



REVISITING EMPEDOCLES' PHILOSOPHICAL POSTULATIONS TO SCIENCE

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Abstract

A philosophical postulation is a foundational assertion or assumption proposed to explore, explain, or analyse philosophical concepts or questions. Philosophical postulation to science denotes the way philosophy has influenced and has been influenced by scientific inquiry. It concerns the foundational mass views, principles, and conceptual frameworks that govern how scientists develop theories. The origin and nature of the universe have always posed serious wonder (cosmological wonder) to man right from the time of his ingress into this existential universe. Unarguably, it is a cosmological wonder that gave birth to knowledge (science). Empedocles of the ancient Greek city of Acragas (modern-day Agrigento) in Sicily, a pre-Socratic philosopher and well-known ancient Greek cosmologist or materialist (C.492 – 432BC), rationalized and came up with four “roots” or elements: earth, water, air, and fire, as the basic constituents of the material universe. Although his predecessors had a monistic view of the universe, Empedocles refused to toe their line of thought. Rather, he thought out a pluralist view of the universe and remains the first ancient Greek Philosopher to come up with a pluralistic view of the material composition of the cosmos. This paper employs analytic and hermeneutical methods to evaluate the philosophical postulations of Empedocles to science. The paper argues that Empedocles' four “root” or elements are foundational to the development of science, especially Chemistry and Physics. It also posits that his philosophy of “love” and “strife” is still influencing the calamitous climatic changes in our universe today, consciously or unconsciously. The paper further avers that the progress of development and advancement in scientific knowledge, understanding, and technological innovations witnessed in our world today is a result of the gradual accumulation of knowledge of the universe over the centuries. The paper concludes that the philosophy of Empedocles is foundational to the development of science; that his philosophy is still influencing our world today, whether we are aware of it or not.

Keywords: Empedocles' philosophy, scientific development, elements.

Introduction

Philosophy is a rational endeavor to answer the most general questions about the nature of reality and human existence. It does not ask questions about the nature of a specific field of existence (as the physical or the historical realms) but about the nature of reality, which is effective in all



realms (Tillich, 1957). Philosophy strives to understand absolutely everything about the universe. It (philosophy) is the science that investigates the nature of being as it is in itself. It is the science of sciences (*scientia scientiarum*) or the queen of sciences. According to Alex Rosenberg, philosophy deals initially with the questions that science cannot yet or perhaps can never answer, and with the further questions of why the sciences cannot answer these questions (Rosenberg, 2005). Science asks questions that relate to a particular field, trying to understand how that field of existence operates, but philosophy attempts to have a holistic view of the why of existence in general.

Science as a distinctive enterprise remains the unique contribution of Western thought to all the world's other cultures, which it has touched. It seems to have begun with ancient Greeks, and the history of science from the ancient Greeks to the present is the history of one compartment of philosophy after another, breaking away from philosophy and emerging as a separate discipline (Rosenberg, 2005). Science did not just emerge from nowhere. It has a beginning; in fact, every age has its science and scientists. The scientific enterprises of a particular age help in the formation of better scientific ideas of another age, most of the time. In the words of Nathan Smith, "the ancient Greek philosophers were known as sages. This is because sages are most of the time associated with mathematical and scientific discoveries and, at other times, with their political impact (Smith, 20220).

Empedocles, who is known to come from an aristocratic family, lived in Acragas in Sicily (Kulcu, 2003). He was a prominent figure in Ancient Greek philosophy and science, often considered a pre-Socratic thinker. Empedocles was known for his theories about the fundamental nature of the universe, positing that all matter is composed of the four elements (air, fire, water, and earth) and that these elements are constantly being combined and separated by the forces of "love" and "strife". Plato of Athens and Aristotle of Stagira developed these views. Aristotle introduced the concept of the quintessence – a fifth element that filled the universe beyond the terrestrial sphere. In the Middle Ages and the Renaissance, the four elements became integral to alchemy and early Chemistry. It is the belief of the Alchemists that by manipulating these elements, matter can be transformed (e.g., turning base metals into gold). This Empedoclean theory of four elements has a grave influence on the foundation of Chemistry and Physics; the development of the scientific method; and the transition to modern science. The theory has a serious, enduring cultural impact and interdisciplinary influence.

Empedocles Philosophy

The rational explanation of nature beyond mythologies in the ancient era of philosophy is considered the starting point or *terminus a quo* of scientific thoughts. It is the natural philosophers who actually began a critical reflection on the nature and operations of the universe, which closed the door of myths and opened the door of Logos. If scientific thoughts should be described as a way of reasoning or thinking that gives rise to the generation of knowledge, within the limit of episteme, through observation, experimentation, and testing of facts, it owes its foundation and origin to ancient times. Empedocles of Acragas in Sicily made an important contribution to the growth and development of scientific thought. Empedocles, who was both a



philosopher, physician, scientist, and politician, lived around 492 – 432BC, spent his life in the southern part of Sicily, and concretised a pluralistic cognition of philosophy and reconciled warring, debates, or views about change during his time (Kulcu, 2003).

The philosophy of Parmenides, that being is permanent or unchanging, and the philosophy of Heraclitus, that being is perpetually in flux or ceaselessly changing, were apparently irreconcilably contradictory. Empedocles' philosophical thought is a candid attempt to reconcile these opposing philosophical views. In the words of Brook Noel Moore and Kenneth Bruder:

The next major Greek philosopher, Empedocles (em – PED- uh – Kleez] (C. 490 – 430), thought that true reality is permanent and unchanging, yet he also thought it absurd to dismiss the change we experience as mere illusion. Empedocles quite diplomatically sided in part with Parmenides and in part with Heraclitus. He was possibly the first philosopher to attempt to reconcile and combine the apparently conflicting metaphysics of those who came before him (Moore and Bruder, 2002).

For Empedocles, change in the universe is real. But in the midst of this change, something or some things remain permanent and unchanging. In other words, if everything is perpetually or ceaselessly changing as put forward by Heraclitus, how can we be sure of our knowledge of reality at all? And if everything is permanent as thought out by Parmenides, how can we account for the vagaries of life that stare us in the face? This led Empedocles to come up with four basic roots or elements that make up the material universe. The words of Moore and Bruder are also important here:

According to Empedocles, the objects of our experience do change, but these objects are composed of basic particles of matter that do not change. These basic material particles themselves, Empedocles held, are of four kinds: earth, air, fire, and water. These basic elements mingle in different combinations to form the objects of experiences as well as the apparent changes among these objects (Moore & Bruder, 2002).

The coming into being of any material reality is a result of the joining together of these four elements. It is also the separation of these elements that brings about the disintegration of matter. This action of joining together and separation is made possible by two opposing forces. Empedocles called these two antagonistic forces “love” and “hate”. “Love” is in charge of the joining together of the four elements in required proportions to bring about the existence of any physical reality. “Hate” is responsible, on the other hand, for the actual separation of the elements. The action of joining together of the elements to form matter is known as generation, while the separation upon degeneration of matter is called corruption. Roberto Barbosa de Castilho writes that:

The elements join to form matter (generation) and separate upon degradation (corruption) by the action of two antagonistic forces, love and hate. The force of attraction (love) is responsible for the aggregation of the elements in different proportions and generating the substances, while the force of repulsion (hate)



leads to the separation of the elements and degradation of the substance (Castilho, 2021).

The continuity of life is absolutely dependent on the maintenance of equilibrium between the force of love and hate. In the context of Empedocles' philosophy, equilibrium means balance or a state of stability that results from the interplay of his two basic forces of Love (*Philia*) and Hate (*Neikos*). In other words, when "love" and "hate" are in a balanced condition, which brings about a temporary stability of the universe, where none of the forces dominate, equilibrium takes place. It is this balance that gives room for the co-existence of order and chaos, growth and decay, which is pivotal to the Empedoclean concept of the eternal cosmic cycle. Put differently, equilibrium in this context refers to the dynamic balance point where Love and Hate are in harmony, eschewing either from taking upper hand on the other, ensuring the maintenance of the prevailing cycle of change and stability in the universe.

Furthermore, according to Empedocles, the joining of the elements is not haphazardly done. No, it is achieved through mathematical proportions so that stability will be accorded to the object formed. Ierodiakonou submitted that: "...bones consist of four parts fire (4f), two of earth (2E), and two of water (2W), and no air (0A), while the tendons derive from fire and earth mixed twice the quantity of water. The "Chemical" formula or the proportion of the four elements for the formation of the bones might be: E2 W2 A0 E4 (Ierodiakonou, 2005). Again, it is very important to note that Empedocles did not support his four-element theory with any experimental proof. However, there are some scientific views of his that he based on experiment. For instance, through experiment, he showed that the existence of "air" is real and is not just a space. This he carried out with a clepsydra, a vessel with a hole in the bottom and one in the top. He placed the bottom hole of the vessel underwater and observed the vessel fill up with water. If, however, he puts his finger over the top hole, then the water does not enter the hole at the bottom, but it does once he removes his finger. Empedocles correctly deduced that the air in the container prevented the water from entering (Mac Tutor, Empedocles of Acragas).

Empedocles' Influence on the Development of Physics

Empedocles significantly influenced the development of physics by formulating the theory that all matter is made up of four basic elements: earth, air, water, and fire. He also proposed the idea that these "roots" or elements are unified or disintegrated by the action or forces of "Love" and "Hate". This influenced his ideas on physics and cosmology. His four-element theory furnishes the underlying structure for the knowledge of the composition of matter, which laid the foundation for subsequent theories. Aristotle, for instance, followed this line of thought while developing his theories (byjus.com).

Again, Empedocles' idea of two antagonistic forces, love (attraction) and strife (repulsion), operating on the four roots or elements, supplied an explanation for the multiplications and alterations inherent in nature. The creation and destruction of various substances is the influence of these two forces, which propel the joining and separation of the elements. Empedocles' approved cylindrical view of the universe (cosmic cycle), where the elements join and



disintegrate when affected by the forces of love and strife. This leads to the endless cycle of growth, decay, and regeneration (byjus.com).

Empedocles also held the belief that light travels through space and takes time to reach the eye (byjus.com). He also maintains that light takes time to travel from one place to another, but that we cannot perceive its motion. He was aware that the moon shines by light reflected from the sun and also knew the cause of a solar eclipse (Healy, 2003). This idea predates modern scientific understanding of light. Although his theory of light was not developed, it is foundational to the finite speed of light associated with modern physics, like Ole Romer, who first measured light's speed in the 17th Century, and Albert Einstein, who incorporated the finite speed of light into his theory of relativity.

Empedocles also proposed a theory of perception that has its roots in his larger cosmological ideas. He suggested, in his theory of perception, that perceptual experience is made possible by the interaction of the four elements (earth, air, water, and fire) with our sense organs. He approved the idea that perceptual ideas are the effect of some sorts of “effluences” or “images” emitted by objects, which enter the sense organs. Specific parts of the body are equipped to receive particular kinds of effluences – eyes for visual effluences, ears for auditory effluences, etc. Sensation or perception takes place by the interaction of these effluences with the right sense organ. For Empedocles, these effluences are matter-like, and the mixture or separation of the basic elements of the universe can influence them. Most of the later ideas of perception have their root in this Empedoclean theory of perception. This stresses the need for interaction between objects in the external cosmos and internal sense organs. His theory is a precursor to the naturalistic theories of sensory experience.

Empedocles' Influence on Chemistry

The term for Chemistry in the Modern Chinese is “hauxue” which literally stands for “science” of material change”. Depending on context “huaxue” may precisely be translated as “Science of becoming, influencing, (material) changing into, turning into, transforming, converting, digesting, incinerating, melting, dissolving, thawing (Brakel, 2014). The materialist, Empedocles, proposed that matter is made up of four basic and indivisible elements: earth, air, fire, and water. It is worthy of note that these elements were not meant to be literal substance but rather primordial “roots” from which all other things were made.

Empedocles introduced the forces of “love” and “strife”. It is these two concepts (love and strife) that govern the interactions between the elements. Love was responsible for bringing the elements together, while strife caused them to separate. It is this idea of forces acting upon elements that provides a framework for understanding chemical reactions and transformations. Empedocles' theory, while not scientifically accurate in the modern sense, can be considered the earliest endeavor to explain the composition and transformation of matter. He recognized that something was preserved during these transformations, which he attributed to the four elements. This is a proto-chemistry. His theory, despite its inaccuracies, was a significant step towards the foundation and development of scientific thinking. It significantly influenced the development of



chemistry by the introduction of the concept of elemental substances and the forces that govern their interactions. His view that matter is composed of four elements – earth, air, fire, and water – served as a foundational idea in understanding the composition of the physical universe. While this theory was later superseded by modern chemistry, it laid the groundwork for the study of matter and its transformations. Barbosa de Castilho submits that:

Although the conception of the chemical elements in modern chemistry is different from the theory of four elements, that theory was valuable as an intellectual effort to understand nature and transmutation and to conciliate reason and sense, besides being the first theory postulating the pluralism of matter's composition, in opposition to monism. I argue that chemistry has a past, and it is important to know the theory of the four elements for its historical value because it can be considered an introductory chapter of chemistry, introducing the concept of indestructible elements and the proportional combination of them in Western thought (de Castilho, 2021).

The four elements of Empedocles remain the historical development of the science of chemistry. One major problem plaguing the theory is its inability to criticize facts. The theory was downright explanatory. Again, there was no experimental evidence given to support the theory. In fact, the words of Barbosa de Castilho capture it all: “The failure to criticize facts and inferences that underpin the theory and then propose a new or innovative experiment are the main problems with the theory. Ideas like equilibrium and proportion of combination are the main contributions of the theory of four elements” (de Castilho, 2021).

The theory of four elements gave chemical elements in modern chemistry a simple beginning. Knowledge is progressive. One can rightly argue that the four roots of Empedocles are different from the modern chemical elements, but the theory of four roots was its foundation. That is why de Castilho remarked that:

Today, we know more than a hundred chemical elements, so the roots of Empedocles are very different from the present chemical elements. Psychologically, it is quite unreasonable to postulate that matter is composed of more than a hundred elements. The easiest way to speculate about the composition of matter is to begin with one or four elements. Our perception is not prepared to deal with hundreds of elements at once—therefore, we need mathematics. The concept of the chemical elements has evolved from the simplest (one, four ...) to the more complex (more than a hundred) by combining new experiments with new theories. Even considering the epistemological rupture of the four elements with the modern chemical elements, we can say that the theory of four elements was important to ancient chemistry and gave us fundamental concepts like combination, proportion, and balance (Barbosa de Castilho, 2021).

With everything included or counted, the contribution of the four roots or elements of Empedocles to the development of chemistry is immense. One can say that the four-root theory is not a precursor to modern chemistry, properly speaking. Be that as it may, it is right to remark



that a bad theory is better than none. In other words, the past of modern chemistry of today is Empedocles' four elements.

Conclusion

Empedocles' four roots, or elements—earth, air, fire, and water—are foundational to the development of the sciences of chemistry and physics, and even medicine. His four-element theory provided the underlying structure for the knowledge of the composition of matter, which laid the groundwork for subsequent theories. His idea of two opposing forces, “love” and “strife,” which operate on the four elements, explained the changes inherent in nature. Basic concepts like alterations, combinations, proportions, and equilibrium, which are at the heart and soul of Empedocles' philosophy, are crucial to the development of the science of physics, chemistry, and medicine.

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