

Beginning of an Era. (Editorial)

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I believe that when history of civilisation of Mirpurkhas is written, October 2010 will be written as a day when thinking of the region started to change from a superstitious one to an evidence based, scientific thinking. It is indeed a historical day* in the history of Mirpurkhas division when first scientific research journal of this region is being released. Along with original and review articles, the Abstract Book of 4th Annual! Medina! Symposium of 2006 whose theme was "Ethics in Medical Practice and Research". Subsequent editions of this journal (JMMC) will have abstract books of following years: Hence valuable data and information of local diseases of Mirpurkhas will unfold in medical literature for the first time in history.

Scientific research goes back a long way with the Edwin Smith Papyrus (circa 1600 BC) describing the examination, diagnosis, treatment and prognosis of the disease,

Early Greek Rationalists:

Plato (and to a lesser extent Aristotle) was the greatest rationalist (Rationalists believe that the criterion of the truth & not sensory but intellectual and deductive and that reason has precedence over other ways of acquiring knowledge or even that reason is the unique path to knowledge).

The rationalist before Plato included the Joman cosmologies of the Old Sumerian BCE, who differentiated between: the ideal order and a reality accessible only to pure reason: the Parmenides early 5th century BCE}, who used rational argument to prove that the world is an unchanging unity; and Pythagoreanism, which, held that the world is made of numbers, and hence mathematics can guide to the ultimate truths. During 3rd century BC, the Greek physician, Erasistratus of Chios was repeatedly weighing a caged bird, and noting its weight loss between feeding times.>

Aristotle contributed significantly in progress of scientific reasonings. I believe that universal truths can be known from particular things via induction, though he did not accept that

knowledge acquired by induction could rightly be counter! as scientific knowledge.

He maintained that induction was necessary for scientific enquiry. However, he considers intuition more important than induction.

He says in Posterior Analytics,

"We suppose ourselves to possess unqualified scientific knowledge of a thing, as opposed to knowing it in the accidental way in which the sophist knows, when we think that we know the cause on which the fact depends, as the cause of that fact and of no other, and, further, that the fact could not be other than it is."

Towards the end he accepts:

"Thus it is clear that we must get to know the primary premises by induction, for the method by which even sense

perception implants the universal is inductive. {...} it follows that there will be no scientific knowledge of the primary

premises, and since except intuition nothing can be truer than scientific knowledge, it will be intuition that apprehends

the primary premises. [...] If, therefore, it is the only other kind of true thinking except scientific knowing, intuition will

be the originative source of scientific knowledge."

Islamic Golden Period:

Early Islamic Philosophy tried to combine theory with practice. Scientists could be artisans and instrument makers. Experiment and quantification were used by Jabir ibn Hayyan (a.k.a. Jabir ibn Hayyan) (721-815) to compare competing scientific theories" and by Alkindus (801-873).*

Ibn al-Haytham (Alhazen) used experimentation and mathematics as described in his Book of Optics (1021), He said

"Truth is sought for its own sake. And those who are engaged upon the quest for anything for its own sake are not

interested in other things. Finding the truth is difficult, and the road to it is rough."

15th February 1999 is another important date, when first class of the first batch of Muhammad Medical College

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was held.

Ibn al-Haytham's scientific method was close to modern scientific method like hypothetico-deductive procedure in scientific research and consisted of the following procedures

- Explicit statement of a problem, ties to observation and to proof by experiment
- Testing and/ or criticism of a hypothesis using experimentation
- Interpretation of data and formulation of a conclusion using mathematics
- The publication of the finding

Ibn al-Haytham emphasized scientific skepticism and empiricism. He also explained the role of Induction in syllogism, and criticized Aristotle for largely ignoring induction, which Ibn al-Haytham regarded as superior to syllogism, and he considered induction to be the basic requirement for true scientific research.

The Persian scientist Abu Rayhan al-Biruni introduced early scientific methods during the 1020s & 1030s. Al-Biruni's methods employed repeated experimentation. He was concerned about making errors, "errors caused by the use of small instruments and errors made by human observers." In his scientific method, "universals come out of practical, experimental work" and "theories are formulated after discoveries", like with inductivism.¹¹

The Persian philosopher and scientist Avicenna (Ibn Sina) discussed philosophy of science and described an early scientific method of inquiry. He criticized Aristotle's Posterior Analytics. His popular questions included "How does one acquire the first principles of a science?" and how a scientist might find the initial axioms or hypotheses of a deductive science without inferring them from some more basic premises?" He explained that the ideal situation is when one grasps that a "relation holds between the terms, which would allow for absolute, universal certainty." Avicenna described two methods for finding a first principle: the Aristotelian method of induction (istiqla) and the newer method of examination and experimentation (tajriba). Avicenna criticized Aristotelian induction, arguing that "it does not lead to the absolute, universal, and certain premises that it purports to provide." In its place, he advocated "a method of experimental as a means for scientific inquiry."¹² Earlier, in The Canon of Medicine (1025), Avicenna was also the first to describe what are essentially methods of agreement, difference and concomitant variation which are critical to inductive logic and the scientific method.¹³

However, unlike his contemporary al-Biruni's scientific

method, in which "universals came out of practical, experimental work" and "theories are formulated after discoveries", Avicenna developed a scientific procedure in which "general and universal questions come first and led to experimental work". Al-Biruni described himself as a mathematical scientist and Avicenna as a philosopher during debate between the two scholars.¹⁴

Middle Ages or Medieval period: It is a period in Western European history that followed the disintegration of the West Roman Empire in the 4th and 5th century, and lasted into the 15th cent., i.e., into the period of the Renaissance. Medieval scholars of the 12th century focused on studying Greek and Arabic works of natural sciences, philosophy and mathematics, rather than on such cultural texts.

Most medieval philosophers after St. Augustine (354-430) took an empiricist position, at least about concepts, even if they recognized much substantial but nonempirical knowledge. The standard formulation of this age was: "There is nothing in the intellect that was not previously in the senses." Thus St. Thomas Aquinas (1225-74) rejected innate ideas altogether. Both soul and body participate in perception, and all ideas are abstracted by the intellect from what is given to the senses. Human ideas of unseen things, such as angels and demons and even God, are derived by analogy from the seen.

During the European Renaissance of the 12th century, Robert Grosseteste commented on Posterior Analytics and concluded from particular observations into a universal law, and then back again, from universal laws to prediction of particulars. Grosseteste called this "resolution and composition". Further, Grosseteste said that both paths should be verified through experimentation to verify the principles.¹⁵

Inspired by Grosseteste, the 13th-century scientist Roger Bacon (1214-1294) emphasized empirical knowledge of the natural world.

He described a repeating cycle of observation, hypothesis, experimentation, and the need for independent verification. He forwarded what is commonly regarded as "Empiricism" today.¹⁶

Renaissance:

About 1450, European scholars became more interested in studying the world around them. Their art became more true to life. The new age in Europe was eventually called "the Renaissance." Renaissance is a French word that means "rebirth." Historians consider the Renaissance to be the beginning of modern history. It was a cultural movement that spanned roughly the 14th to the 17th century, beginning in Florence (Northern Italy) in

the Late Middle Ages and later spreading to the rest of Europe. Renaissance humanists did not reject Christianity; quite the contrary, many of the Renaissance's greatest works were devoted to it, and the Church patronized many works of Renaissance art. However, a subtle shift took place in the way that intellectuals approached religion that was reflected in many other areas of cultural life.

Age of Reason or Age of Rationalism:

17th-century philosophy is often called the Age of Reason or Age of Rationalism and is considered to succeed the Renaissance philosophy era and precede the Age of Enlightenment. Whereas Aristotle thought that a science should be demonstrated from first principles, Galileo (1564-1642) had used experiments as a research tool. Galileo also used mathematics to obtain scientific results.¹⁷ In 1619, Rene Descartes (1596-1650) began writing his first major but unfinished *Rules for the Direction of the Mind*. His aim was to create a complete science. This work had emphasized on thinking: I think therefore I am (*cogito ergo sum*).^{18,19,20}

Bacon's approach was empirical (knowledge arises from evidence gathered via sense experience) whereas Descartes approach was based on rationalism (any view appealing to reason as a source of knowledge or justification).

Age of Enlightenment (Late 17" & 18" Century):

John Locke (1632-1704) is sometimes called "the father of the enlightenment." His ideas would become the foundation of the Declaration of Independence, the American Constitution, especially the Bill of Rights, and the French Declaration of the Rights of Man.

The Enlightenment was less a set of ideas than it was a set of values. At its core was a critical questioning of traditional institutions, customs, and morals, and a strong belief in rationality and science. Thus, there was still a considerable degree of similarity between competing philosophies.

Kant says that Enlightenment is man's emergence from his self-incurred immaturity. Immaturity is the inability to use one's own understanding without the guidance of another. This immaturity is self-incurred if its cause is not lack of understanding, but lack of resolution and courage to use it without the guidance of another.²¹ The motto of enlightenment is therefore: *Sapere aude!* Have courage to use your own understanding! Hence it is not surprising that Empiricism is considered a product of Enlightenment. Deism became prominent in the 17th and 18th centuries during the Age of Enlightenment, mostly among those raised as Christians who found they could

not believe in either a triune God, the divinity of Jesus, miracles, or the inerrancy of scriptures, but who did believe in one God.

Newton (1643 -1727) rejected Descartes rationalism. His four "rules of reasoning" in the *Principia* were,

1. We are to admit no more causes of natural things than such as are both true and sufficient to explain their appearances.
2. Therefore to the same natural effects we must, as far as possible, assign the same causes.
3. The qualities of bodies, which admit neither intension nor remission of degrees, and which are found to belong to all bodies within the reach of our experiments, are to be esteemed the universal qualities of all bodies whatsoever.
4. In experimental philosophy we are to look upon propositions collected by general induction from phenomena as accurately or very nearly true, notwithstanding any contrary hypotheses that may be imagined, till such time as other phenomena occur, by which they may either be made more accurate, or liable to exceptions.

Inductivism was popularized by Issac Newton. {It says that scientific research proceeds from observations/ experiments to theories (a scientific method of "Induction"). Scientists begin with experiments, finding out what happens in specific cases. They then use the results of these experiments to develop general theories about what happens in all cases (including unobservable cases). In the results of these experiments to develop general theories about what happens in all cases (including unobservable cases), In other words, general statements (theories) have to be based on empirical observations. The classical example goes from a series of observations:

Swan no. 1 was white, Swan no. 2 was white... Swan no. 3 was white... to the general statement: All swans are white.

Newton believed that argument based on induction may not be nullified by hypothesis. But Newton also left an admonition about a theory of everything:

"To explain all nature is too difficult a task for any one man or even for any one age. It is much better to do a little with certainty, and leave the rest for others that come after you, than to explain all things".²²

Newton's work became a model for scientific work of 18" and early 19" century.

David Hume (1711-1776) took empiricism to the skeptical extreme; among his positions was that there is no logical necessity that the future should resemble the

past, thus we are unable to justify inductive reasoning itself by appealing to its past success. Many of Hume's radically skeptical arguments were argued against, but not resolutely refuted, by Immanuel Kant's Critique of Pure Reason in the late 18th century. Kant saw the first critique as an attempt to bridge the gap between rationalism and empiricism - and, in particular, to counter the empiricism of David Hume - famously arguing that, although all knowledge begins with experience, it does not follow that it all arises out of experience." Hume's brilliantly formatted arguments continue to hold a strong lingering influence and certainly on the consciousness of the educated classes for the better part of the 19th century when the argument at the time became the focus on whether or not the inductive method was valid.

William Whewell (1794-1866) presented the concept of hypothesis deductive model or method (first hypothesis then confirmation (corroboration) or falsification by experiment/observation), already suggested by Ibn al-Haytham. The raven paradox is a famous example. The hypothesis that 'all ravens are black' would appear to be corroborated by observations of only black ravens. However, 'all ravens are black' is logically equivalent to 'all non-black things are non-ravens' (this is the contraposition form of The original implication), 'This is a green tree' is an observation of a non-black thing that is a non-raven and therefore corroborates 'all non-black things are non-ravens'. It appears to follow that the observation 'this is a green tree' is corroborating evidence for the hypothesis 'all ravens are black'.

In the late 19th century. Charles Sanders Peirce (1839-1914) proposed in "How to Make Our Ideas Clear" (1878) an objectively verifiable method to test the truth based upon both Deduction and Induction. To him, induction and deduction were complementary rather than competitive, Secondly, Peirce put forth the basic schema for hypothesis testing that continues to prevail today. Peirce examined and articulated the three fundamental modes of reasoning that play a role in scientific inquiry today. the processes that are currently known as abductive, deductive, and inference. Thirdly, he played a major role in the progress of symbolic logic itself. Charles S. Peirce was also a pioneer in statistics. He formulated modern statistics in 1877 (1877-1878) and 1883 (1883). Peirce held that science achieves statistical probabilities, not certainties, and that chance. a veering from law, is *very real*. Most of his statistical writings promote the frequency of probability. He introduced blinded, controlled randomized experiments, He "corrected the means". He used regression, correlation, and smoothing, and unproved the treatment of outliers. He introduced terms 'confidence' and 'likelihood'. Many of Peirce's ideas were later popularized and developed by Ronald A. Fisher, Jerzy Neyman, Frank P. Rarricy, Bruno de Finetti, and Karl Popper.

Hence we see the methodology of scientific research has moved from Plato's rationalism (that reason has precedence over other ways of acquiring knowledge) to inductivism (first observation / Experience then theory/hypothesis).

It is said that Enlightenment gave birth to popularity of Empiricism and Empiricism led the way to hypothetico-deductive model or method (first hypothesis the observation / experiment).

History of scientific research (known to us) is spread over 3600 years. Empiricism appears to have won the war against rationalism.

Inductivism and hypothetico-deductivism are considered as a complimentary method then contradictory ones. Unfortunately, it is obvious that many region of the world are still at a very preliminary stage where empiricism and evidence based practices are still not give the place they rightly deserve. Mirpurkhas and indeed most regions of Pakistan riddled with baseless superstitions.

I hope the JMMC, Being inaugurated on the day of 8th Medical Symposium of Muhammad Medical College, will pay its role in establishing a culture of Evidence Based Practice where people value knowledge arising from observation and experience gather via sense experience.

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