbits.

[For the motion of particles the classical Newtonian equation had to be replaced by the quantum mechanical equation of Schrödinger and ~~Heisenberg~~ the matrix formulation of Heisenberg. Both formulated the quantum mechanical theory of the atom ~~by quantizing the orbital parameters~~ by adopting the Rutherford idea of the Nucleus ~~and the Coulomb~~ proton and Neutron ~~with the orbiting electrons~~ and postulating quantized orbits for the electrons revolving around the Nucleus.]

Louis Debroglie ~~was~~ / particle dualism and Heisenberg's principle of indeterminism are behind bagging a Nobel of QM that caters to us even today.]

Biology in the 20th. Century

Genetics made great leaps.

Space Travel

[A Series of Electronic Computers, Materials (plastics, New etc) Stimulated by pace in Space Travel
It is this development that made possible advances in medical techniques (Laser, CT Scan, etc) and in Communication — Satellite, Mobile phone, e-mail, Internet etc —
that has increased the pace of Scientific advance, in fourth dimension etc.]

p107 Limitations of Modern Science

Physical world — a biological Medium
Could both as their mechanical analogies

17th Century — Dynamic universe.
Scientific Determinism
Royal Society } (1662)
Paris Academy } Exchange of Scientific ideas

Anthropocentric View ⇒ Universal View
(Sun just one Star.)

End of 17th. Century → end of Cosmology
of Plato, Aristotle, Ptolemy.
Science acquires a STATURE

AGE OLD IDEAS prevailed in the background
BUT Galileo, Kepler, Newton – inclined
towards THEOLOGY.
Kepler believed the human brain
made in the image of God.
Newton – God as Creator.
Rene Descartes believed in God.
Bacon – God has written two books
"Scripture and Creation"
Such an attitude did not cloud their Objectivity.

Since growth of Science →
Avoid prejudice, personal bias,
Give at objectivity.

Observe vs Observed

Karl Popper

Theories could never be verified.

"Science by its present method could never claim that it had attained the truth, not even its probability"

Concept of falsification

External Character of Science

Industrial Revolution - middle of 18th & 19th Century

NEHRU and Dissemination of India.

(pills) Science = Planning = Doing.

* International Character

Science is International - heritage of mankind
No boundaries (?)
Advanced Technologies not Shared.
gap between Developed and Developing Countries because of this.
International Cooperation essential

(117) Limitations of Science.

exploitation of Nature for human needs.
environmental degradation. — global warming.

(to what extent Science and Tech should be blamed for this. It is the Politicians that has to be blamed)

* (Science knowledge high HUMAN SENSES + ALL THE EXTENDED INSTRUMENTS - TELESCOPES, MICS, SCANNING, LASER etc.)

What about input & knowledge from Philosophy and Religion?

observer - observed problem Participatory Universe

Objectivity ≠ Absolute Reality.

Concept of Relative Reality.

(118) REALITY

Eddington - The Stuff of the world is Mind Stuff.

Basic Assumption of Natural Science is
UNIFORMITY OF NATURE

? Has not been able to provide an acceptable explanation of the origin of the universe but both assumptions about origin of Life.

All explanations failure so far.

Purpose of existence?

Ethics and Science
Social Darwinism - Evolutionary Ethics

* The Human aspect

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(What happened in Germany in the 1930
Events that drove out -
Lawmen in Stock -

Overview of Maths is to introduce / set the stage for the book

1 Contribution of each ancient Culture in the acquisition of knowledge

Each culture had its own approach to astronomical ideas, mathematics, physical ideas of the world, medicinal concepts

2 Extensive Literature on Maths in Sanskrit so also in other languages - Arabic, Latin
Arabic became language of Science

3 & India evolved in mathematics

4 Renaissance - yearning for understanding phenomena like motion - falling of bodies - Circular motion Aristotle, Ptolemy

5. 14th Century onwards - Galileo, Copernicus, Kepler
Why origin of Science is Europe?

6 India - Brahmi Numerals, decimal place Value System
To know the development as Europe is an over simplification

7. History of Modern Science

Early Astronomy - Role of Copernicus, Newton

Beginnings of Science - Descartes, Bacon (France)

Heat and Light - living theories

Magnetism and Electricity - Gilbert

Benjamin Franklin, Volta, Oes Oersted

Ampere, Faraday, Maxwell - Description of individual Contributions

Concept of Energy - Doctrine of Energy

Measurement - Joule

Chemical investigations - alchemy, metallurgy, glass, dyes

Medicinal Chemistry (Stress

(Mercury sulphide, Soda)

Cavendish (16th-19th Century) - Carbon dioxide

Hydrogen, Chlorine, Lavoisier - Hydrogen

ideas of phlogiston killed

Berthelot - Naming of Chemicals

Boyle - Revived the Greek Atomic Hypothesis

(17th Century)

Proust (18th, 19th Cen) - Law of definite proportions

Dalton's Atomic Hypothesis (early 19th)

(Atoms of elements)

Berzelius - Electro-Chemical Concept

Mendeleev (20th Century, early 1834-1907)

Periodic Table

- Structure of the Universe
  Paris Observatory - earlier 17th Century
  Huygens -
  Greenwich observatory - (1676-1859) Charles II
  Edmund Halley (1656-1743)
  { 1682 - Comet prediction
  { 1705 - Again
  Kirchhoff and Bunsen - Spectroscopy of elements
  Cesium and Rubidium - Doppler Study (1803-53
  19th cty.

- Terrestrial Investigation
  Terrestrial Magnetism - Gauss the instrument behind it
  Studies of the earth - Concept of the Gondwana land

  Biological investigation (17-19th)
  Botany and Zoology - Microscope
  Classification and Naming - botanical latin

- Nature of Life - as mechanical explanation
  (early 18th Cen) possible?
  Protoplasm is individual Cells identified by
  Purkinje - Cells as the basis of life
  Claude Bernard - Body process - Chemical,
  physical phenomena

- Evolution Darwin (1809-1892)
  Lamarck (1744-1829)
  / Law of use and disuse

Malthus (1766-1834)
Essay on Population - Struggle for existence limits the population

Charles Lyell Lyell - influence of land masses (Environment?) on distribution of living beings

Darwin's Theory of Evolution
Wallace (1823-1913) } fairly obtained confirmation of their theories

Natural Selection makes the species fitter
Survival of the fittest

Wallace - ~~inherent of~~ inheritance of

End of 19th Century
New experiments - that changed physics
X-rays, Radioactivity, Electron

20th Century • Rutherford - discovery of the nucleus
Genetics, Space technology
information technology - globalization
Cosmology - Big Bang - Expansion of knowledge
Intellectual Human mind.

• Limitations of Science
Stages of development of Modern Science
from the Renaissance Period

Nature = Language of Mathematics
Experimentation 16th Century

Problems left by Church - Copernicus
Bruno

17th - Dynamics, Chemistry
Structure of living organisms

Paradigm Shift - Universe -
Work of God? Newton, Darwin, Boyle } all believers

Darwin's Theory they applied -
Popper's Verificiability - Science can never attain truth

Exploitation of Nature by Man - Lorry

Developed and Developing Nations Divide

- Interaction Chemistry of South
Clandestine operations - parties in the
SAT = Political-Economic Game
annihilating power of testing
- Limitation
Eroding harmonious relation between Nature?
Change in the foundation of Space. Law time

- Reality - What is the ultimate reality?

What is the basic stuff of the known world? is it projection of our senses or outside them?

Enlightenment - the stuff of the world is mind stuff

What is the Purpose of our existence?

Evolutionary Ethics - Spirit of altruism

Darwinism

The intrinsic essence of Science

Atom Bomb (Pros and Cons)

- Values: 20th Century transforms the face of the world Conquest & trade happened in 5000 yrs ever

Achievements of Science - on the + side

gains knowledge thru senses and the mind

Co-ordinates the knowledge

most democratic approach

- Science as total knowledge certainty -

Recreation of the hidden secrets of nature

verifiable facts - no bias - no authority can impose

No finality no dogmatic assertions

Blind faith is required.

- Spirit of,

free enquiry and Reasoning
Value of Reasoning.

Science and Religion are products of the mind.
Religion is a way of life - Hinduism, Buddhism
Can there be a dialogue between Science and Religion?
Values in Life -

Environment
Science has its faith too - Uniformity
laws of nature

Motivation for Science - truth and understanding
Question for Einstein
Science has been trying to find a unifying
theoretical basis for all observed phenomena
E - God Reveals himself in harmony of the
boy/

Science Is it lower quotient? -

Spirituality - Oneness
Man Sth does not know why he is born
to the earth? What purpose
The Universe Continues to be mysterious
but all the questions

Substitute of old values for thought control

and

6. Humanism of Science

1. Can science be a force generating humanism?
2. Has science forgot the seeds of dehumanisation?

Humanism: One human being & thinks of another as the thinks of himself

Science has been misused for the advantages of others

Human sensitivity is the key factor for promoting humanism

irrationality regarding environment degradation

Collective devoted efforts rationality and interchange

- Education plays an important role to promote altruism

Has man become slave of technology instead of exploiting use and depend

- Human Conduct - they have degraded!

20th Century - harbinger of social unrest, disorder and conflicts

Atharva Veda

Life has its openness and freedom
material enrichment

Science and indic religions — historical
India's past is also its present
God is immanent in the created — Brahman
Hinduism, Jainism, Buddhism
Vedic texts — astronomy, mathematics, medicine and dental, biology —
metallurgy — physics as part of religious
texts

- Early Scientific Ideas —
four Vedas Vedic Gods had no physical form
Sun, Moon, clouds, rain, lightning, fire
and other natural phenomena extolled as Gods
Gradually idea of ONE God
Vedic scholars — universe is not capricious
but ordered one

physical regions in Chanting
Study of nature of Sun and Moon
Sacrificial altar — geometrical forms —
Sulvasutra
Worship of forms came much later.

Indian Mathematics and Astronomy

Hindu numerals, decimal place system

Kerala mathematics - trigonometric series

Aryabhatiyam - Computation and true position of planets

Eclipses - as bad omens

Medicine - Ayurveda - Charaka, Sushruta Samhita

Unani during Mughal rule

(Tunics) for Central Asia

Colonial period - Western scholarship

Botanical, Zoological, Geological teachings taught

by European scholars, explorers

flora, fauna, minerals, climate, soil and geographical studies

Revival of traditional learning - Sanskrit, Arabic, Persian

Raja Ram Mohan Roy - Hindu College in Calcutta (1823)

Universities - Calcutta, Bombay, Madras (1857)

Lahore, Allahabad 1882, 1887

Social and Religious Reform Movements

'Hindu Renaissance' and Western Influence

Bombay Samaj - 1828. Raja Ram Mohun Roy
Arya Samaj - Dayanand Saraswati
Upasak & Tattva Bodhini
Vivekanand - Ramakrishna Mission

Hindu Science

British Policy - Neutrality and Non interference in religious matters

Many European Scholars believe Hindus, Jains, Buddhists important glimpse to Hindu Culture, astronomy and Hindu Medicine

Madras Observatory established in 1792
systematic research of the stars

P.C. Ray - Hindu Chemistry

Doctor of Chemistry from ~~Edinburgh~~ Edinburgh
first pharmaceutical Company in India

Ayurvedic Colleges - Bombay, Delhi

Indian Pioneers in Science
Mahendra Lal Sircar - founded Indian Association for the Cultivation of Science
1876
C.V. Raman Nobel Prize Indian 1930

S.N. Bose, M.N. Saha

Preface

1885 - Natl Congress - Gandhi's news
Nehru

Nehru, Religion and Society

Sec 8 — A synergetic science
Globalization and Tradition

Manifold Implications of Thinking.
World is no longer isolated -
telecommunication, fast travel
Globalization has accentuated consciousness, have good
physical as psychological problems - not style of life
Double edged sword - enhancement of mental life
faster pace of life style
increasing anxiety stress

Indic Traditions
Astronomy, Astrology - interwoven
Ayurveda - in tridosha theory } all
Homeopathy, Siddha, Unani
Western medicine
} alt. concepts

Religious and Spiritual Traditions not affected
by Globalization Yoga has become
international.

Supplementary Notes