Aristotelian Metaphysics as a Unifying Paradigm for 21st Century Science:

Common Sense-ible Science

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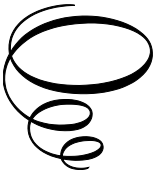
By

Jacob Joseph

Cambridge Scholars Publishing



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This book is dedicated to the memory of Fr. John J. Connelly,
who guided my explorations in metaphysics

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PREFACE

I never imagined that I would write a book on a subject – metaphysics - that most people nor I had encountered during our formative years. It was my meandering across the globe in search of knowledge that culminated in acknowledging Aristotelean metaphysics as the foundations of all that I already knew and will come to know. I will offer the history of how this book came to be written, to explain why it was written and for whom.

Like many, I am a man who has traversed the world in search of knowledge, from India to America, ultimately transporting myself back to Ancient Greece to rediscover the thinking of Aristotle, the originator of our systematic search for knowledge. It was an unexpected journey into medicine, and then a reverse journey, back from medicine to biomedical sciences, to natural science, to philosophy, to finally reach First Philosophy or Metaphysics. A journey back from being a witness to fragmentation of knowledge, called more elegantly sub-specialization, back to a more holistic approach.

As I went through schooling in the state of Kerala, in the southern tip of India, I became enamored of mathematics and physics. I loved the linear progression of ideas from A to B to C, the certainty of mathematical proofs, the charm of unraveling algebraic equations to find out the unknown. In contrast, I disliked the seeming complexity and irreducibility of biology. I could not embrace the need for memorizing without equations to explain what we were studying in biology. Hence, I did not think I would pursue any career tied to biology.

But that was not to be. My father was a physician who treated many poor people. Some of them used to come home and ask to see the son (I was the only son). And they would tell me that I must become like my father, become a servant of those in need. The repeated messaging throughout my teenage years influenced me, and I decided to become a doctor and was admitted to the local medical school. My father who knew my academic proclivities, asked me to think carefully before I committed to becoming a physician, and I, with all the false certainty of a teenage mind with minimal world experience, confirmed my decision.

The first two years of medical school left me in disarray. My medical school prepared doctors to be clinicians; there was not much biomedical research going on in the India of that time. While the pre-clinical subjects like physiology and biochemistry had their basis in physical sciences and had mathematical equations, the lack of application and discovery and the need for rote memorization took its toll. I wondered if I had made the wrong choice in entering the field of medicine.

My worries disappeared when I encountered my first patient in my third year of medical school. I felt an instant connection to the basic premise of the medical profession – to make individual lives better by treating disease. Even though I was just a medical student learning to take a medical history and examine a patient, I felt that encountering another human being in the depths of their being, with their fears and insecurities brought on by disease, and walking with them in their journey, that just seemed to be what I was called to do.

But I still had difficulties with medicine as it was taught, its focus on gathering symptoms and signs from the patient and coming to a diagnosis and a plan for investigation and treatment. While there was an interest in the underlying pathobiology, i.e., understanding what aspects of human biology had gone awry, most of the focus was on assessing the symptoms and signs and deciding on management as had been established. I was fascinated by the combination of science and art in the practice of medicine. But I still yearned for that certainty that I perceived was provided by physics and mathematics.

It was then that I happened upon a textbook of medicine called “Cecil’s Essentials of Medicine,” edited by an American academic physician, the late Professor Thomas E. Andreoli. In it I found a greater focus on pathobiology than I encountered in the standard textbooks we studied. I immediately felt a connection to what I thought was an American approach to medicine, one that focused more on the science of why we did what we did as physicians. I decided I had to get to America for further training. My intention was to understand how to apply basic sciences to medicine and come back to India to continue my journey.

The path to further training was strewn with blocks that I had to get over, from taking a specific examination in another country, Singapore, to being denied a visa to go for interviews in America, to finally landing up via New York in the small university town of Columbia, Missouri. There I

was introduced, during my training in internal medicine and cardiology, to basic research. I spent time in a molecular biology lab and investigated how to get a third strand of DNA to bind to the gene for collagen to shut down collagen production. After training, I decided that I had to stay in America and pursue an academic career, since I felt the combination of research and clinical practice and teaching would give me the greatest satisfaction.

And so it was that I embarked upon research into heart failure as I launched my academic career. I felt that, finally, I could at least study some aspects of medicine in a manner that was akin to physics or mathematics. My illusions were quickly dispelled when I realized that while most of the advances in medicine were spurred by very specific studies of specific proteins and receptors and trying to enhance or block them to prevent or treat disease, what was happening inside the cell or the human body was too complex to be reduced to linear processes. It was clear that if you affected a single protein, there was not one specific effect, but multiple effects. It seemed that biological systems were complex systems that were composed of innumerous interacting molecules. How could science possibly unravel the functioning of a single cell, far less the functioning of a human being that I encountered every day, anxiously awaiting my judgements on their health and well-being?

Intertwined with this quandary about dissecting a path forward through the thicket of humanity and its medical underpinnings was another seeming dichotomy: between the reason that I continued to be a physician – a deep seated altruism that seemed contrary to the dictates of a purely material existence; and my vocation as a scientist devoted to the biomedical sciences steeped in empirical, material science. In the increasingly physicalist realm of the biomedical sciences that accepted only facts established by experimentation, how could I achieve a consonance between my personal and professional life and not split my humanity into two spheres of action? The answer came in the form of a retired priest, who was a second father to me, who introduced me to Aristotelian metaphysics. Finally, I reached a milestone in my quest for knowledge – the joyful discovery that even though knowledge starts with what we could sense and observe, we could go beyond these empiric observations to find truths that pertain to all existing beings, and that explanations, while we would try to ground them in the material realm as far as possible, could go beyond the material to the non-material realm if necessary. Furthermore, I was comforted to find that in the Aristotelian metaphysical framework,

searching for certainty, for answers to the question 'Why?' and not just to the question 'How?' is the true avenue for pursuing knowledge. And all this using reason alone, without recourse to any supernatural explanations! I also saw that metaphysics was the answer not only to the increasing fragmentation of knowledge into further and further sub-disciplines that I observed in my own field of the biomedical sciences, but also to the almost frightening divide I saw developing between the public and those who were perceived to be part of a self-appointed scientific elite. This was no more apparent than during the battles played out in the public sphere during the tragedy of the COVID-19 pandemic.

One more episode from my life that shows the interplay of determinism and chance in the universe. I was in a flight reading a book on metaphysics. To my left was a young man who had been twice bumped off other flights to end up in the middle seat to my left. He was a medical student at Harvard, where I was a faculty. Interestingly, he had also been searching for answers to questions similar to mine, and was very interested in metaphysics. He convinced me to offer metaphysics as an elective course at Harvard Medical School, and this book is the offshoot of that course and the lecture notes I developed for the students.

That, my dear readers, is my journey to rediscover and update metaphysics that has reconciled my duties as a physician and scientist with those of a citizen of humanity. I offer to you the fruits of my labor to make the quest for knowledge have some common themes that make that quest the property of all humanity, not of just a select few who may have a degree in the sciences – or in philosophy.

ACKNOWLEDGEMENTS

This book would not have been possible without the profound influence of Fr. John J. Connelly, who introduced me to metaphysics as the avenue to unify my entire intellectual life. His carefully curated reading lists from his vast library, the countless sessions discussing each book, and the many, many, stimulating conversations we had before his passing in 2021, all contributed to the writing of this book.

I am very grateful to S.B. Easwaran, who read the first drafts of each chapter and offered extremely helpful suggestions and edits. I am grateful to Dr. Michael Dykstra, who, when he was a medical student in Harvard Medical School, encouraged and assisted me in offering an elective course in metaphysics to medical students. My gratitude to Veronica Schrenk who critically read the manuscript and to Bernhard Schrenk who offered helpful suggestions.

I am very grateful to my family for their support. My thanks to my wife Lija for her encouragement and critical reading of the manuscript. I am most grateful to my children, Anjali, Joe, and Anne, whose passionate striving to make this world a better place, and their encouragement, gave me the inspiration to write this book.

CHAPTER 1

INTRODUCTION: BEGINNING AGAIN WITH THE *WHY*?

To be human is to strive to know. Not just some facts and the *how* of things, but to truly understand, to know the *why* of things. A beaver may build a dam, but doesn't know – and doesn't care to know – how water flows. Or even why it builds dams and what drives it to build them? But we humans wonder incessantly. Like the warthog Pumbaa in the Disney movie *Lion King*, we muse if the little dots in the night sky are balls of gas. Thirsty for knowledge, we seek answers even to questions devoid of immediate practical value. *Why do we exist? What is the meaning of our existence?* From childhood we keep asking *why?* Memory, storytelling, writing, and now digital media – these have made possible the uniquely human facility for sharing what we know and learning from others, even previous generations. But though we enjoy the benefit of the view from the shoulders of giants long gone, we still stride out in search of truth. For to be truly human is to strive to know the truth.

Our ancestors interrogated the material world around them primarily for acquiring knowledge to better their lives. But they did not stop there – they searched for an understanding of how their world came to be and what lay beyond mere appearance. Initially they explained the world, its origins and its workings through myth. Later, starting with the Greek thinkers, our search for knowledge became systematic. Knowledge in the modern sense – *scientia*, Latin for knowledge, from which the word science derives – was born. Aristotle, considered the foremost among several originators of what we now call science, conceived of science as asking not just *how* things are, in order to use them to our benefit, but also *why* they are so, in order to truly understand the inner workings of the world. For Aristotle, science was *certain knowledge* of the reasons why things were the way they were. That is to say science should not stop at gaining practical utility from what it studied but would try to understand it by elucidating all underlying causes. This aspiration for certain knowledge thrived for two millennia since the time of Aristotle.

As civilization progressed, we built instruments to aid our search for knowledge. Microscopes, telescopes and atom smashers made it possible to perceive the material constituents of the world. From the thirteenth century, however, the thrust of human knowledge shifted from discerning 'certain' causes to using knowledge gained by observation for practical purposes. In the seventeenth century, there occurred a major inflection point in the quest for human knowledge – the Scientific Revolution, during which the *why* undergirding our pursuit of knowledge was mostly abandoned for the *how* that would let us harness the power of nature.

The new knowledge paradigm progressed rapidly and has now become a dominant worldview – physicalism, the idea that modern science can explain the whole universe, including human existence and human aspirations. It has no doubt benefited humanity enormously by increasing material comfort and breaking the shackles of disease. But the claim that physical matter is all that matters is a major sticking point. Is every action– including me typing these words – solely the result of the purposeless motion of particles of matter? Materialistic reductionism militates against our humanness. As physicians, I and my colleagues do not treat a patient as a passive recipient of tests and treatments, but as an active agent of knowledge, able to participate in decisions about her wellbeing. We teach medical students about patient autonomy – the imperative to let the patient make an informed decision about treatment choices. Why would we let a patient decide against a lifesaving treatment if we believed that such an abhorrent thought was the result of a material brain state that we could ignore for his material well-being! Whether we claim to be materialist reductionists or any other-*ists* who won't see beyond matter, we still wouldn't consider a person as just a material being subject solely to manipulatable physico-chemical laws.

So, by respecting patient autonomy, are we acknowledging that there are *trans-physical* entities? By *trans-physical*, I mean an entity that transcends the properties assigned to matter and energy by physics and chemistry – not a supernatural cause. As we will discuss later, human society is based on concepts that lie beyond material comfort and could even be contrary to self-preservation, like sacrificing your life for your country. The recognition of a trans-physical aspect of the human person, and concepts such as altruism, integral to human functioning, yet transcending material comfort, also make us question whether the origins of the universe lie solely in its material components. Clearly, physicalism doesn't give us all the answers, and even a firm materialist behaves

contrary to his beliefs while treating another human as something more than solely a physical collection of atoms.

The new paradigm has also artificially dichotomized the world into scientists and everyone else. Never was this schism more evident than during the COVID-19 pandemic and the controversies over COVID vaccines. Scientists wondered why their seemingly reasonable conclusions and recommendations were not being accepted verbatim; and non-scientists resented what they saw as an unwanted intrusion into their lives based on what they surmised was less than the truth. The internet and media, which allow the rapid dispersion of any information regardless of its verity, further separated the accidental adversaries. Disregarding my access to the best medical information on COVID, friends and acquaintances have plied me with news items and YouTube videos put out by self-proclaimed experts! It is time to recover the foundations of knowledge, so that it becomes part of the heritage of all people, so that all divisions based on artificial hierarchies of knowledge are removed for the benefit of humanity. For, within its narrow confines, modern science is just a part of the human quest for the sort of knowledge that makes life not just materially comfortable but also meaningful. This quest for meaning can and must go beyond the vague and vapid fashions of the age.

In medical research there is a slow but inexorable trend towards studies that encourage the meaningful participation in the design of the study of those for whom the treatment is meant. In fact, some research funding is contingent on patient participation. Such studies merge the concerns of the scientific and lay fields in research. As a physician and medical researcher, I am involved in a trial that seeks to answer a key question: Do adults older than 75 years benefit from cholesterol-lowering statins?[1] Heart attacks and strokes are usually caused by the rupture of blood vessels in which cholesterol-rich plaques have built up. Blood clots and clogs the vessel at the rupture site, interrupting supply to the heart or brain. Researchers, including myself, find ourselves gravitating to impersonal questions such as whether statins, by checking plaque build-up, prevent heart attacks and strokes. But the question uppermost on the mind of a participant might be this: *If I have lived to the ripe age of 75 without a heart attack or stroke, would taking additional medication make me live a longer, meaningful life?* When patients' perspectives were included in the study, we modified the question it addresses to: *Will the drug lead to better survival without dementia or disability?*

Such integration of concerns and interests will without doubt benefit applied science and its users. But is such bridging possible, even necessary, when it comes to pure theoretical science? I think it is – on both

counts. All spheres of human knowledge can be melded, even in their austere beauty, by removing artificial divides. The novelist and chemist C.P. Snow spoke of divide between the "the two cultures" of arts and sciences; there is also one between the so-called hard sciences and lay knowledge. Such rifts are artificial and have materialized not out of any malign, elitist intent on part of scientists or other groups, but because ideas assume lives of their own and metamorphose into little worlds in themselves. Subsequent ideas that tried to repair the breach ended up widening it into a chasm of irreconcilable differences and mistrust.

We can recover 'common' human knowledge by retracing our steps to the origins of our common quest for knowledge, by understanding the foundations of science before any biases crept in, and by recognizing the causes of those artificial rifts. Ours is an opportune era for such reconciliation. The internet has made dispersion of knowledge easy, and the discoveries of modern science – in physics, cosmology, medicine, neuroscience, neuropsychology, and evolutionary biology – are bringing us back to where we will again be able to ask the basic *Why?* Among the answers is the possibility of a trans-physical human soul and an explanation for the origins of the universe that includes an Uncaused Cause. I believe this approach will enrich rather than diminish science, and allow humanity to celebrate science as knowledge possessed by all – not just an elite.

I call this rediscovered concept of science 'common sense-ible science' – common to all humanity, and derived from a) normal thinking, taking into account verified scientific findings, not inadequately elucidated scientific theories, and b) our own analyses using our senses and sense-enhancing instruments. Metaphysics (from the Greek *meta ta phusika*, translated as *after natural things*), and physics itself, had broader connotations than modern day physics and encompassed the study of nature in its entirety. Modern physics itself posits many entities in nature that are not directly observable by the human eye or any instrument – like sub-atomic particles and black holes. So metaphysical thinking – which looks beyond appearance and the results of empiric investigations – must reclaim its position amongst academic endeavors, for its principles affect all subdisciplines of human knowledge. Metaphysical thinking also needs to verify the plausibility of mathematically based theories of science – for while there is a close correlation between many mathematically derived laws of nature and what happens in nature, not every equation that makes mathematical sense is instantiated in nature. Even historical events ought to be analyzed through the lens of common sense-ible science, verifying facts using testimony and probability, weighed always by the eternal yet forgotten *Why?* Equally, it is important to answer, rather than dismiss,

skeptics who think COVID vaccines are a money-minting ruse of pharma giants or that climate change is a hoax. Their doubts may perhaps originate in incomplete answers to the *why* of vaccination or climate change. If people understand the *why*, there likely won't be discrepant actions or beliefs.

I have been privileged as a physician and scientist to observe both people and the workings of modern science. In this book, I will draw upon that experience of the theory and practice of biomedical sciences and my understanding of how the human quest for knowledge was established and then veered off course, to propose that all knowledge – even advanced cosmology and gene manipulation – can become a true common endeavor of all humanity by the recovery of its Aristotelian foundations. Nothing is beyond the reach of common sense-ible science. Everyone – scientists and non-scientists – can and should interrogate every aspect of human endeavor. I hope this book will empower you to do that and become a philosopher in the true sense of the word – a lover of knowledge, an active participant in the advancement of the frontiers of knowledge. No background in philosophy as a discipline is needed – just a love of knowledge, a love that has spurred us all since the first time, as a child, we asked the question *why?*

CHAPTER 2

END OF THE BEGINNING

While we may take pride in knowing more than our ancestors, we should recognize that our burgeoning knowledge is because of those who came before us. Extraordinary individual genius has existed in every age; what has advanced us, however, may be our collective human genius. If the treasures of human knowledge and the range of human intellect have grown exponentially, it is because we have transferred knowledge horizontally across societies and vertically across generations. Human knowledge may be thought of as a rope that is forever being braided, and comprising strands entwined since the time the first human pondered the world around her. Some of its strands extend right from the beginning to now, some have frayed, and some that were too weak to merit inclusion were excluded, have worn away or been replaced. That is why any survey of human knowledge – which is not a current fad but our collective heritage – must include its beginnings, and not just focus on the last few decades or centuries.

Whoever invented the wheel may have been a greater genius than Einstein since she would have been operating *de novo*, without any well of previous knowledge to draw from. Put yourself in the shoes of a prehistoric human. Think of her waking up and looking for food in the various plants around her, wondering which plants are useful, which harmful or even deadly. Think of how our prehistoric predecessors decided which animals to hunt and which to stay away from. Careful deliberation preceded even the most mundane decisions. For we humans are born with fewer of the instincts that animals innately possess, which enable them to survive without "thinking." As John Locke put it in *An Essay Concerning Human Understanding*, we may even be born with a *tabula rasa* – a blank slate – for a mind, yet still attain such great heights of intellectual achievement.

The very beginnings of the human quest for knowledge are shrouded in myth, which of course serves certain societal needs for comfort and communion. Focusing on the scientific approach to knowledge, however, we could start with the Greeks, who laid its foundations. Until

the advent of the philosophers (*lovers of wisdom,* and not professional academics) who preceded Socrates, answers to the questions of *why* were clever fictive and literary creations that included gods endowed with supernatural powers. These inventions offered facile explanations of creation and natural phenomena through the agency of anthropomorphized gods who didn't stray far from human foibles. Such interventionist gods were in fact integral to Greek theater: a *deux ex machina*, or god from the machine, would descend on the stage to extricate humans from a difficult place in the story.

The pre-Socratic philosophers, however, forayed beyond myth and began to wonder about the composition of the world beneath what they could sense, and how the changes they saw all around them could be explained. While they all thought that what they saw was composed of some underlying common entity or entities, they had different conceptions about what those were. Thales declared it was water. Anaximander insisted that four elements – air, water, earth and fire – combined in different proportions to create everything in the world. Others had different explanations. While these may sound simplistic to us through the lens of the 21st century, such succession of ideas was a huge step forward in the progress of human knowledge. It ushered in the idea that the world was intelligible to humans, that the human mind could try to understand what lay beneath the appearances of things, that it was possible to discern the nature of the world as it truly is from what it seems to our senses.

We are all familiar with the theory of atomism. But what we may not recognize is that it was first proposed by two Greek pre-Socratic philosophers, Leucippus and his disciple Democritus (who is more strongly associated with it). They proposed the idea of all matter being composed of tiny, basic units called atoms. These are indivisible and move about in a void, and their various combinations account for the rich variety of the world. This theory immediately provided the grounds for materialist reductionism, or the idea that our whole universe can be reduced to particles of matter. Most importantly, in the context of this book, the atomic theory is an example of the power of the human mind to propose plausible suppositions about reality not in lockstep with experimental verification. For it was proposed without a shred of empiric proof, and persisted so for more than 2,000 years till modern scientists showed that in fact the material world was truly composed of atoms!

Besides the composition of matter, its changeability – and change itself – had to be explained and understood. Was there anything permanent about the world around us? How could we explain change without losing the sense of permanence that the world possesses? Two pre-Socratic

philosophers had widely divergent views. Parmenides declared that change is an illusion. He argued that it did not make sense that an existing being could change into another since all being was one anyway. Parmenides just couldn't get around to the fact that there could be different kinds of being. For Parmenides, change would have to go from being to non-being and back to being – that did not make sense, or course, since non-being would be the extinction of being and you couldn't then get back to existing. So he concluded that all change was an illusion. Heraclitus, to the absolute contrary, could not accept the permanence of any being and concluded that change alone was what was real.

> "*Panta rei* (everything flows),"

he said, and more famously,

> "We never step into the same river twice."

But he also proposed a more fundamental concept – that of logos, the word, or reason, or order, which underpins the existence of the universe. The idea that the universe has a rational order and hence can be interrogated by human thought proceeds from this Heraclitean concept.

While we do not have any written record of Socrates' teaching, we do know from the writings of his illustrious pupil Plato that Socrates' most important lesson was his act of pleading ignorance:

> "I know that I know nothing."

And this stands parallel to a crucial characteristic of being human – that we are constantly striving to know more. We are never satisfied with believing that we have known all we can about the world; the more we know, the more we desire to push the boundaries of knowledge. Isn't it amazing that the world seems to continually open itself to us? The more we find out through science, the more there will be to find out, because, as we will discuss later, the world might not fit into neat templates of explanation. In the Socratic sense, we must be skeptical of the position that we already know enough, or that it is only a matter of time before the fully enumerated properties of the physical world will completely explain how the world works. We must be wary of the physicalist position, for then we cannot accept the thoughts generated by the material state of our brain as representing anything real.

Plato conceived of the world as consisting of unchanging, eternal 'ideas' that are imperfectly embodied in the visible world. What we see is

not the real thing, for the real thing only existed as an idea, imperfectly represented by matter. Only in our mental world do real things exist. Thereby, Plato inaugurated the opposite of materialism – idealism, or the concept that the only real things were mental beings. What we see are not real things but just their approximations. And where did the ideas in our mind come from? Plato thought that ideas existed in the mind of God, the Ultimate Good, and that these ideas were imprinted on our souls, which pre-existed our bodies. With the idea of an immaterial soul separate from and inhabiting the material body, Plato also set into motion the error of dualism, i.e., the sharp divide between an immaterial being and the material body, as in the soul-body and mind-brain dichotomies.

Fortunately, Plato's disciple Aristotle, whose teachings are the major springboard for the ideas expressed in this book, rescued us from this prison of the mind and offered a solution that laid a foundation for human knowing.

CHAPTER 3

ARISTOTLE'S SYNTHESIS: LOOKING BEHIND APPEARANCES

"All men by nature desire to know."[2]

While Aristotle is the seminal thinker who inaugurated systematic human knowing, we have inherited only a meagre share of his writings. What we have, rather, are what might be called lecture notes from his teaching sessions at the Lyceum in Athens. We are not even sure whether he wrote these or whether they were jotted down by his students. In the absence of more polished work, we are forced to piece together Aristotle's creative thoughts from the available vulgate. Compared to the 21st century corpus, the empirical knowledge Aristotle worked with was minuscule. So, in adapting his ideas to our times, it is possibly to our advantage that we are working from those broad outlines.

Aristotle was a star student of Plato, but broke with his teacher to dissect his own path. Plato conceived of a world that existed primarily in the mind and secondarily in the material world. Aristotle, however, framed a startling assertion – that what we know had to start with what we could see, hear, touch, smell, and taste, and not arbitrarily from what we thought about what we saw, heard, touched, smelled or tasted. But he did not eliminate the role of the mind. For Aristotle, mental action was important in that it got behind what was sensed in encountering a particular being and grasped abstract universal ideas beyond that particular being. For example, from seeing poppies, daffodils and lilies to reaching the universal idea of what a flower is, or "flowerness." He took the median course between idealism, or the premise that only mental beings truly existed, and materialism, the premise that all that comprised any being was solely a particular arrangement of some basic matter, be it air, water, or the atoms of Leucippus and Democritus. Universal ideas existed in the mind; they were realized only as particular beings. "Flowerness", for instance, exists in the mind, but is embodied and made real only in a real daffodil.

Based on his observations of nature, living and non-living, Aristotle derived explanations of nature. He conceived of science, or

"natural philosophy", as *certain* knowledge through causes. For Aristotle, scientific quest did not end when we had acquired knowledge of the properties of an existing being sufficient for practical human purposes. The aim of science was to obtain *certain* knowledge of causes from observed effects. Certain knowledge of the object of inquiry meant obtaining answers to questions such as: *What were the reasons for a particular thing to exist with its unique properties?* and *Why did such a change have to happen?* The one deficiency in Aristotle's scientific method was that he did not incorporate experimental investigations into his method of enquiry of causes. Incorporating experimental investigations into the Aristotelian framework to create the premises from which certain knowledge can be deduced would be an appropriate updating of the method of metaphysics.

Aristotle applied his genius to explore almost all domains of human knowledge, from the principles of logic, the non-living and living worlds, human beings, and human endeavors such as ethics and politics. In Aristotle's days, as mentioned before, the discipline that investigated the natural world was called physics (from the Greek word *phusis* or nature), and *Physics* is the title of one of Aristotle's extant works, in which he details principles pertaining to the natural world. Andronicus of Rhodes, who collected and edited the lecture notes of Aristotle into books, titled one of these books *Metaphysics*, meaning 'after physics' in Latin, and that's exactly where Andronicus placed this book, after the book titled *Physics*.

Why did Aristotle lecture on metaphysics and what is its relevance for us today? *Metaphysics* starts with the statement "All men by nature desire to know." We have to surmise that for Aristotle, the individual study of specific aspects of nature was not adequate for human understanding. From reading *Metaphysics*, it is clear that Aristotle surmised that underlying the study of all beings are some basic principles, or a "First Philosophy", as he called it, that would unite all intellectual inquiry of nature. In the words of Aristotle, 'There is a science which investigates being as being and the attributes which belong to this in virtue of its own nature. Now this is not the same as any of the so-called special sciences; for none of these others treats universally of being as being. They cut off a part of being and investigate the attribute of this part.' For Aristotle, since human knowing was about existent beings, we had to derive some principles that applied to the investigation of any and all beings in the universe before we embarked on the study of specific categories of beings.

Metaphysics then becomes common human knowledge, with each science an independent offshoot of that common trunk. Thus, each

science is not a separate entity with its own set of principles of knowledge separate from metaphysical foundations. Anthropology and medicine both study the human being but from different vantage points. But both are meant to operate under metaphysical foundations or first principles. These are based on common sense understanding of being, but incorporate definitely proven discoveries of science. (I emphasize "definitely proven" because some scientific premises are less proven than scientists claim.)

An interesting fact about Aristotelian concepts: they would have been lost to the world forever but for a set of fortunate occurrences. The texts of Aristotle disappeared from the Western world during the so-called Dark Ages, but were fortunately kept alive and commented on by Islamic scholars. In the Middle Ages, they were rediscovered by the West and the concepts further developed by Western scholars, most notably St. Thomas Aquinas.[3]

While these Aristotelian principles are derived from the study of the world around us, they pre-exist knowledge derived from observation, and are waiting for us to apprehend them. The Aristotelian synthesis of the first principles of human knowledge was called metaphysics, as described above. These are first principles because they constitute *certain* knowledge, which is known intuitively and cannot be proven experimentally. One might draw a parallel here with some self-evident first principles of every science that cannot be proven from within the science itself. A first principle in medicine, for example, is *primum non nocere*, Latin for 'first do no harm.' This is obviously not based on experiment, but makes clear sense and is self-evident from observing what a doctor is called on to do in her trade. Notably, it was this first principle that the Nazi doctors and the Tuskegee experimenters violated in their abhorrent investigations on people for the purported benefit of advancing medicine.

Sciences aim to achieve *certain* knowledge through causes. One way Aristotle proposed is through the instrument of logic, that definite proofs are provided by the syllogism, an instrument of logic which can reach certain conclusions by systematic progression through a three-part *premise: middle term: conclusion* construct, as seen in:

> *All planets revolve around the Sun*
> *Earth is a planet*
> *Hence, Earth revolves around the Sun*.

Notice that the middle term is certain. If we proceed with this mechanism to prove any theory as being certain, we will have to stop at some principles that we cannot prove by further syllogisms. These are intuitively

known, cannot be empirically demonstrated, and are "First Principles." In the words of Aristotle (*Metaphysics*, Book IV, Part 4), referring to the first principle of non-contradiction you will learn in the next chapter,

> "Some indeed demand that even this shall be demonstrated, but this they do through want of education, for not to know of what things one should demand demonstration, and of what one should not, argues want of education."

The syllogism can also be used in sciences subsidiary to metaphysics to reach certain conclusions that are not first principles and are derivative of other facts or of empiric investigations. For example, you can see the syllogism work in the following example:

> "If air is needed for fire to burn, then a fire will go out after a finite period of time if enclosed in an airtight glass jar.
> Fire does go out when enclosed in an airtight glass jar.
> Hence fire needs air to burn."

While Aristotle's lack of experimental focus is considered a weakness of his approach to knowledge, we can see that his method of searching for certainty works even in empiric science.

Back to first principles - I would like to call these first principles common sense-ible human knowledge, accessible to all humans who think about the world around them. Being first principles, they need constant updating with new discoveries about the physical and living world. In this book, updated with examples, I will offer the salient features of this system of thinking: the first principles of non-contradiction and sufficient reason, metaphysical commons-in-being to explain being and change (existence/essence, form/matter, substance/accident, act/potency), and the four causes that underlie any certain explanations of being and change: material, formal, efficient, and final causes. Then we will examine the application of these principles of thinking to a number of major questions: the origin of the universe, the origin of life, living systems, evolution, and finally, to what is a human person.

Some of Aristotle's concepts may not seem as applicable in light of the scientific understanding of today, because Aristotle did not have access to today's vastly increased empiric knowledge enhanced by instrumentation and experimentation, and also because Aristotle, while his genius touched all aspects of human knowledge, was first and foremost a naturalist studying the living world and hence may have exuberantly applied concepts to inanimate objects that are more fitting for living beings. However, I argue that his concept of the four causes is irrefutable,

standing the test of time, and should be the lens through which you interrogate any scientific claim. You should not accept scientific claims that do not satisfy the certainty criteria, and you should not be dazzled by the enormous technological advances into accepting theories, some unverifiable, put forward by scientists as definite knowledge. You should feel empowered as an individual to challenge conclusions that are described as certain if they are not based on these principles of common sense-ible human knowledge. To empower you – that is the intent of this book.

CHAPTER 4

OF FIRST PHILOSOPHY AND FIRST PRINCIPLES

"First principles and causes are the most knowable"
(*Metaphysics Book I)*

As we discussed in the previous chapter, we need first principles to initiate any human knowing. Metaphysics, which formulates first principles for all other sciences to assist in their study of specific beings, also needs first principles. First principles imply that, while all knowledge starts from sensed objects, we must have some principles that are so certain that they don't need further verification by the senses or demonstration by the stairway of syllogism ascending from premises to conclusion. That creates a seeming paradox. In the words of Aristotle (*Metaphysics Book I Part 2*),

> "And these things, the most universal, are on the whole the hardest for men to know; for they are farthest from the senses…first principles and the causes are most knowable; for by reason of these, and from these, all other things come to be known, and not these by means of the things subordinate to them."

These first principles, he writes, are both the hardest to know and the most knowable. By hardest to know, what Aristotle means is that we find the objects that we can perceive with our senses easier to acknowledge in our minds than derived mental concepts such as first principles. And by most knowable, he means that these concepts, abstracted from our sensory perceptions of the world around us, are clearer to our mind since we can examine them carefully in the confines of our minds. Material objects may seem easy to grasp, but we have had limited success: we are still struggling to understand the components of matter after a century of investigation using atom-smashers, electron microscopes and such. But certainly, these first principles are not easily arrived at and require careful deliberation.

Aristotle speaks of two first principles underlying the study of all being. By being, what is meant is any existing thing. With the advent of

relativity and quantum mechanics, we know that matter and energy are interchangeable and hence (existing) being includes not only matter but also energy. And as scientific knowledge expands, we are finding out that there are more enigmatic entities such as dark matter and gravity-repelling dark energy that also must be included as existents in the universe of beings.

The first is the *principle of non-contradiction.* In *Metaphysics (Book IV, Part 4)*, Aristotle writes,

> "But we have now posited that it is impossible for anything at the same time to be and not to be."

And also that *(Metaphysics Book IV, Part 3)*

> "Evidently then such a principle is the most certain of all; which principle this is, let us proceed to say. It is, that the same attribute cannot at the same time belong and not belong to the same subject and in the same respect."

This means that I cannot be both writing this sentence and not writing this sentence at the same time, that a man cannot be alive or dead at the same time, that a swan cannot be both black and white at the same time. Seems simplistic and unnecessary from our vantage point. But that is precisely the point – *once arrived at*, *first principles seem intuitive in retrospect*. But if you ruminate more, while this principle of non-contradiction seems simplistic, without this basic first principle, all knowledge becomes impossible, for we would be able to state something and its contrary to be true at the same time – which wouldn't make any sense, and would undermine common sense-ible human knowledge. The study of the sub-atomic world governed by the laws of quantum mechanics poses some interesting quandaries related to this principle. A sub-atomic entity such as an electron can exist as a wave of probability and thereby can behave as though present in two places at once till it encounters an instrument that is able to measure its existence as a negatively charged particle and then it behaves as a particle! As we will discuss later, it is not that an electron violates the principle of non-contradiction and behaves as a wave and a particle at the same time, but that its behavior is dependent on how we measure it.

The second principle – that of causation – is not explicitly stated in Aristotle's extant texts but implied by his concept of causes. As he states in *Physics* (Book II, part 3)[4],