History of Indian Science

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1. *India’s Contributions to the West* (2004)
Some Incredible Achievements of Ancient Indian Scientists

<table>
<thead>
<tr>
<th>Velocity of Light</th>
<th>3,00,000 kms</th>
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<td>Sayana Bhashya of the Rig-Veda, I.50.4.</td>
<td>Also quoted by</td>
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<td>1. G.V. Raghavrao</td>
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<td>2. Dr H. C. Varma</td>
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The Nasadiya Sutra of the Rig-Veda
(Rig-Veda 10.129)
That this and other Vedic descriptions of creation are a “Big Bang” theory has been accepted after proper examination of the texts.

It is generally held by the historians that the concept of the heliocentric solar system was invented by the ancient Greeks, and that the division of the heavens or sphere into 360 part and the 12 signs of zodiac were borrowed by the Indians from the Babylonians.
"Twelve spokes, one wheel, navels three.
Who can comprehend this?
On it are placed together
three hundred and sixty like \textit{shanku} (cones, angles).
They shake not in the least." RV 1.64.48

The three axes are clearly: diurnal, annual and precission.
RV 1.164.2 also mentions "three naved wheel".
"Formed with twelve spokes, by length of time, unweakened, rolls round the heaven this wheel (cycle) of orderly existence. Herein established, joined in pairs together, seven hundred and twenty sons, O Agni."

*Rig Veda* 1.164.11;
It is explicit in the Chandogya Upanishad that the Sun is the “madhye-sthata” lying at the centre.

Ch. U. 3.11.1

Also,
"The moon gets light from the ray of the sun named *Susumna*."

*Shukla- Yajurveda Samhita* 18.40.

Also, *Taittiriya Samhita (Krishna Yajurveda)*, 3.4.7.1.
Such views about moon had survived at least until about 1000 AD

Al-Biruni, a Muslim traveller and historian from about 1000 AD noted that the Hindus believed “when the solar ray meets the moon, the ray becomes as cool as moon herself, then, being reflected, it illuminates the darkness, makes the night cool and extinguishes any hurtful kind of combustion wrought by the sun.
It is important to accept the incredible mature of these views. Because people outside India believed that sun and moon are lighted objects placed by God to are arrangements.
Current available evidence shows that India was the world leader of science from the earliest times (Vedic Period) until the twelfth century. Bhaskaracharya II was the best mathematician and astronomer world over in the twelfth century.

By the end of the twelfth century, Indian universities at Nalanda, Vikramashila and Odantpuri were destroyed by Bakhtiyar Khilji, propelling India into a Dark Age of ignorance.
However, some mathematicians and scientists fled to the South, where they continued to flourish as the South or Kerala school of Indian mathematics. Nilakantha, Mahadeva etc are mathematicians from that school of Kerala.

It has been found that much of what Newton is credited for, and many of the European mathematical discoveries were actually brought to Europe as the translations of the works of the scholars of the Kerala school, and also the earlier Indian scholars like Bhaskara, Aryabhata and Brahmagupta.

Pythagoras in the sixth century BCE came to India, where he learned Indian mathematics and then went back to Greece to establish the first mathematical tradition of Europe. The Baudhayana Sulba Sutra of the Vedic text Katyayana Kalpa Sutra is known to us today as the Pythagoras’s Theorem.
Early Mathematics

Any mathematics textbook from Vedic times has not survived till today. Yet from the stray mentions, we are able to arrive at an evidence based conclusion that the decimal system of numbering, geometry etc were present during the Vedic Age itself.

We will not go into the details of Vedic Age mathematics.
Kanada’s Vaishesika Sutra

THE ONLY SURVIVING TEXTBOOK OF PHYSICS FROM 6TH CENTURY BCE
KANADA’S VAISHESHIKA SUTRA

PERIOD: SIXTH CENTURY BC
A COMPREHENSIVE TEXTBOOK OF PHYSICS
DISCUSSES:
- MECHANICS
- HYDRAULICS
- ELECTRICITY
- HEAT
- LIGHT
- MENTIONS MAGNET
- QUANTUM, ATOM AMD SPACE
- PHYSICAL CHEMISTRY
Anti-matter

Mentioned by Kanada as “abhava-padarthā”

Today we can say that *abhava-padarthā* of Kanada is nothing but anti-matter.
Anti-Matter

“Tadabhave samyogabhuvopradurbhavashcha mokshah.”
Tad abhave samyoga bhavo pradurbhavah cha mokshah.
The union of bhava matter and abhava matter leads to annihilation of (both).

Vaisheshika darshanam, 5.2.18
“Mani-gamanam suchi-abhisarpanam-adrishta-karanam”.

(When the magnet moves, the suchi also moves; this is due to invisible cause.)

Vaisheshika Sutra, 5.1.15

Linguistic analysis shows: suchaka = indicator derived from “suchi” (needle) why?
Magnetic compass mentioned in 9\textsuperscript{th} century

Adi Shankaracharya (9\textsuperscript{th} century AD) too mentioned magnet and compass “\textit{bhraamakasya lauha bhramanena}”.

(Sri Madbhagavad-Gita, 18.66 commentary 66.12)

He uses the word \textit{bhraamaka}.

Bhraamaka literally means “one which aids in \textit{bhramana}”.

We will today examine some sutras discussing mechanics

- One substance changes into other substance, and its properties change into other properties. *(Vaisheshika sutra, 1.1.10)*

- This is Law of Conservation of matter and energy. *(First Law of Thermodynamics)*

- The First Law of Thermodynamics is stated at many places in ancient literature. One is *Bhagvad-Gita* 2.16, other is *Chhandogya Upanishad* 6.2.2. *kathamasad-sajjayet*
One *karma* (energy) is not produced by other *Karma* (energy).

[karma karma saadhyam na vidyate] (Vaisheshika-Sutra, 1.1.11)

Here Acharya postulates, that one karma (energy) cannot produce another karma (energy) [directly, without intervening work]. Only a modern physicist can judge how far he was correct.
Karya-virodhi-karma.
Energy is against the work.
(Vaisheshika-Sutra, 1.1.14)

In other words, the accumulated *karma* (potential energy) is exhausted by same amount of work in the opposite direction.

Another meaning is:
Work done = Energy Required; And the diction is opposite.
An example of systematic disposition of a topic by Kanada

VAISHESHIKA SUTRA: CH. 5.

IT DISCUSSES PRIMARILY PHYSICS INVOLVED IN THE PROCESS OF MILLING (POUNDING).

ENERGY, ELASTICITY, COLLISION
Active and passive work, gravity and collision (elastic) have been discussed in Chapter 5 of the Vaisheshika Sutra.
The self causes the ‘hand’ to move up. This is the first cause of initiation of the milling process.
Effort by hand (lifting) produces *karma* in the *musal*. (*Vaisheshika-Sutra*, 5.1.2)

At this point, we do not know whether *karma* means kinetic energy or upward momentum.
When the *musal* falls back on the *ukhala* (base), hand is not working. (*Vaisheshika-Sutra*, 5.1.3)

Here it has been explained to the student, by means of a suitable example, that for doing a work, one needs to apply force. Hand is not applying any force hence not working. In this case actually gravity is doing the work.
When the *musal* rebounds upwards after hitting the *ukhala*, there is no effort by hand. (*Vaisheshika-Sutra*, 5.1.4)

Here Kanada gives an example of a perfectly elastic collision in vertical line.
When the hand holds the rebounding musal, a *karma* is generated in the hand due to contact with the musal. (*Vaisheshika-Sutra*, 5.1.5)

The sutra-kara understands that ‘hand’ is not active in upward movement, yet it has developed a velocity. Hence a *karma* develops in it. Thus we get that *karma* is a function of ‘velocity’ in this case. But it is not clear as yet from the text whether it is momentum or energy.
In this way, *karma* generated in hand may be either due to the hand’s link with the self, or due to its link with an object. *(Vaisheshika-Sutra, 5.1.6).* Author means to say that a physical contact is essential for transfer of ‘*karma*’.

This sutra explains that *karma* can be transferred in anything only because of a link between it and something else for transmission.
Then he mentions exceptions: The invisible forces:

- Like the ascent of sap in a plant against gravity. *Vaisheshika Sutra, 5.2.7*
- Ascent of vapor in sky appears to be because of invisible cause, yet actually it is because of sun-rays causing negative and positive pressures in air. (*Vaisheshika Sutra, 5.5.5-6*).
- Gravitation
- Magnetism

The purpose of the author here is to explain that often the cause may not be obvious, and one may think the cause to be non-existent, but even in there the cause exists.
Coming back to *musal*, Kanada says:

If the hold is lost, object falls because of gravity. (*Vaisheshika-Sutra*, 5.1.7)

The sutra explains here that hold ‘opposes gravity’. If there is nothing to oppose the force of gravity, “gravity causes” the fall (*gurutvaat patanam*).
Kanada claims this to be universally applicable, even for the water in the clouds.

*Vaisheshika Sutra. 5.2.3* says

“apam samyogabhave gurutvat patanam” in context of cloud and rain.
Back to *musal*: (Anything) cannot move upwards unless there is (applied) a critical *nodana*. (*Vaisheshika-Sutra*, 5.1.8)

This concept of ‘critical force’ just after the sutra discussing ‘gravity’ is significant. It hints that gravity (m.a or m.g) is a particular force, and any force less than that will not cause an upward motion.
Then Kanada gives relationship between *nodana* and effort:

A particular *prayatna* (effort, force) produces a particular *nodan* (?momentum).

*(Vaisheshika-Sutra, 5.1.9)*

- Hence we can say that ‘change of momentum is proportional to the force applied.’
A particular *nodan* (?momentum) produces a particular rise (of projectile). (*Vaisheshika-Sutra, 5.1.10*)

This reminds me of $H = \frac{v^2}{2\theta}$;
When the hand (holding musal) falls freely (with the musal), it is doing a *dara-karma* or ladies act (passive work). (Vaisheshika-Sutra, 5.1.11)

This gives the definition of passive-karma. Passive karma is that karma when force is applied by something else and the motion and force both are in the same direction, as in the case of hand-musal combine.
Thus the *Vaisheshikas* understood that work, kinetic energy and potential energy are only different stages or forms of the same thing.
Samskara is ‘action’ done on to someone in the past. It includes ‘impacts’ of past violence.
Correlation with spiritual karma

- Karma is ‘accumulated work’ of past actions/efforts.
- It cannot be destroyed.
- It has to produce a certain amount of work/fruit, before it can be exhausted.
Rate of change of sanskara with height in a vertically thrown projectile \((\text{d}\overset{\circ}{\text{o}}/\text{dh})\)

- \(\text{Nodnat-aadyam-ishoh karma tat-karmakaaritaat-cha samsakarat-uttaram tathottaramuttaram cha. Vaisheshika-Sutra, 5.1.17}\)
- \(\text{Samsakaara-abhaave gurutvaat patanam. Vaisheshika-Sutra, 5.1.18}\)
- Meaning: Initially the impulse (\textit{nodana}) applied to the projectile produces \textit{karma} (?kinetic energy) in the projectile. As the projectile rises, higher and higher \textit{samsakara} (energy stored) is used. When the \textit{samsakara} of the projectile is exhausted, it starts falling down under the influence of gravity.
Prashastapada says that *samskara* is of three types viz. *vega*, *bhaavana* (impression) and *sthitistapaka* (form-restoring).

*Samsakara Prakaranam* in the *Prashastapada Bhashyam*, Hindi Tr. *op. cit.* p. 221-3.
Knowledge of Vector in ancient Indian Physics

*Dig-vishishta (karma-padartha-nirupapanam Prakaranam)* and *niyat-dig-kriya-vishishta (samsakara prakaranam)* of the Prashastapaada Bhashya
Break for two minutes allowing a few questions
Rediscovering Indian Past
By the time the British came in power in India, India had lost nearly all memory of her pre-Medieval past. Whatever was available comprised only of folklores and some legends contained in the religious texts like the Puranas and the Mahabharata.

Thus in the nineteenth century, Chandragupta Maurya, Kautilya’s Arthashastra etc were not known to anyone.
The British took the task of unearthing India’s ancient past.

However, there was resistance from Western minds to accepting any great achievement to the ancient Indians.
When it became obvious in the twentieth century that the “zero” was invented in India, many Eurocentric scholars staked claims that the “zero” had been invented by the Greeks from the Greek letter ‘omicron’.

However, when an inscription dating back to 585 AD was found in Gujarat with numeric “zero” in it, everyone had to agree. (Basham:495; Duncan:166;
By now it has been known to the historians that the modern number system and the ten numerals were invented in India, yet the name of the numerals as the “Arabic Numerals” stays in vogue. They should be called the “International Form of the Indian Numerals” as named in the Constitution of India (Art. 343-1), or simply the “Indian Numerals”.
Pingala

Even the binary number system used in computer science was invented in India.

(Pingala, *chhandah-sutra*, 8.24-25)

Pingala’s book also discusses Permutation and Combination
Panini (600 years before Christ) gave the language theory, which became basis for modern compute language: **Backus-Naur form language**. It has been renamed as Panini-Backus form.
Has Modern Science derived from transmission from India
The Indian province of Sind was under Arab rule. A diplomatic delegate from Sind went to the Caliph’s court in Bagdad in 771 AD. The delegate had included an Indian scientist Kanaka, Called al-Kanakah al-Hindi by al-Qifti.
Kanaka had taken with him a large number of Sanskrit books discussing Indian science. He presented and explained them to the Caliph al Mansur. Caliph got amazed by science of India. He ordered translation of the texts into Arabic.
Al-Fazari and Yaqub-ibn-Tariq

Caliph appointed these two Arabic scholars, al-Fazari and Yaqub-ibn-tariq to become students of Kanaka, to learn Sanskrit and to translate all the Sanskrit texts into Arabic.

Fig. Commemorative stamp on Al-Fazari
The most important texts were
1. Books of Aryabhata
2. Books of Brahmagupta
To house and preserve these texts, Caliph al-Mamun ordered founding of a library at Bagdad, which was completed in 833. It functioned like a university.

All the Arabic version of Indian books were kept here.
Al-Khwarizimi appointed head of the library and mission for knowledge.
He visited India twice to take more books to Bagdad.
Later al-Khwarizimi synthesized the entire knowledge to compile a book of mathematics and science.
The book compiled by al-Khwarizimi was named “SIND-HIND” which is a corrupted version of “siddhanta”.

It became the main text book of maths and science in Europe later.
Al-Kwarizimi

- Al-kwarizimi wrote another text book, which is not available today, but its translation into Latin served as the main light of Europe. This book was called in Europe “Algoritimi de numero Indorum” (Al-Khwarizmi on Indian numbers).
Knowledge moves West: Library at Cordoba

Caliph Abd-ar-Rahman III (891-961) got a huge library constructed in Spain at Cordoba, and started the work of translating Indian science texts, available as Arabic, into Latin for use by the Europeans.
The Journey of Indian Science
Translations continued in Europe until 1600

More such libraries-cum-universities were opened in Europe:

- Naples
- Paris
- Bologna (Where Copernicus studied later).
Al-Khwarizimi also translated the Indian books on Bij-Ganita (algebra) and compiled them as a text. This was translated into Latin by Geraldus Cremonensis as “Liber Maumeti filli Moysi Alchorismi de algebra et al muchabala”.

Algebra
Did We Come from outside
DNA studies of *Homo sapiens sapiens* origin

1987: Cann and Stoneking

1988: Stinger and Andrews

Proposed “Out of Africa”
Homo sapiens sapiens originated 160,000 BP in East Africa. It was thought that man came out of Africa by Egypt-Suez-West Asia route.

1 = Afro-Asiatic;
2 = Elamo-Dravidian;
3 = Aryan;
4 = Altaic.
But soon the West Asian route was ruled out by further DNA studies.

It was found that it was from India that entire surviving non-African Humanity has evolved. It was assumed that the first Indians came from Africa.

It was further noted that African specific LINEAGES never went out to anywhere (male A, B, and Female L0-L6).

Thus, Indians are Out of Africa, and rest of the world is “Out of India” in the current consensus view.
Migration Maps
Some men leave Africa

Man left East African horn,

Reached India,
Once only.
100,000 years back (some authors write 70,000 to 60,000 years back).
This population expanded numerically, culturally and linguistically in India over time.
The first journey out of India started 85,000 years back and reached Australia by 60,000 years B.P. Hudjasove, 2007
India played a central role in populating the world. **All the European, Asian and Amerindian maternal lineages originated from India** over time as waves (Fig. Metspalu *et al.*, 2004)
The view is now a consensus and official view.

Fig: Natural Environment Research Council, Cambridge, UK.
After first migration to SE Asia, came the worst Glacial Phase (74,000 years back to 65,000 years back)

Human populations survived in India, Southeast Asia and East Africa only.
Estimated figures of survival are 1000 in India, 9000 in Africa and less than 1000 in SE Asia.
Following glacial, all the three human populations expanded. But African one did not migrate out of Africa.
About 60,000 years back, post-glacial population expansion in India led to migration to west.
By 52,000 years before present:
40,000 b.p.: People enter China from three directions. Two sources originated from India, one from Southeast Asia.
Implications for Linguistics
It was noted that DNA lineages and Language families overlapped exactly.


Cavalli-Sforza, 1998; **Eurasiatic Super-Family of Language and DNA lineages matched.**
HUGO- similar matching for East half of Asia
Hence we need to see DNA lineage migration and Language family migration together.
At 85,000 ybp people migrated to Madagascar and Andaman from Mainland India.

Maternal lineages from root of ‘M’ and Paternal (Y-chromosomal) C and D were involved.
Austronesian has left substratal remains to modern Indian (and also Sino-Tibetan, Austro-Asiatic and Daic) languages. One such example is word ‘bahin’

*bahine* (woman, Rapanui, Austronesian l.),
*wahine* (woman, Maori and Hawaiian),
*vahina* (woman, Tahitian),
*fafine* (woman, Samoan)

AND:
*bahin* (sister, Hindi)
*bo-chhin* (mother, Chinese Quanzhou, Xiamen, Zhangzhou dialects),
Asianitic Language Super-family migration: 60,000 to 52,000 BP

Mini Ice Age. Aurignacian Upper Palaeolithic people moved from Turkey and Central Europe through Bulgaria, Europe. They followed the prehistoric river system, which they called "Asianitic lang" and took up the Danube into what is now then Austria.
Central Asians moved north into the arctic and joined East Asia to start the spread into east Eurasia. This period saw the birth of specific works of art, as in the Chauvet cave in France.
It is now established that Altaic and Uralic languages are one Altaic-Uralic super-family.
Different views on origin of Chinese language make better sense with understanding of DNA migration.
Some examples of such words are

1. Sow (English),
2. se, seh (PIE, to sow),
3. si, siu (Munda, to plow),
4. sA- (Sk. To plow), sitA, sirA (Sanskrit, furrow)

etc.
2. Derived from Sa/ seh

- *sehm* (PIE, grain),
- *sasa* (Sanskrit; sasam in Rig-Veda),
- *sasya* (Sanskrit, food, seed, grain, herb),
- *Sasja* (Proto-Celtic)
- *sito-* and *sitya-* (PIE, ‘corn’),
- *sitiyam* (Sanskrit, corn, ploughed),
- *siri* (Khowar, Afghan, barley), and *sili* (Kalasha, Hindukush, millet).
- Selo (Latin, to sow)
- Munda family *saro, sar* (paddy) and Munda and Kharia have *–sro* and *–srA, paddy*.
- Words *sro, sre* and *sru* meaning ‘rice’ in some Khmer (Cambodia) dialects.
3. Mill (E.),

Old English *mylen*, Latin *mola*, all meaning millstone; Latin *molere* to grind. PIE *mel / mol / ml* to grind.

German *muhle* and Sanskrit *musala* (grinder).

Thai language *mo:h* means ‘mill-stone’ and ‘to grind’.
4. Pestle (E.),
PIE *pis-to,
Sanskrit pis-

5. Pita (colloquial English ‘bread’),
Greek pitta bread, Italian pizza,
Hindi (Bihar, East UP) pittha,
Sanskrit paishta.
6.

- Grind (E.),
- Old English *grindan*,
- P. Germanic *grindanan*,
- PIE *ghren*, *ghreu-*, *ghen*, (*grendh-*)
- Munda guru, Santhal and Kherwa guRgu mean ‘grinding stone’.
- Thai *gruaam* (to grind), *gro:hng* (mortar), *gra-deuuan* (stamp-mill, mortar)
Fuller 2008, gives a large list of words used in textile present in Sanskrit and Dravidian/Munda fam. One such example is ‘tantu’

*tantu* (Sk., fiber), *tantra* (Sk., loom), *tAna* (Sk., fiber, tone, tension), *tanti* and *tatama* (Hindi, weaver);

tendon (E.), tentacle (E.) tendril (E.), tent (E.), tenter (E., loom), tenet (E.), *Dendron* (Gk. fibre);
*tonti* (Juang, weaver), *dendra* (Telgu, weaver).
*tay* (Bonda, to weave), *tan* (Kharia, to weave).
*ten* (Santali, to weave),
*thai:n* (Khasi, to weave).
*tor* (Thai, to weave), *tan* (Alak, Lave, Khariya Sura and Niahon, to weave); *tana* (Nicobarese, to weave),
tUla (Sk., cotton), tUlika (Sk., brush),
tula (Munda-Juang; cotton, feather, hair),
tol (Old Mon; cotton, hair, feather),
tuy (Tamil, cotton),
towel (E.)

This linguistic argument is stronger than ‘horse’ linguistic argument which had said: Cognate of PIE akwa (Sk. Ashva) is found in all the IE languages therefore Aryans must have originated at Central Asian steppes where horse was found in the wild.
Male mediated Y chromosomal DNAs
In this theory, those who went out of India before 35,000 years back, they evolved into many language groups and cultures following LGM.

Then they started invading India as male-alone lineages about 10,000 years back from all directions.
Some authors guessed that all the male lineages of India arrived from outside during Neolithic.

**Dravidians** from West Asia: male lineage J2 and L1, with farming, barley and cattle (Wells, 2001); Or Africa (Winters) H, K2.

**Austro-Asiatic** (Munda) came from China (or Southeast Asia): paternal O2a and maternal R7. Or from Africa, maternal lineage M1.

And some claimed that they came from both China and Africa (Basu, 2004; Winters 2009).

**Aryans** (Y lineage R1a or M17) came from **Central Asia** with pastoralism and horse (Wells, 2001).
But further studies just broke these conjectures. They say: Austro-Asiatic speakers originated in India.

Chaubey *et al* (2008) ruled out maternal DNA R7 migration to India from SE Asia and established that this lineage originated in India.

Kivisild (2003) proved that all the inhabitants of India are descendants of original settlers in India, whether of any cast, tribe or linguistic affiliation.

A large number of DNA tests of Indian castes, tribes and linguistic groups repeated the same results and conclusion.
We have seen that Chinese population came from NE India 40,000 years back.

- Current Han population is mainly composed of O3 male lineages, which originated in Burma and Northeast India.
- Other lineages in China are older C, D; and O2a and O1a.
- O3, O2a and O1a are branches of ‘O’ which originated in India.
DNA says--In fact no one migrated from China to even Northeast India. In reality, Chinese originated from Southeast Asia and Northeast India.

Hua Zhong *et al* 2010: 2 articles

1. Some came to China from India and Tibet: *Extended Y-chromosome investigation suggests post-Glacial migrations of modern humans into East Asia via the northern route*, *Mol Biol Evol*.

2. But majority of Chinese emerged from SE Asia: *Global distribution of Y-chromosome haplogroup C reveals the prehistoric migration routes of African exodus and early settlement in East Asia*, *J Hum Genet*.
Hua Zhong (2010), with the help of Y Hg C, not only proves that from Africa people came to India, and from India to SE Asia, but also that the Chinese population originated from SE Asia.
Hong Shi, 2005, although studied the origins of Chinese O3 DNA only in which India was not studied, yet its maps showed that the Chinese lineage had originated from the boarders of India.
Hong Shi et al, 2005; China’s main male lineage O3 (Frequency map)
Metspalu, 2004, rightly had made the maps:
Aryan Invasion DNA Theory
Wells 2001, made a claim that Aryan marker male DNA, lineage R1a and R2, originated in Central Asia.

- This gave a new lease of life to Aryan Invasion Theory. Later studies established that R1a and R2 originated in India.
Well’s theory of Aryan Invasion was decisively ruled out by DNA studies by the following groups of workers in Genomics:

1. Oppenheimer 2003
2. Sahoo, Kivisild et al 2006
4. Trivedi et al 2008
5. Sharma et al 2009
6. Underhill et al 2009
R1a-M17 and R2 both originated in India--Underhill, 2009; Sharma, 2009; Sahoo, 2006; Sengupta, 2006.


Underhill, 2009 showed that Aryan male lineage R1a originated in India 16,000 years back.
Underhill 2009 also gave age of R1a in different areas
Another controversy is about original Neolithic first farmer DNA.

- It was claimed that J2 originated in Anatolia and from there dispersed to Europe (with Indo-European language), and to India with farming and Dravidian language.
- Another DNA, L1 which was found in India and West Asia was claimed to be a marker of Dravidian arrival from Elam to India.
Farmer DNAs are of Indian origin

- Sengupta *et al* 2006 found by appropriate DNA test that L1 and J2 are Indian in origin.
- J2b2, a sub-branch of J2 originated in UP near Lucknow, about 14,000 years back. Hence J2 must be much older in India.
- J2b reached Anatolia in 8,500 BP and Balkans in 4,000 ybp.
Sengupta, 2006; J2b2 distribution and origin maps
Sahoo et al 2006
R1a male lineage. Note particular density in Ganga Valley

Sahoo et al, 2006
Similarly, theory of Dravidian arrival into India (L1, J2) or from Africa (K2, H1) etc have been ruled out by further detailed studies of these DNAs (Sahoo, 2006; Sengupta, 2006; Trivedi, 2008).

I am forced to conclude by the facts that Last Glacial Maximum imposed restrictions to human movements within India, promoting evolving of 3 language families
Evolution of modern Indian Languages in India

There was enough climatic barrier in India during LGM (Petraglia, 2005). Isolation of Indian people into three groups led to linguistic differentiation over time, and three language families emerged after LGM, from the common Mesolithic language family of India. There is no other way to explain these findings.
Study of cattle and domesticated animals
The First cow was domesticated in India, 45,000 years back

Evidence from DNA Study of Domesticated Cows
Earlier, many authors had said:

- Cow was domesticated first in West Asia from where it migrated to India. (Epstein, H. & Mason, I. L., in *Evolution of Domesticated Animals*, ed. Mason, I. L., Longman, New York, 1984, pp. 6-27.)

But Loftus (1994) found that Indian cow had been domesticated independently of West Asian influence.
There are two types of cows in the world: taurine (Europe, west Asia, China), and Zebu or Indica (India, Africa, Southeast Asia and South China, sporadically in Europe, Central Asia, West Asia)

- Chen (2009) proved by DNA studies that all the Zebus all over world have migrated from India, and Zebu had been domesticated only in North India.

[Chen, S. et al; Zebu cattle are an exclusive legacy of the South Asian Neolithic, *Molecular Biology and Evolution*, Sept 21, 2009]
Domesticated Indian zebu was central to catalyzing cow domestication in other parts of the world.

Zebu genes are present in most of the taurine cow lineages of Europe, West Asia, Africa, Central Asia, China and Southeast Asia.


Map of distribution of DNA of Indian cows: hatched area represents hybrid of Indian with local cows
Indian cow dispersal to Africa by sea route implying sea-trade:
Linguistic evidence also supports it

- English ‘cow’
- Sanskrit: go
- German: kuhe

This is expected. But --

- *Chinese: gu (Pinyin), ngau (Cantonese)*
- Thai: Koh
- Bantu African: *gombe*

*mean migration of cattle-rearing from India.*
Mouse Migration: from India to rest of the world  

Bonhomme et al 2007, Genome Biol
Following species of mice and rats have been studied so far. And all of them have been found to have originated from India.

- **Black Rat** (*Rattus rattus*)
- **Bandicoot-rat**, *Bandicota bengalensis*, a noted rice-field pest in Indonesia originated in Mahanadi delta in association with buffalo
- **Mus caroli**, **Mus cervicolor** and **Rattus argentiventer** are widely distributed in Mainland Southeast Asia north of the Malay Peninsula; their distributions are spotty in the archipelago and invariably restricted to wet rice growing areas.
- **Mus dunni**, a small mice, native of northeast India and **Rattus nitidus**, a native of Nepal, are ricefield pests of Indonesia.
Water buffalo, considered essential for early rice cultivation (Bellwood), was domesticated in India.


- Kumar, Satish et al, Phylogenography and domestication of Indian river buffalo, BMC Evolutionary Biology 2007, 7:186,
Barley was domesticated for the first time in India, although later another breed was domesticated independently in West Asia.

Rice domesticated for the first time in India: *Oryza sativa indica*; DNA evidence


These studies enable us to push dates of Indian archaeology much back, as has been attempted by Petraglia.
Lahuradewa: Rice
Thus first cultivation (rice) also done at Ganga Valley at 10,000 ybp.

First pottery was made in India: 10,000 years back at Koldihwa, Jhusi and Lahuradewa.


Lahuradewa--Tewari, R et al. 2006.

Lahuradewa : Vase
Some less well known newer archaeological facts
In light of DNA findings, we need to rethink Indian history. We need to weigh seriously views of Kennedy, who found that Hathnora skull was a *Homo sapiens*.
Nor should we ignore 160,000 years old pediatric perfectly *Homo sapiens* skull found near Madras: *Rajendran et al, 2006, Ancient Asia*. 
Many things are yet to be incorporated in human story.
Archaeological findings prove two things more:

1. First copper was made in India 9000 years back
2. First cotton was spun in India, 9000 years back
9000 years old Cotton thread in Copper Bead

Journal of Archaeological Science
Volume 29, Issue 12, December 2002, Pages 1393-1401

First Evidence of Cotton at Neolithic Mehrgarh, Pakistan: Analysis of Mineralized Fibres from a Copper Bead

Christophe Moulierat*, Margareta Tengbergb, Jérôme-F. Haquetc and Benoît Milled

a Centre de Recherche et de Restauration des Musées de France (CNRS-UMR 171), Paris, France

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d Centre de Recherche et de Restauration des Musées de France (CNRS-UMR 171), Paris, France
Drilling treatment of teeth: 8000 years old, Mehrgarh
Brief Communications

Palaeontology: Early Neolithic tradition of dentistry

A. Coppa¹, L. Bondioli², A. Cucina³, D. W. Frayer⁴, C. Jarige⁵, J. - F. Jarige⁵, G. Quirion³, M. Rossi⁶, M. Vidale⁵ and R. Macchiarelli³

Prehistoric evidence for the drilling of human teeth in vivo has so far been limited to isolated cases from less than six millennia ago¹,²,³. Here we describe eleven drilled molar crowns from nine adults discovered in a
And that the robust human skeletons of Sarai Nahar Rai (Mesolithic) actually belonged to a colder period i.e. before 16,000 BP (Kennedy, 2008).

And that Indian Mesolithic (Microlithic) started in 35,000 years back, earlier than anywhere else: Petraglia, 2009a. James and Petraglia 2005
And Petraglia’s findings from Jwalapuram in Kurnool Dist, Andhra Pradesh--that there has been a cultural continuity in India over last 100,000 years or more: Petraglia, 2007, 2009b.

These show that the time to rewrite history has arrived.

Thank You