Knowledge vs. Knowledge System in Indian Knowledge Systems

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This talk is the result of a pursuit of the epistemology and ontology of Academic Knowledge that we (the authors) have been engaged with over the last four decades.

1. Preliminaries

The idea of studying and promoting Indian Knowledge Systems (IKS) was proposed in India in the National Education Policy 2020, and has since then been followed up by the National Credit Framework 2020 and the UGC guidelines for university education. As far as we know, however, in what is taught as 'knowledge' in universities, there has been no attempt to integrate what is of value in IKS with what is of value in Modern Global Knowledge systems.

As long as there exist channels of communication, knowledge travels from the geographical locations of their origin across countries and continents. The decimal notation for arithmetic originated in Ancient India, was taken to Europe by the Arabs, and has since then become part of the foundation for number theory in modern mathematics.
(See History of the Hindu-Arabic Numeral System at https://en.wikipedia.org/wiki/History_of_the_Hindu%E2%80%93Arabic_numeral_system).

The Paninian system of classifying speech sounds has been adopted in modern phonetics. As Jacqueline Vaissière points out, "Since Panini, in the 5th Century BC, most of the sound changes in historical phonetics and natural

processes have mainly been interpreted in terms of natural articulatory processes." More importantly, Panini's formal system, which is essentially an algorithmic system that generates representations of words, has been the role model for modern generative linguistics, initiated by Noam Chomsky in the 1950's. (See "Paninian Linguistics,"
https://web.stanford.edu/~kiparsky/Papers/encycl.pdf)

Similar remarks apply to Ancient Indian Logics, especially that of Nagarjuna, whose system of *Catushkoti* (tetralemma) rejected the Aristotelean Law of the Excluded Middle, and who refined the Prohibition of Logical Contradictions by introducing context dependence in contradictions.

Such instances of the globalisation of Ancient Indian mathematics, logics, and linguistics did not require the efforts of those who promote IKS.

Why, then, is Ayurveda, the sciences of health, illness, and healing that originated in the Indian Subcontinent, viewed as pseudoscience?

> "Ayurveda – traditional Ayurveda is a 5,000-year-old alternative medical practice with roots in ancient India based on a mind-body set of beliefs. Imbalance or stress in an individual's consciousness is believed to be the cause of diseases. Patients are classified by body types (three doshas, which are considered to control mind-body harmony, determine an individual's "body type") and treatment is aimed at restoring balance to the mind-body system. It has long been the main traditional system of health care in India and it has become institutionalized in India's colleges and schools, although unlicensed practitioners are common. As with other traditional knowledge, much of it was lost; in the West, current practice is in part based on the teachings of the Maharishi Mahesh Yogi in the 1980s, who mixed it with Transcendental Meditation; other forms of Ayurveda exist as well. The most notable advocate of Ayurveda in America is Deepak Chopra, who claims that the Maharishi's Ayurveda is based on quantum mysticism."
> (See "List of Topics characterised as pseudoscience," at https://en.wikipedia.org/wiki/List_of_topics_characterized_as_pseudoscience)

Some of the reasons for the dismissal of Ayurveda as pseudoscience are present in the above passage. But we would like to suggest a more important two-fold reason, namely:

(1) the way Ayurveda is presented to the world outside; and
(2) the way it is taught to students, as blind faith, instead of as rational knowledge that is open to doubting, questioning, and self-correction.

To solve problem 1, we need to clarify the concepts of KNOWLEDGE, SYSTEM, and KNOWLEDGE SYSTEM with specific reference to Ancient Ayurveda, such that we can integrate what is of value in Ancient Ayurveda and what is of value in Modern Mainstream Medicine, modifying both where needed, and rejecting what is untenable.

The solution to problem 2 lies in a revamping of the Ayurveda curricula.

This talk may be viewed as an attempt to clear the space for a research program to investigate the knowledge system of Ancient Ayurveda, against the backdrop of South Asian Knowledge Systems of mathematics and the sciences in general. We believe that the ***theory*** of Ayurveda has the potential to be integrated with modern mainstream medicine, promising several Nobel prizes. What stands in the way of achieving that potential is most likely the current curricula in Ayurveda colleges.

2. The Concept of Knowledge

Let us define the ***knowledge*** of a knower (cogniser) as

> *A body of propositions that the knower judges to be true beyond reasonable doubt.*

Knowledge can be either that of an individual (where the cogniser is a person), or that of a community. KPM, for instance, judges the following propositions to be true beyond reasonable doubt.

a. He woke up at 6:00 am on 6th January 2025.
b. The earth revolves around the sun.

Both are part of the ***personal knowledge*** of KPM. But the second proposition is also part of the ***collective knowledge*** of the community of modern astronomers. That the sun revolves around a stationary earth was part of the knowledge of the community of astronomers from the 2nd C. CE till the 16th C. CE.

Academic knowledge is a special category of collective knowledge. Not all forms of collective knowledge come under academic knowledge. That small pox can be prevented by appeasing a deity that controls small pox is part of the collective knowledge of various communities in India and Africa, though not part of academic knowledge.

To distinguish academic knowledge from other forms of collective knowledge, we may define it as either A or B:

A. Academic knowledge is a body of knowledge
1. generated at institutions of research (universities, research institutes), and
2. transmitted to students through institutions of education (schools, colleges, universities, institutes) and to the others through academic publications.

B. Academic knowledge is a body of rational knowledge, constructed, critically evaluated, and legitimised by the community of academics, with a deep awareness of the uncertainty and fallibility of human knowledge, subject to the following norms:
1. All knowledge propositions are subject to doubting, questioning, and correcting.
2. If we accept a set of premises as true, we must also accept their logical consequences as true.
3. Logically contradictory combinations of propositions must be rejected as false.
4. Knowledge claims can be accepted only if they are accompanied by the demonstration that they are rationally justified.

For the purposes of this talk, we will choose definition B, as it allows us to answer questions like:

> If mainstream modern medicine is science,
> is it rational to label Ayurveda as pseudoscience?

The categorisation of knowledge that emerges from the above discussion can be represented diagrammatically as follows:

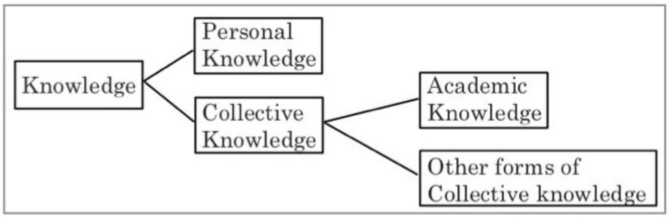

FIGURE 1

Along another dimension, we may recognize yet another distinction:

propositional knowledge of the form, X ***knows that*** Y,
where X is a knower and Y is a proposition; and

procedural knowledge of the form, X ***knows how to*** Y,
where X is a knower and Y is an action.

When we say that Zeno knows that motor cars have four wheels and bicycles have two wheels, we are talking about propositional knowledge; but when we say that Zeno knows how to drive a motor car or how to ride a bicycle, we are talking about procedural knowledge. The former involves understanding and belief, while the latter involves skills, abilities, and capacities.

3. The Concept of Knowledge Systems

3.1 Defining Knowledge System

Having outlined a typology of knowledge, and defined the concept of academic knowledge as a special category of knowledge, we are now ready to go into the distinction between the ***body of academic knowledge*** on the one hand, and on the other, the ***knowledge system*** that underlies it.

We define academic knowledge system as follows:

> An academic knowledge system underlying a body of academic knowledge is employed by the cogniser to generate the knowledge propositions, to rationally justify them, and to critically evaluate their merit and their justification.

Central to a knowledge system is the set of ***epistemic norms*** that tells us under what conditions a knowledge claim should be accepted as knowledge, when it should be rejected as untenable, and when it should be retained for further scrutiny. In what follows, we briefly outline these norms with exemplification.

3.2 Indian Knowledge Systems

What is Indian about Indian Knowledge Systems? India is a nation. A nation can be:

either: a geo-cultural unit (e.g., South Asian culture)
or: a geo-political unit (e.g., India as distinct from Pakistan, Bangladesh, Sri Lanka…)

India as a geopolitical unit did not exist in the ancient times, so if we wish to include Ancient Knowledge Systems in our discussion, the term South Asian Knowledge Systems (SAKS) would be more appropriate. After all, Charaka, like Panini, was part of the ancient university of Takshashila, which is currently part of Pakistan.

4. Epistemology

As a branch of philosophy, epistemology is the study of knowledge, more accurately called Theory of Knowledge. The counterpart of epistemology in scientific inquiry is cognitive science.
[The English words *know* and *cognise,* the Sanskrit word *jñaana,* and the Hindi word *gyaan,* all come from the Proto Indo-European root *gno-*]

Epistemology investigates fundamental questions like:

What is knowledge?
How do we know what we know?
What are the different types of knowledge?
What are the criteria for the acceptance of a knowledge claim as knowledge?
and so on.

Branches of epistemology include theories of reasoning and logic, theories of truth, ways of knowing, and sources of knowledge such as experience, memory, perception, observation, and testimony.

Classical epistemology defines propositional knowledge as ***justified true belief.*** Stemming from the intuitive meaning of the verb *to know*, this definition does not permit knowledge to be revised: if a belief is true, then how can it turn out to be false? To avoid the total certainty of belief, we will replace *true* with *accepted as true by a cogniser*:

Knowledge is a body of propositions accepted by a cogniser as true.

In a statement of the form *X accepts Y as true*, X is the knower and Y is what is known.

If *the* ***knower*** *is:*	an individual human being	a community	the academic community
then *the* ***knowledge*** *is:*	***personal knowledge***	***collective knowledge***	***academic knowledge***

Within academic knowledge, the criterion for accepting a knowledge claim as knowledge is that it should be ***rationally justified***, through an ***argument*** that the defender of the claim advances in its support.

In mathematics, experimental science, and law, we use the term ***proof*** to denote the defence we present in support of a claim, so we will generalize *proof* to cover that which we present to convince a sceptic that the claim should be accepted as knowledge.

Drawing upon definition B proposed in the previous section, we may now say:

> *Academic knowledge is a body of collective rational knowledge, embedded in a knowledge system in which knowledge claims are accepted only if they are accompanied by convincing proofs, and are rejected on the basis of convincing refutations.*

5 Epistemology of Academic Knowledge

5.1 Uncertainty and Fallibility

An important feature of the epistemology of academic knowledge that distinguishes it from that of other knowledge systems lies in an awareness of the uncertainty and fallibility of human knowledge. We construct our knowledge by drawing upon our experience, sense perception, observation, reasoning, thinking, intuition, insight, and imagination. Even though we value truth, certainty, accuracy, precision, and rigour in the use of these sources and ways of knowing, there is no guarantee that we can ever achieve these cherished ideals. Our journey from ignorance to knowledge is an unending process, with no terminus.

We can express these ideas succinctly as follows:

> Being closer to truth, and to greater certainty, accuracy, precision, and rigour, is valuable. However, absoluteness of truth, certainty, accuracy, precision, and rigour is impossible to achieve. We hope that our knowledge approximates truth. "*Is it really true?*" then, is a meaningless question.

What we have stated above is best expressed by Einstein, Feynman, Northrop, and Max Planck, whose quotes are given below. In these quotes, the emphases (in bold) are ours (M&T):

> "Physical concepts are **free creations of the human mind**, and are **not**, however it may seem, **uniquely determined by the external world**. In our endeavour to understand reality, we are somewhat like a man trying to understand the mechanism of a closed watch. He sees the face and the moving hands, even hears its ticking, but he has no way of opening the case. If he is ingenious he may form some picture of the mechanism which would be responsible for all the things he observes, but he may **never be quite sure his picture is the only one which could explain his observations**. He will never be able to compare his picture with the **real mechanism** and he cannot even imagine the possibility of the meaning of such a comparison."
> [Einstein & Infeld (1938) *The Evolution of Physics*, Simon & Schuster (p. 31)]

> "The scientist has a lot of experience with ignorance and doubt and uncertainty, and this experience is of very great importance, I think. When a scientist doesn't know the answer to a problem, he is ignorant. When he has a hunch as to what the result is, he is uncertain. And when he is pretty darn sure of what the result is going to be, he is still in some doubt. We have found it of paramount

importance that in order to progress we must recognise our ignorance and leave room for doubt. **Scientific knowledge is a body of statements of varying degrees of certainty — some most unsure, some nearly sure, but none *absolutely* certain**.

Now, we scientists are used to this, and we take it for granted that it is perfectly consistent to be unsure, that it is possible to live and *not* know. But I don't know if everyone realises this is true. Our freedom to doubt was borne out of a struggle against authority in the early days of science. It was a very deep and long struggle: permit us to question -- to doubt -- to not be sure. I think that it is important that we do not forget this struggle and thus lose what we have gained. Herein lies a responsibility to society."

[Richard Feynman's Public address at the 1955 autumn meeting of the National Academy of Sciences]

"Newton left the impression that there were no assumptions in his physics which were not necessitated by the experimental data. This occurred when he suggested that he made no hypotheses and that he had deduced his basic concepts and laws from his experimental findings. Were this conception of the relation between the physicist's experimental observations and his theory correct, Newton's theory would never have required modification, nor could it even have implied consequences which experiment does not confirm. Being implied by facts, it would be as indubitable and final as they are. In 1885, however, an experiment performed by Michelson and Morley revealed a fact which should not exist, were the theoretical assumptions of Newton the whole truth. This made it evident that the relation between the physicist's experimental facts and his theoretical assumptions is quite other than what Newton had led many modern physicists to suppose. When, some ten years later, experiments on radiation from black bodies enforced an additional reconstruction in Newton's way of thinking about his subject matter, this conclusion became inescapable. Expressed positively, this means that the theory of physics is **neither a mere description of experimental facts nor something deducible from such a description**: instead, as Einstein has emphasized, the physical scientist only **arrives at his theory by speculative means**. The deduction in his method runs not from facts to assumptions, but from theory to facts and the experimental data. Consequently, **theories have to be proposed speculatively and pursued deductively with respect to their many consequences so that they can be put to indirect experimental tests**. For this reason, any theory is **subject to further modification and reconstruction** with the advent of new evidence that is incompatible, after the manner of the results of the Michelson-Morley experiment, with its basic assumptions." [F.S.C. Northrop's introduction to Heisenberg (1958) *Physics and Philosophy* (pp. 3-4)]

"... there are two theorems that form together the cardinal hinge on which the whole structure of physical science turns. These theorems are: (1) *There is a real outer world which exists independently of our act of knowing,* and (2) *The real outer world is not directly knowable.* To a certain degree, these two statements are mutually contradictory. And this fact discloses the presence of an **irrational or mystic element** which adheres to physical science as to every other branch of human knowledge."

[Max Plank (1933) *Where is Science Going?* Ox Bow Press (p. 82)]

A word of caution. In the passage from Max Planck that we have quoted, the term "irrational" is used to denote *not rationally justifiable, and hence not a rational conclusion*.

5.2 Doubting and Questioning

What we have outlined in section 5.1 naturally leads to the following thought:

> *We must doubt and question all knowledge claims — both our own and those of others, including those that we regard as authorities, namely, parents, teachers, textbooks, encyclopedias; articles published in high prestige journals; leaders in politics, religion, and other domains of life; and those who claim that their knowledge was arrived at through divine revelation.*

This may appear to contradict what is called *aaptopadesha* in ancient Indian epistemology. *Aapta* is an expert, trustable and ethical, and communicates knowledge with clarity and precision; and *upadesha* is advice. Hence, what an *aapta* says must be taken as reliable knowledge. When it comes to academic knowledge, *aaptopadesha* is also subject to dobting and questioning.

Now, there are two possible positions on this, when it comes to the Vedas, including Ayurveda:

- ~ They are of divine origin, and hence, are not subject to doubting and questioning.
- ~ They were created by humans, and hence are fallible, and hence, are subject to doubting and questioning.

As in the case of Buddhist epistemology, the epistemology of academic knowledge accepts the second position, rejecting the first, and demanding proof for all knowledge claims.

5.3 Rationality

The demand for proof is embedded in the context of rational inquiry and rational knowledge, which in turn is located in the concept of rationality, where reasoning is central.

> *Knowledge is rational iff it is subject to the norms of rationality.*

The ***norms of rationality*** are:

A. Acceptance of the ***logical consequences*** of the propositions that we have already accepted; and

B. Rejection of ***logical contradictions*** in combinations of propositions, where one negates another.

Consider the following example of reasoning, where P stands for 'premise' , and C for 'conclusion':

P 1: Birds are vertebrates.
P 2: Vertebrates have vertebrae.
P 3: Zeno is a bird.
C1: Therefore, Zeno has vertebrae.

The conclusion here is a logical consequence of (is ***entailed*** by) premises (1)-(3). Hence, by Axiom A, if we accept the three premises, we must accept the conclusion as well.

Now consider the conclusion from premises (4)-(6):

P 4: Insects are invertebrates.
P 5: Invertebrates do not have vertebrae.
P 6: Zeno is an invertebrate bird.
C2: Therefore, Zeno does not have vertebrae.

Suppose we admit the concept of invertebrate birds in biology (as in P6), to denote birds that do not have vertebrae. The following premises then lead to a logically contradictory conclusion:

P 1: Birds are vertebrates.
P 2: Vertebrates have vertebrae.
P 5: Invertebrates do not have vertebrae.
P 6: Zeno is an invertebrate bird.
C1, 2: Therefore, Zeno has vertebrae and Zeno does not have a vertebrae.

Given Axiom B, we must reject this conclusion, as C1 and C2 contradict each other. Hence we must reject at least one of the premises that leads to the contradiction.

5.4 Empirical vs. Axiomatic Proofs

Proofs in the knowledge system of mathematics are restricted to classical deduction. In mathematical inquiry, establishing a knowledge claim (a conjecture) calls for classical deductive logic, where the ultimate premises are the axioms and definitions postulated in the theory. Proofs in other systems of academic knowledge appeal to other forms of logic, including defeasible and probabilistic deduction, inductive logic, and so on. In scientific inquiry, the proof for a claim (a hypothesis) based on an observational generalization uses inductive logic (whether quantitative or qualitative).

The axioms and definitions of mathematical inquiry themselves do not require proofs. But those of scientific inquiry do. The mode of reasoning used for the proofs of theories in scientific inquiry are those of speculative-deductive reasoning mentioned in Northrop's quote in section 3.1, the relevant part of which is repeated below:

> "…as Einstein has emphasized, the physical scientist only **arrives at his theory by speculative means**. The deduction in his method runs not from facts to assumptions, but from theory to facts and the experimental data. Consequently, **theories have to be proposed speculatively and pursued deductively with respect to their many consequences so that they can be put to indirect experimental tests**."

5.5 What is a Theory?

The distinction between the theoretical and the experimental is restricted to empirical forms of inquiry that characterise the physical, biological, and human sciences. But the concept of theory itself is relevant outside of the sciences as well, including in mathematics — for instance, number theory, probability theory, and so on — and in the humanities, where the term covers philosophy and the arts. Under philosophy, we have epistemology, ontology, and ethical theory; and under aesthetics, the investigation of beauty, we have theories of poetry, theatre, dance, music, painting, and sculpture.

At the heart of the concept of theory is the idea of ***deducing a set of logical consequences from a set of premises***. In mathematics, as mentioned above, these premises are axioms and definitions, and their logical consequences are ***theorems***. In science, the premises are theoretical laws or models, and their logical consequences are ***predictions*** that match what we observe. If we generalise the concept of prediction to philosophy and aesthetics, then the predictions in ethical theories have the requirement that they match our ethical judgements, and in aesthetic theories, that they match our aesthetic judgments.

In philosophy of science, a set of statements that describe what calls for an explanation is called ***explanandum***; and a set of statements that yield the explanation is called ***explanans***. We provide expanations by showing that the explanandum statements can be derived from the explanans statements through deductive reasoning.

5.6 Proof as the Backbone of Academic Knowledge Syatems

In mathematics, a proof is meant to show that a given conjecture in a theory is true and hence is a theorem admitted as knowledge. The demonstration that a given prediction is a ***logical consequence of the postulates of a scientific theory*** is the equivalent of a *mathematical proof*. So we may extend the term ***proof*** to the derivation of a prediction from the postulates of a scientific theory.

Now, showing that a given set of predictions is the logical consequence of the premises of a theory does not necessarily show that the predictions are ***correct***. To do that, we need to show that the predictions match the observations. Once established as 'correct', we also need to show that they explain what is puzzling about the observations.

In philosophy of science, what needs to be explained is called explanandum, and what yields the explanation is called the explanans.

Premises of a scientific theory	(EXPLANANS)
↓ (*derivation*)	
Conclusions derived from the premises	(PREDICTION)
↕ (*match*)	
What is puzzling in our observations Observational Generalisations	(EXPLANANDUM)
↑ (derivation)	
Patterns in our sample	(OBSERVATIONS)

FIGURE 2

To show that the theory of Ayurveda as outlined in ancient texts has the potential to develop into a scientific theory, we need to explicitly articulate its theoretical propositions (explanans) and show how we derive the predictions (explanandum).

6 Knowledge Systems of the Sciences of Health

[This section is under construction. It will be finalised only after Kishor Patwardhan has written his article in our jugalbandi.]

Central to the study of health, illness, and healing is ***causation,*** which means that ***causal reasoning***, and ***causal logic,*** the study of causal reasoning, ought to be at the heart of any curricula in medical education. In academia, the term **etiology** refers to the study of causes, the causal relation being of the form: X CAUSE Y, where X is a **cause** and Y is its **effect.** At a general level, we can talk about gravity being the cause of the parabolic trajectory of a stone thrown up in the air, and the magnetic field being the cause of the attractive and repulsive motions of magnets. These are examples of what etiology seeks to understand in physics. Turning to the sciences of health, illness, healing, and prevention), we can talk about the etiology of illnesses, where the term ***symptoms*** refers to what we have called ***effects***.

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Take the concept of fever as an example. If we look up the phrase, "fever: causes and symptoms," in a medical education website such as the Clevelend Clinic, Mayo Clinic, Johns Hopkins, or WebMeD, we see the following information:

Definition:
A state of the body temperature higher than normal

Main effects
chills, shivering, sweating, headaches, muscle aches, fatigue, flushed skin, and loss of appetite

Additional effects
Irritability, dehydration, sore throat, cough, runny nose, and in more severe cases, confusion or difficulty breathing

Causes:
Infection (viral, bacterial, parasitic); inflammation, heat exhaustion, malignant tumour, medications, immunisation.

Let us use the symbol of a curved arrow as a formal notation to express the cause-effect relation.

FIGURE 3

In this, we are adapting the straight arrow notation from the formalism of propositional calculus where the straight arrow expresses the relation of implication.

FIGURE 4

Using the curved arrow notation, the information in the medical literature can be expressed as a causal network as follows:

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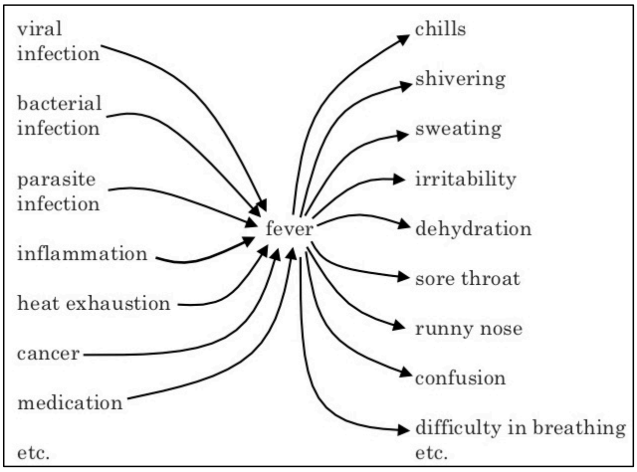

FIGURE 5

Diagnosis is the art and craft of moving from what is given on the right of the diagram to what is given at the left.

This diagram needs to be expanded in several ways. For instance, it needs to include information about a typology of fevers along multiple dimensions. Fever typology classifies them:

~ by their temperature range, duration, and timing pattern, including acute, chronic, persistent, intermittent, continuous, and so on;
~ by specific causal agents (variola virus, Streptococcus Pyogenes, Haemophilus Influenzae, Mycoplasma Pneumoniae, Staphylococcus Aureus, Pneumocystis Jirovecii, P. falciparum, and so on), and infections they are associated with (influenza, typhoid, malaria, dengue, chikungunya, and so on); and
~ related illnesses associated with raised temperature (e.g., pneumonia, covid, tonsilitis, pharyngitis, and so on)

Needless to say, the causal arrows too would have to be specific to the what can be observed or measured (e.g., the symptoms of the fever caused by the Streptococcus pneumoniae vs. the dengue virus). When more relevant information is added, the rise in temperature measured with a thermometer would be a nexus of causes and effects in a many-to-many CAUSE-EFFECT relation.

The next step would be to identify the ***causal mechanism***s, not just the ***causal relations***, moving from “X CAUSE Y” to the question: “How does X cause Y?” For instance:

From *X causes migraines*, to *How does X cause migraines?*

From *P. falciparum causes malaria* to *How does P. falciparum cause the particular symptoms associated with Malaria?* and

How do heterozygotes for the sickle gene provide immunity from P falciparum?

Such questions take us from diagnosis and etiology to immunology and epidemiology, and from there to defeasible logics.

Finally, it takes us to a vision of a theory of health, illness, and healing as a community of interacting theories: a theory of fever being connected to a theory of cancer on the one hand, and theories of headaches and of confusion, on the other. Such a community of theories will take us way beyond the simplistic diagram in Fig. 5, to a diagram that can be implemented only on a computer, requiring theoretical research over several years.

Getting back to Fig. 5, we may say that it is the beginning of an investigation of complex cause-effect chains that connect one set of observational reports (e.g., blood test reports) to other sets of observational reports (what the patient reports, what the physician observes in a clinical examination).

At this point, we also need to ask if fever is to be defined as an observable rise in body temperature, or as an abstract concept one of whose effects is rise in body temperature. The only way to answer that question is to construct a theory of fever using both these definitions, with similar but distinct causal laws, to decide which of these theories is the better one. Such choice between alternative theories is central to science as a knowledge system, unlike in the knowledge system of mathematics, where we do not ask which theory is better, a theory of projective geometry or a theory of spherical geometry.

One final remark. We need to place the theory of fever in the context of

a) normal temperature,
b) hyperthermia, and
c) hypothermia.

To do that, a fever theory has to be placed within a theory of deviation from the thermo-homeostasis (deviation from the normal temperature range), whether downwards or upwards. Hence, the concept of 'balance' in Ayurveda needs to be fleshed out as the concept of homeostasis.

7 Concluding Remarks

Inspired by the best practices of a very small number of those who have made the most significant contributions to academic knowledge, what we have outlined may be viewed as the ***normative epistemology*** of academic knowledge. The distinctive characteristics of this epistemology are:

A sense of Uncertainty and Fallibility
The willingness to Doubt and Question
Commitment to the norms of Rationality
Appeal to Diverse Systems of Logic,
Distinguishing Empirical and Axiomatic Proofs, and
Axiomatic Derivation of Predictions from theoretical postulates.

These normative characteristics are not necessarily found in the actual practice reflected in the bulk of research literature or educational programs.

A great deal of what is taught as science in universities, for instance, lacks the spirit of uncertainty and fallibility, doubting and questioning, and also signals a lack of understanding of the evidence and arguments for the conclusions taught as 'knowledge'.

Such deviations from the norm are painfully obvious in the case of the norms of rationality, stated earlier as axioms A and B:

A. Acceptance of the ***logical consequences*** of the propositions that we have already accepted, and

B. Rejection of ***logical contradictions*** in combinations of propositions.

These norms are important as beacons that guide research and curriculum design in institutions of research and education. They are also central to the demonstration that Ayurveda is not a pseudoscience, and to the project of integrating Ancient Ayurveda and Modern Mainstream Medicine.