# EVOLUTION AND ONTOLOGICAL REALISM: A CRITICAL INTERPRETATION

**Ph.D. THESIS**

*by*

**HAREESH AG**


**DISCIPLINE OF PHILOSOPHY**

**INDIAN INSTITUTE OF TECHNOLOGY INDORE**

**JULY 2018**

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**A THESIS**

*submitted in partial fulfillment of the*

*requirements for the award of the degree*

***of***

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**JULY 2018**

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## CANDIDATE'S DECLARATION

I hereby certify that the work which is being presented in the thesis entitled **EVOLUTION AND ONTOLOGICAL REALISM: A CRITICAL INTERPRETATION** in partial fulfillment of the requirements for the award of the degree of **DOCTOR OF PHILOSOPHY** and submitted in the **DISCIPLINE OF PHILOSOPHY, Indian Institute of Technology Indore,** is an authentic record of my own work carried out during the time period from July 2013 to July 2018 under the supervision of Dr. C. Upendra, Associate Professor, Indian Institute of Technology Indore. The matter presented in this thesis has not been submitted by me for the award of any other degree of this or any other institute.

Signature of the student with date
**(HAREESH A.G.)**

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This is to certify that the above statement made by the candidate is correct to the best of my knowledge.

Signature of Thesis Supervisor with date
**(Dr. C. UPENDRA)**

**HAREESH A.G.** has successfully given her Ph.D. Oral Examination held on

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Date:

Heartfully dedicated to my FAMILY

# Acknowledgements

First and foremost, I thank my supervisor Dr C. Upendra. His advice and intellectual enthusiasm has enabled my progress on many occasions. His guidance has always been appreciated. I would like to also thank Dr Bharath Kumar, Dr Amarjeet Nayak and Dr Neeraj Mishra for their continued support throughout my research. I am also grateful to Dr Sanjram P. Khanganba (Head, SHSS, IIT Indore) for providing me a suitable environment for research. I would like to thank all the faculty members of the school of HSS for their support and encouragement all these years.

Immense gratitude must also go to my family, mother Kousalya and brother Sastharaj for their constant encouragement and financial assistance without which I could not have completed my PhD work. My wife, Prajitha stood by me over the last few years for which I have no words to express. I would also like to thank my sister-in-law Krishna for being supportive.

My friends Ashna, Jasmine, Smruti, Harish, and Manu deserve a special mention for the moral support on every occasion. It was a wonderful learning experience to work in the School of Humanities and Social Sciences at IIT Indore. I would also like to thank all the staff members of the Central Library, IIT Indore for procuring books and research material I needed for my thesis work.

Hareesh AG
31.07.2018

# Synopsis

## Background and Focus

The relationship between biology and metaphysics has always been agonistic ever since biology advanced as an autonomous science through Darwin in the 19th century. On one hand, this can be viewed as an outcome of biologists' collective efforts to defend the claim that biology is an autonomous and independent branch of natural science. Justification to this claim presupposes the apparent seclusion of biology from not only other branches of science but also philosophy; especially, metaphysics. On the other hand, it is shadowed by the principles of *mechanism* that are culminated in physicalism. The latter aims at determinate knowledge of the phenomena in nature whose only context of explanation is *descriptive*. Metaphysical terminology in fact holds *prescriptive* nature; hence, biologists think it is necessary to disassociate metaphysics from biology in order to attain determinism [in terms of knowledge and explanation]. Not only biologists but also some philosophers of biology express the necessity of biology's isolation from metaphysics. Even some general philosophers of science find it hard to think about the alliance of science with metaphysics, although the deterministic tone of explana-

tion of science is modulated after the fall of positivism. However, the justifications for the centuries-old anti-metaphysical resistance, in philosophy, mostly go on par with the trends in the Mechanistic tradition as well as the *verification* principle of positivism whose main strategy was to eliminate metaphysics. That is, philosophers inclined to the rigidity of conventional philosophy of science still consider that positivism was the marginal end of metaphysics. But, in fact, positivism was not an endpoint but a dividing line between traditional and new metaphysics.

Deployment of self-referential concepts as the decimal points of backward causation, to conquer the fear of infinite regress, was the central strategy of traditional metaphysics. Such concepts are ontologically uncertain *i.e.*, we cannot make any existential claim concerning the underlying entities these concepts refer. Because of this, scientists find difficulty in accommodating them in the descriptions of the world. For science, all phenomena fall within the boundary of causation and there could be no phenomena without a reason. The terms or concepts in any scientific explanation must fit into the framework of the context of explanation. That means, an account of a particular phenomenon rightly describes it and the terms/concepts it used in the description must have an independent explanation outside of that description. On the contrary, traditional metaphysics relies on the *a priori* concepts to explain phenomena in nature. The *noumenal* (things-in-themselves) nature of such concepts is devoid of any explanation,*i.e.,* they exist with complete independence [mind independent]. We must understand that the anti-metaphysical claims which follow Mechanistic/positivist schemes generally target this *noumenal* nature of concepts.

The anti-metaphysical movements have gained a rapid momentum, after Descartes, through Mechanism (Mechanicism, for Dupre 2017) in the natural phi-

losophy. The philosophers of science, especially the rigid group, restored the momentum by igniting it with 'reduction' and 'downward causation'. It is remarked that up until 50 years ago, the philosophy of science was actually the philosophy of physical science (Takacs & Ruse 2013, 5). This is pointing towards another fact that biology was marginalized as secondary science. Mechanism and physicalism both have tried to restrain biology within the limits of determinism. One may wonder by realizing that biology was not recognized as a unique science in the framework of natural science and this was mirrored in the philosophy of science.

All these lead us to the point that successful theories of physical science have sewn the determinate shroud of science. Determinism has played a major role in shaping the anti-metaphysical thought in science and philosophy. The possibility of determinism indeed is subjected to the compartmentalization of phenomena, *i.e.*, the creation of definite boundaries of explanation in science. This strategy is visible even in the early Mechanistic biology of Descartes. Based on the functional analogy he put forth the machine metaphor: *organism-the machine*. In such similar efforts in the later periods, we can see Mechanists attempt to isolate instances from their history. 'Reductionism' and 'downward causation' are essentially the markers of constructed boundaries of natural phenomena.

The realist assertion-condition in general philosophy of science supposedly states that theories/explanations based on the aforementioned principles are true in their descriptions of reality. The underlying belief with this kind of claim is that the boundaries of objects/phenomena, which science accredits, display the genuine joints in reality. Unlike the case of physical science, one cannot easily mark the boundaries of *explanation* in biology. This is so because biology is bound by its history; in other words, the understanding of organic life does not

have isolated instances. It carries its history along with its explanations. That means the condition of existence, of biological entities, play a significant role in biological explanations. Taking this into consideration, it is argued here that instead of downward causation one can appropriately rely on backward causation in biology [historicity]. This historical relatedness plays a key role in understanding the metaphysics of science. The best way to establish this claim is to study the entities which are theoretically important in science. Successful scientific theories are *ontologically* committed to the existence of entities they describe. Some theories postulate entities exhibiting *ontologically indeterminate* nature. In such case, all the interpreters of science may not assert the validity/truth of a particular theory. Some of them express skepticism over the claim that the theory rightly describes the reality 'out there'. The indefinite nature of existence of such theoretically important entities calls for another discussion of the metaphysics of science. Broadly speaking, the ontological aspect of entities described in scientific theories is the carrier of metaphysics.

The ontology of scientific theories possesses entities other than physical or observable entities. Based on this, some philosophers have been "forced to admit that nominalism is too austere an ontological doctrine to do justice to science" (Sober 1981, 147). Nominalism thus responds to realism in such a way that there are no such entities, say, for instance, *gene*, exist in nature; such concepts are names used for pragmatic purposes. This kind of anti-realist claim cannot be true entirely because successful scientific models support the theories which talk about unobservables. Of course, our sense organs play significant roles in framing our ontology of the world. However, the belief that they are the only reliable means is wrongheaded. Getting back to ontology, it is commonly believed that ontology is the forgotten or repressed element in our present-day philosophy is what science

borrowed from philosophy (Grosz 2002, 38). The point is that ontological aspects acquire more attention than the mainstream metaphysics in scientific theories. It is remarkable to note that the metaphysics of biology, both in its philosophical and scientific outlook, has been shaped by the ontological aspects of biological entities.

Even though biology confronts an inherent dialectical situation, it holds a pride of place in natural science and gets more philosophical attention nowadays. The dialectic is that "on the one hand, it is a marginal science since the biosphere forms no more than a tiny part of the universe; on the other hand, it is central because it deals with what counts most-life, including human life" (Possenti 2002, 38). Once we start talking about biology and its metaphysics, it is inappropriate omitting the three philosophical approaches-Aristotelian, Cartesian, and Kantian-to the problems of life (Weber 2018). Their contributions are phenomenal to biology [*natural philosophy*] in its pre-scientific phase. Aristotle addressed the problems of life by explaining the condition and nature of existence of living things; his biological explanations are *vitalistic* because of the supposition of the inner principle of Soul. Descartes' mechanistic biology came into the picture by abandoning the vital elements of Aristotelian biology. He addressed biological issues with Mechanistic principles because, for him, organisms are analogous to 'mechanisms'. In Kantian biology, organisms were considered as organizations with default formative power. These thinkers were more concerned about the existential aspects of living things; hence, we can tie them together with the thread of ontology though they belong to different epistemic traditions.

Pre-Darwinian biology was mostly concerned about the *dependent-relation* of phenomena and most of the biologists in that tradition had possessed a belief on

the necessity of an ultimate ontological ground. The general trend in the philosophy of biology, *i.e.,* bracketing pre-Darwinian biology as *creationist*, reveals that the pre-Darwinians had an implicit goal of exploring the 'where from' aspect of the biological phenomena. From Aristotle to Lamarck through Linnaeus and Erasmus, the necessity of a metaphysical grounding is implicit in their accounts of biological phenomena. This can be seen as their persuasion towards the explanatory dependence on a *prime cause*. This belief on the necessity of *ontological dependence* has been expunged by Darwin through his evolutionary chance explanations. He had substituted teleology and the prime cause by *chance* which is the prerequisite epistemological condition of his theory. Chance is not an antonym of cause because it is implicit in evolution theory that there is cause but it is tentatively indeterminate. Darwin had abandoned or removed the traditional metaphysical aspects from biology but at the same time he, like other naturalists, opened up the possibility of a different kind of metaphysics in biology. The collective efforts for the rejection of metaphysics in modern science were actually setting up a scenario where ontology plays a substantial role. This is the second context of metaphysics in science corresponding to the post-positivist metaphysics in philosophy. The focal question of this new context of metaphysics has been framed ontologically and it is, 'what there is'. Ontology is the study of the entities and their conditions of existence. Philosophers who were concerned about the biological issues were already in place. The analysis of issues in biology concerning its concepts helped us in understanding how metaphysics was rejuvenated in philosophy and science after the fall of the traditional metaphysics.

If we pose the ontological question 'what there is' in the context of biology, it is hard to deny the existence of life and species because successful theories like evolution theory have committed to their existence. While addressing the above

question a biologist will definitely utter "Yes, there is life and species". The ontological investigation does not end up with this; it goes on to the next level by asking the conditions of existence of life and species. Biologists face difficulty in addressing this task. Having a determinate answer to this second level of ontological inquiry is a hard task. A determinate answer is beyond imagination. This is so because the aforementioned concepts are representing some real underlying entities whose condition of existence is beyond our reach. This mind-independence condition is actually the seat of metaphysics in biology.

As noted above, metaphysics was rejuvenated in science through ontology which is an unavoidable part of it. In the new phase, the aspects of metaphysics come with the investigations of ontology [*condition of existence*] of phenomena. The analysis of the three important concepts in biology, *i.e.,* life, organism, and species, and the ontological discussions about them has re-explored the nature of metaphysics in the [evolutionary] biology. In addition, it became clear that the metaphysics of biology rightly mirrors the metaphysics of science. The thesis is concerned with these entities because they are the fundamental pillars without a unique definition in biology. Without these concepts, biology will cease to exist. Analysis of the ontological issues of these entities has revealed that there is an undeniable relation between ontology and realism in biology. A proper philosophical idea/thesis was required to assert such a relation. The choice of 'ontological realism' *prima facie* attests to the relation between ontology and realism. Hence, the discussions in this thesis stemmed from the ground of ontological realism. Ontological realism, here, is explained as a doctrine that argues for the independent existence of ontology of entities postulated by successful scientific theories.

# Focus of the Study

How can we understand metaphysics in post-Darwinian Biology? Does metaphysics in contemporary biology differ from that of pre-Darwinian biology? Could evolution theory still be the subject of philosophical reflection? As there are innumerable works discussed the philosophical issues in Darwinism and evolutionary biology, these questions may seem old-fashioned. But the striking feature is the deep metaphysical [and ontological] outlook Darwin applied in describing the process of evolution. Holistically, evolutionary biology has avoided discussing what life is, what species is, or even what an organism is. The explanations of each of this biological phenomenon/entity are interrelated; each one logically presupposes the true description of the other two. However, that kind of explanatory relatedness is missing in biology concerning life, organism, and species. It is easy to avoid metaphysical essentialism- what makes something what it is – from biology; but it is not that easy to abandon the ontological dependence of biological phenomena/entities. This is agreeing with what Dupre opines, "Metaphysics can be ignored but not escaped" (2017). Biology or science in general cannot itself address our urge to understand the fundamental ground of reality. "Does science leave anything to philosophy when they "spin off", and if so, why do they leave unfinished business to philosophy?" (Rosenberg & McShea 2008) Historically speaking, science seems to leave some questions or issues to philosophy (Smith 2016). Biology too has left some unavoidable but inherently ambiguous questions, for example, what life is, what is the ground of human nature, what is species, etc. If biology cannot answer these questions, why do such questions exist? This is so because biology and its successful theories in specific use these concepts in their explanations. Are some facts of the biological world beyond

the reach of science? These are the questions that inspired this study on the metaphysics of biology.

Having said these, the focus of this thesis is restricted specifically to the metaphysics of biology concerning ontology of life, organism, and species. In specific, the goal of the thesis is divided into a) locating the root cause of metaphysics in evolutionary biology, b) finding out a philosophical doctrine that reflects the metaphysical aspects of evolution theory while endorsing its success and c) extending the possibility of this philosophical doctrine to the general metaphysics of science. The current inquiry will be characterized by a theoretical manner of linking together biology and metaphysics: it will be a matter of delving deep into the question as to what retains the aspects of metaphysics in biology though it gained autonomy in natural science after Darwin. In what follows the purpose of this study was to look in to the possibility of metaphysics in evolutionary biology. A special care is taken of some clichés that assign metaphysical commitments to science, in general, and to evolution theory, in specific, and above all, evolutionary indeterminism.

# Chapters

The thesis offered a non-*mereological* explanation of ontological realism that accounts for the philosophical issues explicit with the concepts - life, organism and species- in biology. Taking this for granted, it picks out the hybrid, epistemico-metaphysical, nature of ontological realism and acknowledge the influence of ontology over the theoretical pursuits the aforementioned concepts possess in biology.

At large, the work contributes to the emerging discussion of the metaphysics of science via exhibiting the importance of ontology in the post-positivist understanding of metaphysics. The arguments concerning category, conditions of existence and intractability are combined which altogether lead to a relatively novel understanding of ontological realism which mirrors the metaphysics of science. The thesis then has one philosophical doctrine, ontological realism as target in its study of the nature of metaphysics in biology. The thesis is divided into four core chapters with a prologue and an epilogue.

In the first Chapter, "Evolution and Ontological Realism", the idea of 'ontological realism' is discussed as a prelude to subsequent chapters. The discussion began by noticing that the reality claims; whether something is real or not, concerning life, organism, and species hold a bigger share in the philosophy of biology. The reason behind this is that they are the *unobservables* widely described in successful theories like evolution theory in biology. It became clear that the reality claims are linked to the realism-antirealism debate concerning theories in the philosophy of science. The question of whether life/species/organism is real has implicit ontological purports. It is linked with the existential claims of realism or antirealism concerning the entities/phenomena described in scientific theories. The relation between ontology and realism is unveiled and to foster such a relation the philosophical doctrine of 'ontological realism' has been used. Analysis of the conceptions of ontological realism, which are in play, revealed the fact that they are inclined towards *meta*-ontology. Also, a different understanding of the relation between ontology and realism was required than the conventional relation put forth by historical ontological realism. The chapter raises the possibility of connecting ontology to realism by emphasizing the undeniable relation between *the condition of existence* and the *mind-independence* of unobservable entities/phenomena pos-

tulated by evolution theory. Ontological realism hence conceived as an idea that addresses the indeterminism concerning the condition of existence of entities, in scientific theories, while endorsing the success of such theories.

In the second chapter, "Darwinism, Life, and the Metaphysics of Biology", the focus was laid on the ontological issues regarding life. A detailed account of the ontological issues in evolutionary biology concerning life has been provided in general. The discussion was centered on Darwinism to address the higher order questions related to life. The concepts of 'common ancestry' and 'tree of life' necessitate the evolutionary debt in addressing life. In order to justify this, arguments for evolutionary indeterminism concerning life-dependent features (mind and consciousness) have been examined. It has led to the point that the reason for the persistence of indeterminism concerning life-dependent feature lies in the fact that the fundamental questions of life are not addressed in evolutionary biology. The chapter illustrates the speculative account of the presupposition Darwin might have had in his mind, concerning life, before the initial development of his theory. It is then argued that the hypothesis would perhaps be that 'life is a given fact' in nature. Further, it specifies the ontological nature of Darwinian hypothesis. The importance of chance in evolution theory was also taken for granted and it explores the metaphysical possibilities concerning the condition of existence. An exploration of the issues regarding the category of life is also included, and this shows the levels of metaphysical aspects one meets while engaging with ontological issues of life. The chapter underlined the fact that indeterminism, in the epistemology of Darwinism, resulting from the independence of the ontology of life is one among the root causes of its metaphysics.

In the third chapter, "Immanence and the Ontology of Organisms", an elab-

orate account of the ontology of organism is given. Organism as an operational concept does not harm biologists and philosophers but the questions about the ontology of organism make them wounded with the embers of metaphysics. The reason for this lies in the indeterminism which conjoins to the question what entities qualify as an organism?' There is no accurate definition of organism both in biology and in the philosophy of biology. This lack of an all-encompassing definition creates the difficulty of understanding organism itself. The primary task was to reveal the ontological indeterminism in philosophy and biology while untying organisms from mechanisms. The discussion also takes note of an account of the varied nature of organismic activities. An organism differs from a mechanism in its activities; the dichotomy of organism/mechanism thus plays a central role here. It is noted that both causality and teleology concerning organism express the intrinsic nature. That is, the causal inquiry goes inwardly into the organism. Organismic actions are contra-Newtonian in nature. They come 'from within'. Unlike this, mechanistic actions are extrinsic because they require external intervention in order to function. With the help of some examples, the chapter established the ontological difference between organism and mechanism despite the needlessness expressed of its distinction. The realization of the 'from within' nature of organismic activities instigates us toward the possibility of an organismic internal state where the actions are generated due to inbuilt reasons. An analysis of the philosophical concept of *immanence* conveys that immanence is a state in nature where two entities or phenomena act symbiotically to manifests themselves differently. This is analogous to that of the organismic state where actions come from within. This internal condition, immanence, is the ground of varied organismic existence. However, we are not able to determine such an internal condition. This endorses that the condition of existence of organism is independent of our understanding.

In the fourth chapter, "Species, Ontology, and the Intractability Issue", the focus is laid on the metaphysics concerning the *ontology of species*. Species is the foundational concept that retains the ontological issues in biology. Historically, Darwin had taken a radical step in biology to vindicate the existence of species through the evolution theory. The species, given evolutionary perspective, became a real entity in nature. The evolution theory, at the same time, had established the fact that species can be understood in two ways, *i.e.,* as a Linnaean 'category' and as the empirical 'taxa'. The absence of a unique definition or concept of species is an ever persisting ontological issue in biology. Noticeably, there are at least two dozen species concepts and corresponding definitions in the literature. The apparent disagreement over the available definitions or concepts of species is collectively called the 'species problem'. Both realists and anti-realists have their stands on the species problem and these concerns actually make us think about the ontology of the 'real'. This chapter analyses the opinions of realism and anti-realism on species in order to shed light on the ontology of the real. After the substantial discussion of the realist issues of species, the chapter gives a brief overview of the two way ontological practice in biology. If metaphysics is considered as the heart of philosophy then, ontology is the heart of metaphysics (Lowe 2006, 3). In general, ontology is historically bound with metaphysics in all the ways. Noticeably, with its usage in some current biological practices, the term ontology has lost its inherited meaning as well as the metaphysical inclination.

In the fifth chapter, "Life, Organism, and Species: Gaia Hypothesis and Anthropocene", the discussion provides an understanding of the ontological issues regarding life, organism, and species through *Gaia* hypothesis and *anthropocene*. It is, in fact, an extra-biological analysis of the problems of the earlier chapters. The *Gaia* hypothesis underlines the fact that both life and organism possess an

indeterminate ontological nature in their existence. On the one hand, it attempts to say that life is conditional to Earth; on the other hand, it argues that earth itself is an organism. The proponents of *Gaia* too did not address the fundamental questions of life and their conception of the superorganism is modeled the concept of organism in biology. The problem associated with life and organism, in *Gaia*, is similar to that of biology. This specifies the fact that the aspects of metaphysics in biology and *Gaia* are rooted in the same ground, *i.e.*, the indeterminate condition of existence. Through an account of *anthropocene*, the chapter points out the ontological issue associated with a particular species taxon [Homo sapiens]. At large, it brings the ontological issues concerning species taxa into the light. The varied nature of human beings is the root cause of the *anthropocene* worries that nature drastically changes due to human interventions. This argument demonstrates the ontological difference between human beings and the rest of nature. Through such explanations, the chapter also illustrates the evolutionary leaps in nature.

The conclusion chapter, "Towards the Metaphysics of Science", assimilates all arguments made in each chapter focusing on the contribution of the thesis. The thesis addressed basically three issues in general; the 'metaphysics of science', 'levels of metaphysics in biology', and 'ontological realism'. An emphasis has been given to one aspect of ontology, the condition of existence, in order to legitimize the relation between ontology and the mind-independence aspect of metaphysical realism. It portrays how the conception of ontological realism discussed in this study accounts for metaphysical issues in biology without harming its scientific status. It also points toward the nature of metaphysics of contemporary science in general. The concept of ontological realism, which has been proposed in this thesis, not only accounts for the tentative indeterminism due to the intractable

ontology of entities postulated by scientific theories but also retains the epistemic utility of such theories. Ontological realism seems to be a stage in the epistemology of science signifies the tentative indeterminism; a half-way stop of realism; or, a position in the scientific progress towards the revelation of the real. Neither science nor metaphysics describe the world at its entirety. There is no successful 'theory of everything'; absolutism is impossible. The work then comes to the conclusion that science can accommodate metaphysical assistance in its endeavor to carve the nature at its joints. This justifies the reliability of successful theories which postulates the existence of entities with an intractable ontology.

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## Publications & Conference Presentations

1. Hareesh A.G & Upendra C (2015) "The Anthropocene: Call for an Ontological Unity in Nature". *Humanities Circle*. 3 (2). pp. 101-114. Indexed: UGC [*Print Journal*]

2. Hareesh A.G (2018) "A Note on 'Two-Way' Ontological Practice in Bi-

ology". *Dialogue-Phi Sigma Tau Honor Society Journal.* 60 (2-3). pp. 164-170. [*Print Journal*] Indexed: *The Philosopher's Index*

3. Hareesh A.G & Upendra C. "On the Intractability of the Ontology of Species". *Socrates.* 5 (3). pp. 29-39. [*Print & Online Journal*] Indexed: *UGC, Harvard Dataverse Project, PKP Index, Dialnet, under consideration of SCI and SCOPUS.* **Imp. Factor -0.765.**

4. Hareesh A.G (2016) "Review of Michael Ruse's *The Gaia Hypothesis: Science on a Pagan Planet*". *Gauhati University Journal of Philosophy.* Vol.1.1 [*Book Review*]

5. Hareesh A.G (2018) "Relocating Philosophy's 'Meta' Position – Review of D. L Smith's *How Biology Shapes Philosophy New Foundations for Naturalism*".*Gauhati University Journal of Philosophy.* Vol.2. Issue.1. [*Book Review*]

1. Hareesh A.G & Upendra C. "Realism through Relativism: Looking at the Possibility of Metaphysics in Species Problem". *Pensamiento.* [**Under Review**]

**Presentations** [ 1.] 2017 January 6-8: A paper titled "Organismic Activity and the Invariability of Ontological Realism" at PSGI Workshop-Concepts in Philosophy of Science: Confirmation and Realism, IIT Kanpur. [ 2.] 2015 January 22: A paper titled "Should Naturalism be Eliminated from Ethics?" at UGC Sponsored National seminar on Theorising Ethics: prospects and Challenges at SKV College affiliated to Calicut University, India on January 20 - 22, 2015.

# Contents

# Chapter 1

# Evolution and Ontological Realism

'It is not simply life on Earth, but this planet itself is an organism.' James Lovelock makes this thought-provoking claim in his *Gaia* hypothesis while dealing with the philosophical aspects of biology. Such a claim may appear *irrelevant* for many biologists; however, it provides loaded ontological insights to philosophers concerning evolution. It also provides a philosophical ambiance to discuss the inherent issues in biology. Inquiry concerning the philosophical aspects of such a claim brought back to the realization that it has deep-rooted epistemological and metaphysical implications. Its explicit ontological claims on life and organism have a great impact on the concept of species. Scrutiny of the literature makes us clear that the fundamental concepts such as life, organism, and species retain ontological issues in biology even in the post-Darwinian period. There are biological and philosophical disagreements over different aspects of life and species; biologists

differ on the definitional issues while philosophers contradict each other on the ontological issues. The ontological issues associated with the organism are bound with the historical dichotomy of organism and mechanism.[Throughout the thesis mechanism with 'm' indicates machine while mechanism with'M' signifies the mechanistic tradition]. Each of these above biological concepts in itself can stand as an independent research area; it was highly necessary to bind them with a common philosophical thread in this thesis. Concerning some seminal works on life, organism, and species (to quote some, Possenti 2002; Sterelny 1995; Wolfe 2010, 2011, 2012, 2014; Wilson 2000; Stamos 2003; Slater 2013; Hull 1976; Kitcher 1984; Mayr 1998; Stanford 1995; Lehman 1967; Ereshefsky 1998; Ruse 1987; Richards 2010; Ghiselin 1974), it became clear that there is an undeniable relation between their ontological issues, and the realist concerns. A suitable platform that legitimizes this relation is evolutionary biology. From the evolutionary point of view, ontological realism would be the finest thread that can tie issues related to life, organism, and species together.

Debates concerning the reality of entities postulated by evolutionists hold a bigger stake in the philosophy of biology. The foundational entities (life, organism, and species) in biology do not exempt from the specter of such reality claims. The question of 'whether biological entities such as life, organism, and species are real' has substantial theoretical and empirical implications over the argument that evolution theory is a successful scientific theory. Specifically, evolutionary biology has implicit ontological commitments toward the existence of these entities. This work focuses on the reality of such biological entities to give a satisfactory justification for the success of evolution theory which postulates their existence and to account for the metaphysics of science in general and evolutionary biology in specific.

Time and again we confront with claims in the philosophy of science which confirm or deny the existence of entities postulated by scientific theories. Based on the nature of such claims, the interpretations of science are divided into two *i.e.,* realism and antirealism. The primary aim of this categorization is to justify whether a particular scientific theory is true concerning its ontological commitment toward the entities it explains. Noticeably, there is a tremendous increase in the discussion of the reality of biological entities corresponding to the recent resurgence of the philosophy of biology. Decades ago, physics (physical sciences) dominated in the philosophy of science (Takacs & Ruse 2013). The reason is that biology made a late entry as a natural science. People argued that biology became a true science only in the nineteenth century, though it has a vast history since Aristotle (Mayr 1982). The specific event that has transformed the status of biology as a scientific enterprise in natural history or natural philosophy was the publication of Darwin's *Origin of Species* in 1859. The evolution theory has offered a theoretical base to the science of biology and which is explicit in Dobzhansky's proclamation – "Nothing makes sense in biology except in the light of evolution" (1973). One may diagnose this evolutionary fever even among contemporary philosophers of biology. They are keen to discuss issues related to evolutionary biology; even traditional philosophical puzzles were analyzed through an evolutionary biological point of view (See D. L Smith 2016, Bunge 1997). It seems evolutionary biology is a fertile domain which supports philosophers who look towards a pluralistic perspectives of reality.

The analysis of reality claims concerning life, organism, and species begins by posing the question that presupposes any discussion of realism and antirealism controversy. The question related to this is, "[d]o scientific theories provide us with genuine insights into the causal structure of the world or do they merely pro-

vide useful models for organizing observable phenomena into coherent patterns?" (Shanahan 1996, 449; emphasis added). Realists assert that the theories do give us insights while antirealists often possess skepticism over such a realist assertion. For antirealism, revealing the hidden structure of the world is out of the ken of scientific theories, so this shows that antirealism has an inherent inclination toward mind-independence. However, the claims regarding mind-independence of the world and the possibility of knowledge of such a world are often conflated under realism (Jenkins 2005, Vineza 2001). In general, there are two types of reality claims in play concerning realism and antirealism. One asserts the reality of the existence of unobservables, along with observable, and the other rejects it. The 'reality claim' here means those claims which either assert or negate the reality of the existence of things. They aim to show whether something is real or not.

To understand the role of reality claim in the philosophy of science, we need to consider what realists say in their explanation of scientific realism (hereafter realism). Realists have a "positive epistemic attitude toward the content of our best scientific theories, recommending belief in both observable and unobservable aspects of the world described by the sciences" (Chakravartty 2017, n.p.). They emphasize the existence of entities described in those scientific theories. That means the structure of the world is investigation dependent. Here, realism links itself with the *real* aspects of the existence of entities. It means that the entities postulated by scientific theories exist really in nature. Antirealists, on the contrary, maintain a belief that the use of scientific theories does not indicate that they are correctly revealing the underlying structure of the world. It seems, for antirealism, the reality is investigation independent like the *thing-in-itself* in Kantian philosophy. The antirealist's reality-claim is that unobservables in the scientific theories may not be real in most of the cases. The strong version of

antirealist criticism of realist claims indeed comes with the denial of the existence of unobservables. In fact, this is the most celebrated anti-realist argument against realism in the philosophy of science.

Irrespective of the variety of reality claims, the discussion here engages with the reality claims only of those entities that are postulated by evolutionary biology through Darwin's theory. The question that immediately arises is that why is the concern of *reality* important. Addressing the question requires answering the following questions. Does reality matter? And if yes, what is the sense of it? Philosophers and scientists concur that their inherent goal is to unveil the reality at its joints. Nevertheless, they have different opinions on the criteria of reality. It is even possible that a philosopher of science may be a realist in some aspects and at the same time antirealist in some other aspects. For example, one may assert the reality of electron while denying the reality of species and *vice-versa*. The reason is that there exist *inter* and *intra* subjective disagreements over the boundary of reality. Life and species do not have concrete references. Hence, both antirealists and positivists may argue that they do not exist. In fact, they are the foundational pillars of biology. Their quasi-empirical (unobservable) nature causes them to remain undefined in biology. This indeterminism creates skepticism over the scientific nature of the evolutionary biological explanations. The argument for the metaphysics of evolutionary biology thus stems from this skepticism. Of course, there are other equally important ways to portray metaphysics in biology, but the articulation of metaphysics through indeterminism concerning entities and phenomena postulated by evolution theory reflects the metaphysics of science too. The post-positivist metaphysics of science has a link to the existential claims of entities explained in scientific theories. The pertinent question is 'what there is' than 'what it is.' If the question 'what there is' is asked in the context of biology,

the answer without life, organism, and species makes it incomplete.

Life is a 'phenomenon' in nature (Possenti 2002); however, one cannot affirm its existence by relying on the empirical means. It is the dilemma of life in biology. Biologists logically argue for the independence of biology from physical sciences by demonstrating the uniqueness of living beings, yet their logic fails to prove the existence of a causal factor that underlies the uniqueness of that which is living. Biologists possess an inherent belief that there is a causal factor that differentiates the organic from the inorganic in nature, though they are incapable of illustrating its existence. Whatever the cause might be, they fail in their attempts to prove the empirical existence of this underlying causal factor of the biological phenomena. One may find such a situation even in Darwin's explanation of evolution theory where he argued that all organisms are stemmed from a common ancestor and illustrated it with a metaphor of the *tree of life*. The ultimate common ancestor, the germ of the tree of life, must be the one on which life first appeared on Earth. At a certain point of history, there happened a transformation that inorganic turned out to be organic. Such a transformation is logically possible if and only if something added to the inorganic matter. And this added thing or element is the causal factor of the uniqueness of living things. One can claim that there is nothing wrong in naming this underlying causal phenomenon as 'life.' Anti-realists; like van Frassen 1980, Poincare 1913, may claim that 'life' is a fictional term used for the convenience to interpret our observations. Even if they are right, such a claim will not abandon the possibility of an underlying phenomenon that separates living things from the inert matter.

Life is not an object of both aided and unaided perception, but the life-induced matter is. One may fail to address the possibility of knowledge of life

through material means in biology. What justification do biologists provide for the use of 'life' in their explanations? To address this question, let us consider the concept of evolution in biology. Evolutionary biology offers a naturalistic explanation of how species originate from the previous ones. Such a change biologists call as evolution. The concept of evolution becomes sensible only in the contexts of biology. Of course, some people talk about cosmic evolution but in such cases, evolution is simply reduced to development. In fact, evolution has a broader sense than development in biology; it is a kind of selective development. All these specify that evolution is a specific aspect of life. Darwin's theory talks about this aspect of life. If a particular phenomenon or an entity does not truly exist in nature, it is logically impossible to have a successful naturalistic explanation of its aspects. The point is that evolution theory has an inherent presupposition of the reality of life like the presupposition of the reality of numbers in the number theory.

Another concept that brings a similar kind of difficulty in biology is species. Evolution theory has an ontological commitment towards the existence of species. The origin of species is that the theory all about. Unlike those who argue that Darwin was a species nominalist, there is a strong reason to argue that he is a realist of species. The reason is that one cannot put forward a groundbreaking naturalistic theory, like evolution theory, if the phenomenon or entity it talks about does not exist in nature. Both 'species' and 'life' are concepts with definite reference out there in nature; to understand their existence one needs to rely on both empirical observation and reasoning. The knowledge of these entities consists of both empirical and non-empirical aspects. The objects of observation in both the cases are organisms which are concrete empirical entities. In the non-empirical realm, the reasoning comes in the form of 'abduction,' *i.e.*, inference to

the best explanation (Harman 1965). Abduction has two different aspects with respect to its historical and modern uses; "in the historically first sense, it refers to the place of explanatory reasoning in generating hypotheses, while in the sense in which it is used most frequently in the modern literature it refers to the place of explanatory reasoning in justifying hypotheses" (Douven 2017). In the above cases, abduction comes in the second sense and which we can call as 'inference to the best explanation.' These altogether not only create a space for unobservables in natural science but also legitimize the possibility of the knowledge of them.

In all the different branches of biology, no single field omits the use of 'organism' in its explanations. An organism is a concrete entity that we can perceive with unaided sense organs. However, there is no 'model organism' that exhibits all the characteristics of different organisms on earth. Biologists and philosophers since the Mechanistic tradition have offered different ontological claims concerning organism. The concept of 'organism' seems to be a metaphor used in biology to indicate the life-induced material entity. The ontological claims of organism come in comparison with its opposite, *i.e.,* 'mechanism.' Biologists rely on the unique nature of organismic activities to exhibit the ontological difference between organism and mechanism. Noticeably, they are still silent on the cause of this organismic uniqueness. On the one hand, the varied nature of organism justifies the ontological priority of an underlying phenomenon (say 'life'); on the other hand, it points toward the difference in their condition, *i.e.*, mode of existence in nature. It is to note that life, organism, and species are meaningful concepts in biology and the success of explanations and theories which use them justifies our belief in their reality. Among them, life and species represent unobservable phenomena while organism represents an observable entity. Their condition/nature/mode of existence possesses independence from our capacity to understand it.

The kind of reality claim we hold concerning successful scientific theories shapes our conception of the ontology of the world. Those who believe that evolution theory is a successful scientific theory in biology should believe that life, organism, and species exist really in nature. An appendage prerequisite condition associated with this claim is that one must not reduce the concept of existence into concrete/empirical existence. Otherwise, it is impossible to think that the evolution theory describes reality truly while holding the belief that only concrete entities exist in nature. One should accept the fact that there is no unique kind of condition of existence in nature. The question ' whether species is real' has an inherent ontological purport than the epistemological one that coupled with it. It presupposes the ontological assumption implicit in the claim that a particular scientific theory, say evolution theory, is true in its description of reality (Chakravartty 2017). It supposes that entities the theory talk about really exist. That means the theory addresses the basic ontological question 'what there is' in the context of evolution. It is also clear that there is a determinate relation between such realist claims and their implicit ontological purport.

Darwin's theory talks about organism and species concerning evolution. So the success of evolution theory indicates that both organism and species exist really in nature. We can add the argument for the ontological priority of life; we discussed already, to this and then modify our claim as life, organism, and species all exist in nature. Here, ontology maintains a relation to realism. A philosophical idea/thesis is highly required to assert the connection between ontology and realism. The first and foremost idea that comes to a philosopher's mind is 'ontological realism' which syntactically exhibits such a relation. Nevertheless, ontological realism in its conventional sense does not assert the connection between ontology and realism in this way. A common consideration is that onto-

logical realism is a "belief that the physical universe exists in full independence of our capacity to investigates the nature of its existence" (Clark 1984, 482). In this explanation, the part 'physical universe exist' comes under ontology and 'full independence' under realism. What it asserts is that the physical universe has a mind-independent existence. The general concept of existence is connected here with the 'mind-independence' aspect of metaphysical realism. It is substantial to unveil the possibility of a new understanding of ontological realism by associating realist claims with implicit ontological assumptions in a unique way. On the one hand, we have to rely on realist claims while endorsing the 'independence' condition of the entities put forwarded by the evolution theory, and on the other hand, we have to connect these aspects to ontology. The reason is that we are concerned about the underlying phenomenon or entity, the referral points of life, organism, and species, whose condition or nature of existence is beyond our grasp. In this way, we address the metaphysical element associated with the indeterminism caused, firstly, by the unobservable or indeterminate nature of life and species and, secondly, by the causal condition behind the unique organismic activities. Before getting deep into such discussions of the possibility of a new articulation of ontological realism, it is required to disseminate some associated claims which generate metaphysical discussions about successful scientific theories in general. For that, we focus on the general principles of two types of realist claims -scientific realism, and metaphysical realism – as well as the antirealist responses to them. A relatively new conception of ontological realism will germinate from the niche created by the discussions of those different reality claims.

## 1.1 Metaphysical Realism, Mind-Independence, and Biology

Metaphysical realism is the thesis that "objects, properties and relations the world contains exist independently of our thoughts about them or our perceptions of them" (Khlentzos 2016). For Hilary Putnam and J.J.C. Smart, it is the doctrine that "an ideally well supported general theory of the world may still be quite radically wrong in its overall structure and ontological presumptions" (Smith 1986, 158; emphasis in original). John Nolt (2004, 71) also noted that it is the "claim that the world has structure that would exist even if our cognitive activities never did." All these definitions explicitly assert that 'independent existence' is the spine of metaphysical realism. A brief understanding of mind-independence would substantially help us to link metaphysical realism with science. The traditional metaphysical realist presupposition is that true existence is mind-independent (Khlentzos 2016).

Let us see how the notion of mind-independence comes in the framework of the philosophy of biology where we discuss the ontological difference between organism and mechanism. What is the principal point of mind-independence? It is difficult to answer this question in a single stretch because on different occasions metaphysical realists talk about mind-independence differently. Consider the statements 'an organism [jelly fish] has mind-independent existence,' and 'an artifact [Vaucanson's duck] exists mind-independently.' In the first statement, the 'mind-independence' indicates that it is the case that the existence of an organism does not require the existence of minds. Even if there is no mind at all, the organism [jelly fish] exists. It is not a creation of the human mind, *i.e.,* not

a projection of our imagination. We may call this kind of mind-independence 'complete mind-independence.' The metaphysical realism eradicates the idealist claim that whatever exists, exists in mind (Guyer & Rolf-Peter 2018). In the second statement, the artifact or mechanism [Vaucanson's duck] is a material entity that has an existence independently of our mind; however, it is ontologically dependent on the existence and imagination of a human subject [for example, Jaques de Vaucanson]. It is a human creation. It has its origin first as an idea in the human mind, and later the idea gets materialized through, in Aristotelian terms, an efficient cause. We may call this kind of mind-independence 'partial mind-independence.'

The noticeable point is that the characteristics of a mechanism or an artifact are causally dependent on some external factors; while in the case of an organism, its characteristics are shaped by 'nature,' *i.e.,* by itself. The 'nature,' here, is in agreement with Possenti's concept of *nature* explained in "Nature, Life, and Teleology" (2002). Nature is the inner principle of movement and life; it exists within natural beings. It is an intrinsically analogous concept. He remarked that its central character is of being a principle of auto movement and change from within; the term in *quo est* expresses its inwardness or immanence, which marks the difference between natural and artificial, in the sense that artificial objects receive change from without (Possenti 2002, 42). A mechanism's causal factors possess extrinsic nature so that we can have a determinate, at least approximately, an account of it. Whereas the causal factors of an organism are intrinsic, as a result, our ambition for causal determinism emphatically fails.

Apart from these two, another remarkable sense of mind-independence we see in the statements like 'species exists independently of our mind.' This statement is

a complicated one than the other two. In the earlier statements, we had material objects as references to the organism [jelly fish] and mechanism [Vaucanson's duck]. The word 'species' here does not refer to a concrete entity. How can we then claim for its existence? To make an existential claim of species, we have to rely on biological theories as well as the claims of biologists. As we have noted above, Darwin's evolution theory explicitly asserts the existence of species in nature because, for him, evolution means the origin of species (Darwin 1859). Evolution theory holds pride of place in the post-Darwinian biology. As a successful theory in biology, it has an ontological commitment to the existence of species. Likewise, biologists like Mayr claims that species is a real entity in nature (Mayr 1969, 1996).

Let us come back to the question that how do we discuss the mind-independence of species? For Darwin (1859) and Mayr (1996), species is not a mental construct. It exists outside the mind. It is not a projection of our imagination; rather, it projects itself in nature that invokes our imagination of its condition of existence. It is an extra-mental phenomenon. Species do not have an individual existence. Its existence is subject to the existence of particular instances, *i.e.*, organisms. The 'mind-independence' of species is meaningful only if one realizes that species is dependent on organisms for its existence and organisms have an existence outside the mind. The assumption that generally presupposes the claim for mind-independence of species is that organisms exist 'out there' in nature, so does species. This sort of mind-independence, 'obscure mind-independence', represents the mind-independent nature of those phenomena which have a material inclination concerning existence but exhibit intractable ontological nature. Simply, it is the mind-independence of an entity or a phenomenon which we can experience but cannot explain. They have an obscure kind of ontological nature.

The 'mind-independence' is that which outlines the metaphysics of metaphysical realism. Mind-independence also maintains the belief that theories may not rightly depict reality (see Putnam's view above). Contrary to this, scientific realism argues that what science describes is true (Boyd 2002, Chakravartty 2011). That is, the world is not exactly mind-independent; we can have true or approximately true understanding of it.

## 1.2 Realism, Antirealism, and Implicit Metaphysical Aspects

As we often refer to the evolution theory and the claims in evolutionary biology, in the succeeding discussions, the focus is on the metaphysical aspects implicit in the realist claims. Realism is 'a positive epistemic attitude' (Chakravartty 2017, 2013) toward our best scientific theories, *i.e.*, theories are true or approximately true in their descriptions of phenomena (Chakravartty 2011; Psillos 2005 [1999]), it posits a belief in both observable and unobservable aspects of the world described by such theories (Boyd 2002; Chakravartty 2017, 2013a, 2013b, 2007). Following this, realism can be understood in two ways; as a view about scientific theories and as a view of the world (Psillos 2005). In light of the latter, some philosophers (Devitt 1997) claim that realism is a metaphysical thesis *via* endorsing the reality of unobservable entities. Such a reduction is inappropriate since there are other dimensions of realism apart from the metaphysical dimension. The different aspects of realism are 'metaphysical,' 'epistemic,' and 'semantic' (Psillos 2005; Chakravartty 2017). Other than these three aspects, Putnam (1982) has noticed that there are three kinds of realisms - 'materialism,' 'metaphysics,' and

'convergence.' Instead of elaborating the relative intention behind these divisions, we hold on to discuss the inherent 'metaphysical' aspect of realism.

From the metaphysical point of view, Chakravartty (2017) notes that realism is "committed to the mind-independent existence of the world investigated by the sciences." In a sense, one may even say that the world exists objectively. It is substantial to remember Psillos' analogical description of objectivity regarding mind-independence.

> ...let us consider the case of modern verificationists. They do not doubt that middle-sized objects exist and are irreducibly physical. Yet, they render their reality mind-dependent in a more sophisticated sense: what there is in the world is determined by what can be known (verified, warrantedly asserted) to exist. At stake is a robust sense of objectivity, viz., a conception of the world as the arbiter of our changing and evolving conceptualisations of it. It is this sense of objectivity that realism honours with the claim of mind-independence (2005, 392).

Though analogical, the above description provides a hint about the meaning of 'objectivity' which realism assigns to entities described in the scientific theories. It specifies that we may have different conceptualizations of what a particular (unobservable) entity is and how does it exist in nature. Such individual conceptualizations are relative to our cognitive capacities and are changing. Realism tries to make the case in such a way that the 'knowledge' of an entity, science provides, would be of *general*. The implicit goal of realism, in this sense, seems to be legitimizing the objective nature of knowledge offered by science. The realists of science held the belief that "the aim of science is to provide a true description

of the world" (Okasha 2002, 59). We must not confuse ourselves by relating realism with logical empiricism and positivism. The latter could only agree with those scientific theories which postulate the existence of verifiable phenomena. For instance, a positivist or an empiricist may agree with paleontological theories which successfully describes or interprets fossil records; while, they may not agree with any modern physicist's theory which asserts the existence of unobservable entities like electron or quarks. Realists, unlike them, express an ardent belief on the existence of both observable and unobservable entities described in scientific theories. The metaphysics of realism then comes in two ways; either by addressing what a particular (unobservable) entity is or by accounting for the existence of such entities.

A successful scientific theory indirectly exhibits 'what there is' in addition to what we already know what there is in the world. For example, evolution theory rightly demonstrates the existence of species. A deeper understanding makes us realize that metaphysics, at first glance, comes in the form of ontology in realism. It links with the claims of the existence of observables [organisms, fossils, etc.] and unobservables [species, genes, etc.]. The discussion of metaphysics in realism becomes serious and rigid when we change the focal question from 'what there is' to 'what it is.' The copula that connects these two questions in realism is the condition of 'observability.' Based on this observation, we divide the interpreters of science as realists and anti-realists. The former group believes that science aims to offer a true description of the world while the latter group holds that science provides true description only of a certain part, the observable part, of the world. The word 'observation' here indicates observation through unaided sense organs, *i.e.,* sense perception. On this point, both realism and anti-realism have some common consent, but the disagreement stems from the boundary of science to

provide knowledge.

Considering these conflicting claims, we can ask about the possibility of reliable knowledge of life, species, and the condition of existence of an organism in biology. It is relevant in the context of our reference to unobservables. It is a common belief that the modern natural science has brought a paradigmatic intellectual shift concerning our conception of the world. The traditional speculative or abstract understanding had been paved the way to an organized image of the world based on observation. The truth of such a belief is relative to how does one understand observation. It is to note that there is a general tendency to equate observation with sense perception in the realist and antirealist debates. Observation has a broader sense than perception in science or in the philosophy of science. Science can describe the observable part of reality. From the anti-realist point of view, we cannot find the truth-value of such descriptions even if it describes unobservables. Terms like *species* and *genes* represent the unobservable part of the world and, antirealists claim, are 'convenient fictions' helping us to explain a particular theory of observable phenomena (Okasha 2002, 60-61). The sense of 'observation' in anti-realism is too narrow and resembles the radical empiricist stance of early positivism. Observation can be identical with perception if the latter gives true knowledge of the content of the former. That will not perhaps be the case in most of the time. We perceive a stick to be bent if partly immersed in water. If observation is identical with perception, then the 'bent stick' truly represents the reality. Interestingly, the 'bent stick' does not represent the reality because the stick, in reality, is not bent. The perception of the 'bent' is due to the refraction of light. One can believe that the 'bent stick' corresponds to reality only with the assistance of the understanding of the refraction of light.

An example from biology may clarify the point. Some earlier biologists defend the argument that species are natural kinds by observing the typological nature of organism/group of organisms. On the contrary, some later biologists (Ghiselin 1974, Mayr 1942) proved that species could not be natural kinds because of their evolutionary nature. They use the same observation, but they have gone more deeply to interpret the observable data to conclude that species cannot be natural kinds. They derive support from paleontology and evolution theory. However, we cannot consider such knowledge as an outcome of mere perception. It is an outcome of perception-cum-mental actions. A theory or a description of a particular phenomenon becomes scientifically significant if the "perceptual experiences are guided, interpreted, integrated in a theoretical framework" (Agazzi & Pauri 2000, 1). Perception cannot always be true; the true descriptions of reality sometimes include perception and mental processes. Philosophers of biology irrespective of realism and anti-realism converge toward a common consent over the statement like 'human beings exist' because here the existence is attested by our perception. Human beings are considered as real things because they make an immediate impression of their ontology in our cognitive apparatus. In such cases, the *real* seems to be relative to 'existence' which is relative to sense 'perception.' The claim above brings a minimalist sense of realism. Direct perception connects us to the ontology of the world in a non-mediated way. Claims like 'genes exist,' 'plant/animal cells exist' etc., are also equally realistic in the sense that mediated perception can prove their existence. Adversely, we cannot claim for the existence of genes and cells because they are unobservables. Making any existential claims to any unobservable entity is improper. This latter argument depicts anti-realism.

Realism also shares the belief that entities like 'genes,' 'cells,' etc. are unobservables in nature. However, it contradicts with its adversary, anti-realism, on

the point that we cannot claim such unobservable entities existing in nature. The realist assertion about the existence of unobservable entities is rooted in the belief that we must not always rely on our capacity to draw an ontological picture of the world. It is illogical now holding the antirealist belief that unobservable entities do not exist because they are not subject to our direct perception. For example, if antirealism is true in its belief about the inaccessibility of unobservables, then it may claim that there is no cell, species, genes, and life because we do not perceive them directly. If so, as a result, then the science of biology will cease to exist. This point above underlines that a radical empiricist stance concerning perception gives only a partial view of reality.

The anti-realist discomfort with mediated perception is anthropocentric that brings the Protagorean principle to the philosophy of science. Protagoras' humanist proclamation was that 'man is the measure of all things.' This pre-Socratic belief had significant ethical implications whereas the anthropocentric prominence in contemporary anti-realism has both epistemological and ontological impacts. Anti-realism performs an indirect reduction concerning epistemology; limiting our understanding of reality within the boundary of human sensibility. In anti-realism, the concept of reality is proportional to perception. A notable point here is that we cannot assume that the reality is proportional to observation because what observation in anti-realism is, is simply perception. In fact, observation has a broader sense than mere perception. It is a complex process which includes perception as a component but not the only component. Consider the anti-realist position that we cannot have scientifically firm knowledge of theoretical terms (genes, for example) because they are unobservables. Anti-realists use the word 'unobservable' in the sense that [genes are] 'not perceivable.' The anti-realist supposition is that correct knowledge is bound with unaided perception. It is not true that percep-

tion alone can provide true knowledge; the knowledge is an integrated outcome of perception and mental reflection. Sense-data are the output of perception which complex mental processes like retention and recognition analyze.

To understand the problem of anti-realism, we may suppose that a scientific theory has two aspects-observation and interpretation. Anti-realists has no explicit objection to the second dimension, but it opposes strongly to some aspect of the first dimension. That is, in the observation part, anti-realists justify only those objects which are subject to unaided perception. The problem hence is rooted in their understanding of the term 'observability.' In realism, the entities which we cannot observe directly but indirectly with the assistance of instruments are considered observables. It is because realists consider instruments are the extension of our sense organs. These enable us to perceive entities which were hidden before. We may call them 'extended phenotypes' by borrowing Dawkins' (1982) terminology. Artifacts, for him, are extensions of our phenotype which simplify our day to day life. Instruments which mediate our perception are also considered as artifacts, and one can reasonably think that they are the "prolongation of our sense organs" (Agazzi & Pauri 2000, 49). Like spectacles or hearing aids, scientific instruments like a microscope also help us to improve our perception of certain aspects of reality which is not perceivable by our sense organs.

Anti-realists' aversion to existential assertions of unobservables is misleadingly partial concerning the evolutionary argument for the adaptation of phenotypic features. According to evolutionary biology, the features of an organism (or species, in a broad sense) are the outcomes of natural selection involving checks and balances of phenotypic fitness (Futuyma 2005, Smith 2007). Features that provide more fitness to the organism will be selected and transferred into the next

generation while features that give less fitness will probably go extinct. Natural selection works in such a way to make the organisms [species] fit to the environment. We, human beings, are the product of evolution and the unique features of our sense organs have relative teleological [teleonomical] roles concerning our existence. "If our access to reality is limited and coloured by physical apparatus selected from a random pool with regard to the peculiar needs of the human life-form, then it follows that alternative life-forms might have access to other aspects of reality and picture the universe in terms of mental structures evolved to suit their needs and interests" (Clark 1984, 485).

Nature has designed every species differently with different features. For example, although the eye is for vision in general, the features of human eyes differ from that of a bat's eyes which are even different from that of a cat. The characteristic variances from one organism to the other must have an explicit impact on their visual capacity. This characteristic relativism, in fact, makes different organisms fit to their environment. In that sense, various species of organisms have different images of the external world. Thomas Nagel (1974) expresses the sense of the above argument in his seminal paper "What is it like to be a bat?" There will always be a difference in the image of the world concerning the relative nature of sense organs.

The proximate-ultimate causal difference has to be noted here. According to Mayr(1961), organismic features have dual causal manifestations concerning their functional and evolutionary roles. For example, the eye is for vision is a proximate answer to the question 'what the eye is for.' The same question can be answered differently by stating that it helps the organism in their evolution and reproduction. This second one is the ultimate answer to the question and which

our focus here is. The eye performs its function differently in different organisms according to the variance in their ontological structure. Human beings have unique ontological structural features. A bat does not have a vision in the day but has a good vision at night; humans have a vision in reverse to bats. Chameleons can directly see ultraviolet rays but a human being cannot. The difference in the characteristic feature of sense organs also results from the difference in the perception. The discussion so far made the point clear that human sense organs have relatively different features which aim to secure the fitness of an organism. Hence, human perception, being different from other organisms (Scanes 2018), can provide only some aspects of reality. Hence, this relativism does not support the inherent anti-realist belief that unobservables do not exist because they are not perceivable.

Anti-realists create an ontological divide between observables and unobservables in reality. Here, anti-realism manifests itself as an instrumentalist view of reality. Okasha (2002) noted that anti-realists are of two sorts. Those who believe that the explanations of unobservables are not understandable because we use terms like species/genes/cells as metaphors in theories. And those who believe that one should take such explanations at face value, *i.e.,* if a theory says that genes contain information of an organism's development, it will be true if genes exist and are containing information of organismic development. Believing that theories are fictional and keeping an agnostic attitude toward them are both problematic and misleading. Of course, there were theories in the past which are proved to be false in their attempt to explain unobservables. The initial belief on the truthfulness of the theory of 'pangenesis,' for example, [proposed by Darwin 1868] that postulates the existence of *gemmules* is proved to be as false later (See Zou 2014, Darwin 1871). Phlogiston theory is another example. The technological

growth indeed has brought us to different avenues of reality which were unimaginable in the past. We can say that there is no harm in believing that there exist entities as *unobservable*. There is a correspondence between, for example, the word 'species' in a theory and a phenomenon in nature. That means the word has a real reference. The assertive claims regarding unobservables cannot always be wrong as believed by the anti-realists. A term denoting an unobservable phenomenon or an entity might be fictional, but it has an intimate relationship with the underlying reality.

Consider the statement that life causes the uniqueness of organismic features. How do we say whether it is true or false? According to anti-realism, it is impossible to determine the truth-value of such a statement because 'life' represents an unobservable phenomenon. One need not have a difference with the anti-realist claim that life is unobservable. However, it is inappropriate to argue that we cannot determine the truth value of the above sentence. It is a fact that organisms possess unique features from mechanisms in nature. Organismic features like evolvability, heredity, homeostasis, etc. support the above point. To address the uniqueness of organisms, one should logically presuppose that there must be at least one factor that causes it. As a natural entity, an organism does not necessitate supernatural causes for its unique features. 'Life' is a name given to the underlying natural cause of the varied features of living beings. It might be a fictional term, but the underlying reality that 'life' refers to is real. The uniqueness of an organism and its underlying cause are equally factual. Hence, we can abandon the anti-realist argument for the impossibility of its truth-value. The anti-realist argument has a close relation to the positivist claim that a proposition will be true, only if it is verifiable. The observation shares some aspects of verification. It seems anti-realism holds some aspects of the verification principle in its argument

for the impracticality of truth-value of statements/propositions which contain unobservable terms. It is now to state that anti-realism would probably be wrong if it relies on the verification principle. Anti-realists worry about the existence of those unobservable entities which are the concerns of scientific practice. Unobservable entities subject to the positivist criticism by verification; they are not part of the realism-anti-realism controversy. Rather, the debate mostly focuses on the reality claims of entities which are not directly observable but can provide factual experiences of their existence. The truth value of any scientific theory implicitly links with the existential assertions of (unobservable/observable) entities which are backed by successful scientific models. The notion of observability is a correlate of the condition of the existence of entities in nature. Observables are, in one or the other sense, empirically given. The theories which talk about such entities are, for constructivism, empirically adequate. Some entities exhibit indefinite empirical nature so that they are independent of our observation. They are observation-independent because they have no empirically given condition of existence. Being said all these, we now focus how the elements in these discussions created a niche for a new understanding of ontological realism.

## 1.3 Ontological Realism and Metaphysical Reflections

Among the three types of independence conditions discussed above, the 'complete' and the 'partial' illustrate independence aspects associated with the existence of organism and mechanism. These differences also specify the differences in their nature of causality. Apart from the complete mind-independence, an organism

exhibits another kind of independence concerning the causal condition of its varied nature of existence. So the condition of existence of organism seems to possess independence from our understanding/epistemology. Life and species exhibit the kind of independence condition, other than the above two, which we call 'obscure' mind-independence. It is obscure because the phenomena in question hold a dialectical nature of existence. They are unobservables, but their existence is dependent on concrete particulars. They are not dependent on our perception, but perception plays an undeniable role while experiencing their existence by relying on reason.

The metaphysical aspect of realism rests on the independence by objectivity. Here the objectivity means the entities or phenomena a scientific theory postulates exist 'out there' independently. As an ontological *a priori* condition of evolution, the existence of life cannot be avoided from the total framework of evolutionary biology. It is a logical necessity before evolution which shapes the unique nature of living beings. The uniqueness of the existence of organisms rests on the adaptability of organisms, and a mere material combination (mechanism) lacks such an ability. Species are the outcomes of the evolutionary process and evolution theory supports this fact. Like life, species also really exist in nature but the existence of species, as we noted, is different other than material existence. Even though we are aware of the intrinsic nature of causality of organismic actions, we are unable to address such an internal condition in the organism where actions are generating in a contra-Newtonian manner. Life, species, and the inner causal conditions of an organism are not subject to the conditions of observation in the anti-realist sense; this is so because anti-realists believe that the senses of human beings are the ultimate reliable means of observation.

Apart from all these, it is true that the question of 'why is life, organism, and species undefined in biology' remains unaddressed. The reason for this is that, we argue, the conditions of their existence in nature remain unexplored. That means the condition of existence (an ontological aspect) is beyond/independent of our cognitive capacities. This ontological aspect maintains the kind of realism that a metaphysical realist usually suggests. Historically, ontological realism seems to legitimize this kind of relation between ontology and realism (For example; Chalmers 2009, Sider 2009). It comes with a claim for the independence of the physical world. It corresponds to the 'complete mind-independence' condition we have discussed before. It is a broad conception but covers only the observable or empirical or physical part of the world [See above mentioned Clark's (1984) conception of ontological realism, for example]. To understand the connection between ontology and realism concerning the entities, especially those which are unobservables, described in successful scientific theories like evolution theory, we need to rely on a different kind of independence condition. The 'obscure mind-independence' condition can be a good option. Hence, an unconventional understanding of ontological realism is possible to account for the metaphysics of evolutionary biology concerning life, organism, and species. In this conception of ontological realism, the condition of existence, not the existence as such, is getting connected to the independence-aspect of realism.

The discussion here would be incomplete without stating how the following, celebrated conceptions of ontological realism are inappropriate to account for the metaphysics of biology (science). We move to this discussion by noticing how Chalmers (2009) differentiates his ontological anti-realist position from ontological realism. He notices that according to ontological realism, there are objective answers to the basic question of ontology, *i.e.*, 'what exists.' In that sense, onto-

logical realism comes into the picture when meta-ontological questions are asked; for example, 'is there an objective fact of the matter about whether gene exists?' (Chalmers 2009). Ontological realism, for Chalmers, asserts that there is an absolute domain of existence while ontological anti-realism rejects it.

Sider says, "Ontological realism is the claim that the world's distinguished structure includes quantificational structure" (2009, 407). As an ontological realist, he tries to address the meta-ontological question about the existence of composite objects. He says, "I... accept a very strong realism about ontology. I think that questions about the existence of composite objects are substantive, just as substantive as the questions of whether there are extra-terrestrials; and I think that the contemporary ontologists are approaching these questions in essentially the right way"(2009, 386) Almost all the accounts mentioned above of ontological realism implicitly acknowledge the objectivity of the answers to fundamental or first order ontological questions. Ontological realism has important roles to play in the meta-ontological discussions. Ontological questions are formed, in a sense, concerning the notion of existence. For example, 'what exists' or 'what there is.' Meta-ontological questions inquire "'What are we asking when we ask, What there is? (van Inwagan 1998, 233; emphasize is original). The ontological realist claims seem to be of second order assertions about the objective nature of the first order claims. All those accounts or explanations mentioned above of ontological realism explicitly use 'ontology' in the philosophical sense. Unlike this, Merrill (2010) uses the term ontological realism in his essay where ontology refers to the non-philosophical/scientific ontology. The use of ontological realism in this essay indicates the realism-based approach to ontologies in data-induced areas such as bioinformatics.

It is important to understand how ontology and realism are connected in the conventional sense of ontological realism. Consider some objects, say, teacups arranged in a triangle shape. The ontological question would be that, does the triangle exist? Ontological realists say yes. Consider another example from biology; homogeneous organisms are representing a species. An ontological realist keeps positive answers to the question concerning the existence of species. These entities; teacup, triangle, and species are composites constituted by particular instances/things. The parts have a real concrete existence in nature. We experience the existence of composite objects too in nature, but there is a sense of the difference between the existence of parts and that of the wholes. The wholes are not mental constructions; they are extra-mental existents. Here ontology comes with the notion of existence and realism with the reality-claims. Ontological realists, like Chalmers 2009, connect the existential claims, of objects, with the meta-ontological claims which assert the objectivity of the existential claims. Ontological realists cannot address the question concerning the existence of species, life, etc., in the same manner, they usually address the question concerning the existence of composite objects like an organism, computer, table, etc. Both the groups of entities are remarkably different; the former ones exhibit an indefinite nature of existence while the latter ones are concrete. Conventional ontological realists ( Chalmers 2009, Sider 2009, Clark 1984, etc.) focus on the existence of objects that we experience empirically. The existential claims are in the ontological level while the reality claims are at the meta-ontological level.

Linking the ontology to realism without yielding to meta-ontology is possible. The realism/anti-realism debate, concerning the existence of entities postulated by scientific theories, is rooted in the indeterminism concerning the condition of existence of unobservable/extra-mental entities. They incline towards the condi-

tion of existence of some entities which are scientifically important. The condition of existence is an important aspect of ontology. This ontological aspect of some important concepts in biology represents some important underlying real phenomena/entities, mentioned above, possess an indeterminate nature. They are not subject of our direct perception, and to understand their existence; we need to rely on mental faculties of cognition. They are not simply ideas in mind; rather, they are extra-mental entities. Their condition of existence (ontology) is beyond our understanding, *i.e.,* possesses 'mind-independence' which is the seat of metaphysical realism. Connecting ontology [condition of existence] with realism [mind-independence] in this way to propose a new conception of ontological realism is not inappropriate. We do not seek to address the question 'whether there is an objective answer to the question, for example, 'do species exist' as the conventional ontological realists did. We stick on the intractable nature of existence of entities and its mind-independent nature. We place ourselves in the realm of ontology while proposing a new understanding of ontological realism. In fact, the ontological realism we propose does not completely exclude itself from the ontological realism which is in place already; rather, the former differs from some aspects of the latter. In this way, we can address both the tentative epistemological indeterminism concerning evolution theory and the resulting metaphysics in evolutionary biology. This biological metaphysics mirrors the metaphysics of science caused by indeterminism relative to the entities postulated by successful scientific theories. Following chapters will explore the ontological issues underlying each of those concepts above. Each chapter has its own specific goal which would link with the holistic theme of the thesis, that is, exploration of the metaphysics of science through an unconventional conception of ontological realism in the conclusion of the thesis.

# Chapter 2

# Darwinism, Life, and the Metaphysics of Biology

## 2.1 Metaphysical Grounding in Biology

In the philosophical discussions of science, we confront claims which are mostly committed to the realist belief that our best scientific theories are true or approximately true in their descriptions of phenomena. Often, we also encounter claims which overwhelmingly negate the epistemic optimism realists possess on the validity of the scientific theories. These latter claims are the anti-realist arguments in the philosophy of science. One of its strand - the *pessimistic (meta)induction* - expresses the incongruity of the truth approximation in realism by exhibiting the faulty theories of past science (Chakravartty 2017; Papineau 2010; Fahrbach 2009). This form of anti-realism grants us an understanding of the nature of scientific progress. However, one cannot deny such anti-realist views as illogical. Anti-

realist arguments mostly depart from the scientific claims on the unobservable entities (van Frassen 1980; Laudan 1981, etc.). In this respect, a brief description of *constructive empiricism* (van Frasses 1980, 2001; Monton & Mohler 2017) is also needed here. Constructive empiricism is the belief that science aims to give us theories which are empirically adequate; and acceptance of a theory involves as belief only that it is empirically adequate (Contessa 2006, 457). If we replace the phrase 'empirically adequate' with the word 'true,' we may end up with scientific realism. Though the distinction appears simple, the cleavage between scientific realism and constructive empiricism is too wide. For the latter, a theory becomes empirically adequate if it takes note of observable entities.

The condition of *observability* plays a significant role in defending the empirical sense of theories in natural science. As a justification for these theories, realism claims that science can explain both observables and unobservables approximately truly. The concept of *real*, thus, is intertwined with the dichotomies of observability & unobservability and existence & non-existence. How does observability relate to existence? It is a complicated question to answer within the domain of natural science. Biologists, for example, claim that both life and species exist in nature, but we fail to find a clear account of their existence in biology. It marks the persistence of ontological concerns in biology related to the conditions of existence of those entities. Physical science, like biology, asserts the existence of electrons. These examples specify the fact that *existence* in natural science has a broader meaning than physical existence. The existence of species does not indicate that it is observable in the same manner as we observe a concrete entity like organisms. It exists as an unobservable entity in nature. The reality according to science thus consists of both physical and non-physical existents.

Non-physical does not denote the metaphysical existence that usually seen in the traditional philosophical or theological arguments. It simply means the existence of quasi-empirical entities with trans-physical existence. How do scientists account for the existence of electrons? They do so because it is possible to trace the presence of electron by experimentation. It is detectable. The concept of observation has an extended sense in realism than the rigid understanding that it is an unaided act of perception. The discussion here commits to the notion that existence does not imply observability. To counter argue against the rigidity of the observability condition, Contessa (2006), following Paul Churchland's (1985) remarks that both observability and unobservability are equally dubious, argues that if unobservability is inappropriate to validate theories, then observability is also inappropriate for the same task. The mistaken ontological commitments of the earlier theories would prove this point. For example, there were influential views which were wrongly committed to phlogiston (unobservable) and witches (observable) in the past.

With this backdrop, the attention is shifted to biology to unveil its relation to metaphysics through an elaborate discussion of life. The anti-realist claims about the illegitimacy of scientific theories [regarding unobservables] are rooted in their epistemic accessibility. Entities that lack immediate observation demonstrate an indeterminate existence. For example, we have many definitions or accounts of life (Popa 2004; Luisi 1998; Jeuken 1975; Trifonov 2011; Knuuttila & Loettgers 2017), but none is deterministic in stating what exactly life is. [Life will always remain something apart, even if we should find out that it is mechanically aroused and propagated down to the minute detail (Virchov 1855); Any system capable of replication and mutation is alive (Oparin 1961); Life is a metabolic network within a boundary (Maturana and Varela 1973); We regard as alive any popula-

tion of entities which has the properties of multiplication, heredity, and variation (Maynard-Smith 1975); Life is the ability to communicate (de Loof 1993); Life is an expected, collectively self-organized property of catalytic polymers (Kauffman 1993); Life is a self-sustained chemical system capable of undergoing Darwinian Evolution (NASA working definition of life, 1994). These are some selected examples of the definitions of life mentioned in Popa (2004, 196-205)]. These definitions are indeed used for pragmatic purposes. Life presents itself as unobservable, but it provides the means to detect it in nature, *i.e.*, through life-forms. The unobservable nature leaves two choices to human beings; we can either be agnostic or be believers of life's existence. On the one hand, the experience of living and dead things in nature discourages us from being agnostic about life. In the same way, one cannot be agnostic about the existence of some planets based on our inability to observe them by naked eyes. There are many things in nature which are inaccessible to human beings. Determining existence by observation is too anthropocentric, says van Fraassen (1980, 19). The distinction between the functions of mechanism and organism, on the other hand, encourages us to believe in the existence of life. It is too complicated for those who think that it is possible to infer the existence from observation. Belief in the existence of life is the base supposition in [evolutionary] biology. Otherwise one should accept the fact that all biological theories have mistaken ontological commitments. Biological theories are mostly concerned about the different aspects of life and not life as such; however, the reality of life is the ground of all these aspects. Ultimately, biological theories are ontologically committed to life.

Let us come back to the question of understanding life. Taking the legitimacy of the evolution theory for granted, we cannot avoid the possibility of common ancestry, *i.e.*, all the existing and extinct species on Earth had evolved from a

common ancestor. One should go deeper than Dawkins (2006/1976) to realize that it is not ultimately the gene but the life that passes from generation to generation. Life is singular, but it exists in nature through the plurality of forms. Here we suppose that life is unique and hence can be treated as an individual entity not kind. 'Continuity thesis' [progression] articulated in the origin of life where there is no divide between the chemical development and the evolution from the common ancestor. Chemical elements progress from the constitution of life toward complex living beings. Even if life has come from space, there must be cohesion between terrestrial and extraterrestrial life. The *ontology of life* (Heidegger used 'the ontology of life' in a phenomenological sense; see Rubio & Fernandez 2010) must be the same in both the places that explain what-it-is-to-be-life. That life-induced matter perhaps is the common ancestor of the living beings on Earth. We may call this transmission of life as cosmic replication. That means, whatever features life had in space might have had possessed by the *panspermic* common ancestor. Hence, the origin of life cannot be much threat to our argument for the singularity of life.

Life is a natural entity but not a natural kind. There are several accounts of natural kinds from Plato and Aristotle to the present (Hull 1967; Aristotle 2011; Plato 2002). These accounts stem relatively from the belief that there is a definite *essence* which makes something a natural kind. It is the reason for the essentialist shroud of such accounts. Wilkerson argues that an account of natural kind will be interesting only if the following conditions are fulfilled; "the notion of a natural kind must be tied to that of a real essence" and "members of natural kinds, and the corresponding real essences, lend themselves to scientific investigation" (1988, 29). (For an elaborate discussion of natural kinds, see Brzovic n.d.; Hacking 1991) It becomes clear that a natural kind is that which has a specific essence shared

by all of its members or instances. All organisms share *life* so that one may even say that life is the essence of living beings. In that case living (not life) would represent the natural kind. It also expresses the singularity of life in nature. Among others, life is an anthropocentric designation given to an experienceable entity. That means there is no common consensus on what life is in biology. Then, how do successful biological theories use the term life in their explanations? Biologists do not have a determinate or definite account of what life is and how it exists in nature. The uncertainty of life's existence or, philosophically speaking, ontological indeterminism compels us to look at the possibility of considering life as a theoretical kind in biology.

A theory's ontological commitment asserts the existence of entities explained in that theory. The ontological commitment to theoretical kinds is the "belief that there are entities that have the properties directly or indirectly attributed to them by a certain theory" (Contessa 2006, 461). That means science uses these terms as functional. In that case, one may think that St. Anselm's God is also a theoretical kind. The limitation of such thought is that we can make only prescriptions of God and not theories. St. Anselm's ontological argument contains only prescriptive propositions of God which is not empirically experienceable by human beings (Williams 2007). Unlike this, we can empirically experience the presence of life or electron through organisms and electricity respectively. Hence, we have theories to be seen as descriptive explanations in science. God, Soul, etc. are prescriptive terms while life, electron, etc. are descriptive terms. The theoretical kind terms, thus, are descriptive due to the physical inclination [A term is "theoretical if and only if it refers to nonobservational entities" (Andreas 2017)]. Their theoretical appearance does not mean that there are no such entities at all. In fact, our cognitive schema is not well equipped to understand their

existence. The theoretical appearances create some ontological intuitions, and it is the reason why we understand theories. We all have some *a posteriori* ideas of what life or an electron could be. The difficulty lies in our inability to express those ideas definitely through language. The play of the intuitive ability (maybe of Bergsonian kind) is present in such situations (Bergson 1944; Strange 1915). It becomes clear now that life appears as a theoretical kind, but it is not.

## 2.2 'Life' in the evolutionary scenario

Since the days of Darwin, evolutionary biology has been facing a reformative challenge regarding the scientific status from those who discontented with the indeterminism. [There is a vast debate between determinists and indeterminist concerning evolution theory and evolutionary biology. Shanahan 2003; Graves, Horan, & Rosenberg 1999; Sansom 2003; Rosenberg 2001; Fisher 1934, etc. argue for indeterminism. While, Weber 2001; Losos 2010; Simpson 1950; Goldberg 2001, etc. stand for determinism]. The retention of the *indeterminism of life* that Darwin had at the time of articulation of the evolution theory keeps the arguments for reformation alive. Also, it discourages the legitimization of evolutionary biology as a scientific enterprise. A close examination proves the fact that it is not an issue particularly in the evolutionary biology; one would more transparently realize that biology as a whole possesses some kind of indeterminism concerning its cornerstone concepts. The foremost among these concepts is *life*. With the emergence of synthetic biology, astrobiology, artificial life, etc., the investigations which seek an objective understanding of life have gained a new momentum. We cannot exclude Darwinism from the inherent task of biology, *i.e.,* 'finding the

meaning of life' in nature. It is so because there is a strong belief that biology had attained autonomy only after Darwin's evolution theory (Mayr 2004). The discussion here notes that Darwinism has an implicit responsibility not exactly to address the question 'what is life' but to determine the ontological priority of life in evolution. Though Darwin's evolutionary arguments are compatible with the principles of scientific realism, his views of life specify the legitimacy of mind-independence in a non-scientific sense. That means mind-independence in the metaphysical and ontological realist sense. By exploring the metaphysics of life, the chapter holistically defends the view that Darwinism indisputably perpetuates the kind of realism that accounts for the mind-independent entities to justify the truth of the evolution theory.

### 2.2.1 Darwinism and Life

Darwinism is hardly concerned about the *reality of life* because of the inherent uncertainty concerning the existence of life and the explanatory impotence of naturalist methodologies in determining what life is. It has a restricted concern about the aspects of life. It gained prominence as a natural science through its explanation of evolution (an aspect of life). It has far-reaching implications in not only biology but also other subjects (Fasolo 2012; Abbey 2008; Dinis 2010). The explanatory success of Darwin's theory perhaps specifies the non-necessity of defining what life is. The 'non-necessity' comes from the contextual practice of science. There is pragmatic compartmentalization of scientific investigations to have determinate explanations relative to the contexts of inquiry. Darwin provides a naturalistic description of evolution which is more or less determinate. But, the general nature of biological explanation entails the *backward causation*. [See Jan

2008 for an elaborate discussion of backward causation]. Generally, backward causation is used to explain the idea of first and final cause in the move to explain the existence of God (mostly in the creationist views). In our discussion the backward causation indeed plays a limited role, that is, it does not lead to the ultimate cause while searching for the historical antecedents of biological events. In fact, Darwinism cannot escape the metaphysical aspects considering the role of metaphors like 'tree of life' or 'common ancestry' in evolutionary biology. It will be inconsistent arguing that we do not judge the explanatory specificity of Darwinism based on the missing account of life. It does not mean that Darwinism and its account of evolution fail in its endeavor to provide a naturalistic understanding of the origin of life. It is certainly successful in that manner. Instead, one can say that Darwinism (in specific) and biology (in general) is incomplete due to the absence of the understanding of the ontology of life. The ontology of life signifies the answer to the question 'what-it-is-to-be' that we call life. It does not harm the belief that evolution theory put forth by Darwin [and refurbished in the Modern Synthesis] has its scope in a definite domain of biology. At this point, we need to explore the meaning of Darwinism substantially. For Lennox, it "designates a distinctive form of evolutionary explanation for the history and diversity of life on earth" (2017 n.d.) but people like Scott & Branch (2009) argue that it is inappropriate to call our present evolutionary accounts Darwinism. Rather we can call it as 'neo-Darwinism' (Noble 2015). In our discussion, the term Darwinism indicates the tradition in biology which is concerned about evolution.

Why do some scholars think that [evolutionary] biology is incomplete? It is because biology carries its history along with the explanations of the aspects of life (Sarkar 2007, 49). Evolutionists cannot deny historical influence on biology while legitimizing 'common ancestry.' We rather seek to find Darwin's take on

this matter. Giving due respect to the contributions (Oparin (1938) and Haldane (1954), for example) in the origin of life research, we do realize the fact that no universal consent has come upon any of the accounts of the origin of life. It seems it is not a 'test case' in biology (Sarkar 2007, 56). The question 'what could be the possible hypothesis Darwin might have had about the reality of life?' would come up here. It is substantial to have a brief understanding about his opinions expressed post to the publication of *The Origin of Species* about life. In the *Origin of Species*, Darwin stated, "It is no valid objection that science as yet throws no light on the far higher problem of the essence or origin of life" (Darwin 1861 cited in Pereto *et al.* 2009). "... It is mere rubbish thinking, at present, of origin of life; one might as well think of origin of matter" (Darwin 1863).

> ...it is often said that all the conditions for the first production of a living being are now present, which could ever have been present. But if we could conceive in some warm little pond with all sort of ammonia and phosphoric salts, - light, heat, electricity present, that a protein compound was chemically formed, ready to undergo still more complex changes, at the present such matter would be instantly devoured, or absorbed, which would not have been the case before living creatures were formed... (Darwin 1871).

These statements give an impression that he was not a nihilist concerning the ontology of life. Underlining this fact of specificity people like Gould (1982, 380) and Pereto et al. (2009, 403), etc., opine that Darwin's goal was to establish the fact of evolution through natural selection. A more significant remark, in the same manner, as seen in Pereto et al. (2009, 395) that Darwin "consciously avoided" the discussion of the origin of life in his groundbreaking work (see also Kutschara

2009, 1250).

Darwin's correspondence to Alfred Russel Wallace, the co-discoverer of natural selection, indicates that he believed in *abiogenesis, i.e.*, the origin of life from *inert* matter. The letters and writings of Darwin also give hints about his optimism toward science to unveil the truth behind the origin of life (Sober 2011). In our opinion, he seemed to have possessed an inclination toward metaphysics [of *chance*] than theology. It implies that metaphysics has different manifestations in theology and biology. In theology, one may find that the metaphysical attribute comes from the *mysterious* nature of concepts; that means we cannot have any hold on any of their aspects. Such concepts exhibit complete independence from us. In biology, metaphysics is associated with our undecidability of the causal conditions of the existence of some entities, though we know and experience their aspects empirically. The epistemic validity of chance must be relative to the context of scientific explanation. In physics, for example, the *Big Bang* happened by chance; in evolutionary biology, variations in organisms happen by chance. Chance in these contexts represents the anonymity of *natural antecedent* of the natural phenomena. Chance replaces epistemic undecidability of the causality of some entities in nature.

Let us return to the discussion on Darwin's opinions of life that take note of causal factors regarding uncertainty. Non-physical methodologies like imagination have their demerits; they might be too subjective in such cases as the origin of life. Darwin at some level had used imagination in his theory because Lyell convinced him about the "importance of imagination for guiding reason" (Richards 2005, 170). One must also notice that Darwin had shown the conditions of imagination while articulating a scientific theory. Imagination presupposes the analogy of

experience. For example, Darwin had thought about natural selection through the experiences of artificial selection. There is an analogical connection between these two selection processes. His analogy has great significance in understanding the natural selection (Ruse 1971, 1973, 1975; Evans 1984; Mayr 1991; Waters 1986). Darwin, at the beginning of the *Origin*, says that

> At the commencement of my observations, it seemed to me probable that a careful study of domesticated animals and cultivated plants would offer the best chance of making out this obscure problem. Nor have I been disappointed; in this and all other perplexing cases I have invariably found that our knowledge, imperfect though it is, of variation under domestication, afforded the best and safest clue (2009 [1859],4).

One cannot find this kind of analogical process leading to the revelation of the unknown process behind the origin of life.

There are some hypotheses about the origin of life, but none have succeeded in their endeavor to provide certain knowledge about the origin of life. Such a situation necessitates the presupposition of the unknown fact. In the case of life, these presuppositions would also be metaphysical because the epistemology of biology expresses indeterminism concerning the questions 'what is life' and 'how did it come into existence.' The ongoing research in the *origin of life* and the lack of a universal definition of life may justify this point. In addition to this, we must remember that there are accounts regarding the origin and definition of life in biology but are relative and functional. It can argue, bearing all these in mind, that whatever presupposition Darwin might have had in his mind would

be metaphysical. It is relevant to remember the point here that "It is virtually impossible to formulate a scientific theory without making implicit metaphysical assumptions, however cautiously these may be framed" (McGrath 2011, 36). This is admissible because we use numbers or figures in mathematics and other sciences without a determinate account of what they are. It seems the success of theories, descriptions, or laws which use numbers and figures exclusively state the presupposition that they are *given*.

### 2.2.2 Presupposition of the given-ness of life

It is right to think now that at the time of the formulation of evolution theory Darwin must have had some presuppositions about the ontology of life. The reason is that evolution, for him, simply meant the evolution of species which was highly life-dependent. Without an assertion of the existence of life, one cannot develop any theory about the aspects of life. That means Darwin's theory is ontologically committed to the reality of life. Life must have ontological conditions as an existent entity of nature. The issue at stake is that what could probably be Darwin's presupposition about life. Darwin had succeeded in his attempt to provide a naturalistic theory of how species originate in nature (Darwin 1859). Evolution theory has the following postulates:- all life-forms on Earth are interconnected by ancestral-descendent relation, the unintentional process of natural selection selects organisms with varied features, these variations which are the markers of high fitness of organism [through contributing to survival and reproduction] would pass on to the next generation. The assumption implicit in this account is that evolution is about the evolution of species. Life is treated as a brute fact. An entity or phenomenon becomes 'brute' if we cannot determine the

condition of its existence; the questions related to its origin and purpose seem to be unaccountable by the human cognitive schema. We still lack a clear understanding of the ontology of life; we do not know how did it originate and what it is for. The evolution theory is undoubtedly successful in its endeavor to reveal the reason behind the origin of species. There exists an indeterminism concerning the ontology of life. This success with an absent ontological determination of life entails the search for the metaphysical presupposition Darwin might have had.

Darwinism marks the boundary of its explanatory range. If it goes beyond the specified limit of evolution, then it must have to predict many things such as the ultimate end of evolution and the causal condition of the origin of life, etc. The existing methodologies are not sufficient to predict the outcome of evolution. The evolution is not a subject of experimentation, but an important principle of confirmation in the sense that there is definite natural cause of the origin of different species. Thus, the explanation detaches itself from the prediction in evolutionary biology. Scriven (1959) (also see, Mayr 1961) sees this as a remarkable philosophical contribution of evolution theory. Evolutionary naturalism instead has the historical aspects in its explanations. The presupposition gets more importance than prediction in evolution theory. The former is used to conceive the unreachable past while the latter is to the uncertain future. The origin of life is a matter related to the indefinite past, and Darwin might have had struggled with the question of 'how did life originate' than 'what is it.' The former is an ontological concern, and the latter is metaphysical [for the discussion about the difference between ontology and metaphysics, see Varzi (2011)]. Both these questions persist in biology without a definite answer. In such a state, the only possible presupposition Darwin could accept to move further for his theory is that 'life has a given condition' on earth. Maybe, he could not have identified an alternative other than

considering life as a brute fact [*given*] because of the scarcity of evidence and the insufficient methodologies to prove its natural origin.

Darwin's presupposition of life would possibly be uncertain. However, without the support of a hypothesis about the fundamental factor, a biologist like Darwin cannot depict a world-influential theory out of the void. We do not intend either to show that the support of this presupposition of life makes Darwin's theory flawless or to show that without this presupposition his theory is in danger. Rather we try to establish the point that scientific theories may have metaphysical presuppositions concerning the base phenomenon/entity. That means the well-established scientific theories may not provide a tightened grip on the base reality; they may exhibit themselves as 'instruments' to organize our experience. Hence, we can emphatically argue for an unavoidable presence of the said presupposition of life in Darwinism, because biological evolution is nothing but the manifestations of life which indeed is beyond the scope of it. It establishes the missing element of the ontology of life from Darwinism. No one can imagine the biological evolution without life, even the hardcore creationists or the defenders of 'Intelligent Design'. Hence, science cannot be complacent in treating life simply as a mere pseudoconcept.

## 2.3 Darwinism as a special science

The enthusiastic response to Darwin's theory since 1859 indicates its epistemic fruitfulness in the science of biology. Asa Gray and Albert von Kolliker draw a teleological picture of Darwin concerning evolution theory while others like Her-

mann von Helmholtz and Karl Ernst von Baer regard him as a critic of teleology (See McGrath 2011; Beatty 1990; Lennox 1993). Issues related to the teleological nature of Darwin's evolution theory are important in the philosophy of [evolutionary] biology though different people have a different take on it. The naturalistic predisposition frames a scientific outlook for Darwin's theory and the flaws in these naturalistic descriptions give a philosophical dimension to it. On the one hand, many agree to the scientific status of Darwinism while, on the other hand, they identify some ontological gaps which question the scientific status of evolution theory. Ontological gaps in evolutionary biology are the void created by the questions related to the origin and existence of fundamental biological entities such as life. Noticing a brief discussion about another ontological issue, apart from the ontology of life, in the Darwinian account may enhance the discussion.

### 2.3.1 Ontological puzzle – *selection*

An important ontological issue other than life comes from the process of *selection*. Darwin had set up a logical base for natural selection in the initial chapters of *The Origin* through an account of 'artificial selection'. One may find semantic ambiguity in the word 'selection' while referring its appearances in these two scenarios; artificial selection and natural selection. The term 'artificial' indicates human assistance; an anthropocentric teleology is explicit with it. To recognize this, consider the following sentences; (a) scientists select varieties of *Drosophila* for analyzing the adaptive differences and (b) Darwin select his career as a naturalist biologist. The idea of 'selection' in these sentences expresses itself as an intentional act by necessitating the presupposition of a teleological subject. Selection, henceforth, seems to be a conscious activity. Unlike this, Darwin used

the word selection to introduce the mechanism of evolution - natural selection - which he claimed is unconscious. This claim supports the mechanical nature of evolution theory and avoids the possibility of Creationism. The question of 'what does it mean by selection in this non-psychical setup' still persists. It is clear that Darwin used the word selection in the same sense as mentioned in the above statements (a) and (b). The difference stems from the different prerequisite conditions for the process of selection. Darwin had created a semantic pluralism *via* assuring the ontological difference concerning the requirement of selection. That means the word selection has a different meaning within biology than its general meaning.

Let us come back to the concern of the science of biology. The positivist boosting of reductionist methodologies of the Mechanism by arguing against the metaphysical claim had paved the way to determinism in the physical sciences. Hence, physicalism was the synonym of science for a while in the history of science (Takacs & Ruse 2013, 5). For physicalists, rigid methodologies such as determinism and reductionism are the backbone of science. As a naturalist endeavor, how do we conceive the scientific status of Darwin's evolution theory concerning determinism and indeterminism? Horan (1994), Graves *et al.* (1999), for example, argue for determinism in Darwinian biology while Fisher (1934), Brandon and Carson (1996), Glymour (2001), etc. stand against it. Those who argue for the evolutionary determinism are successors of the intellectual tradition in which the idea of a lawful universe is apart, *i.e.,* everything is determined. They think that evolution is an orderly process and this regularity is bound to the underlying mechanism [law], *i.e.*, natural selection. The deterministic laws of the history of life on Earth are discoverable by examining the history and fossil records. Determinists rely on empirical and historical facts to argue for the determinate nature

of evolution theory. Their ultimate aim is to equate the status of biology with that of physical and chemical sciences. Those who argue for indeterminism shape their arguments by referring to the unpredictable nature of evolution. Darwinism exhibits the open-ended-ness of evolution because evolutionary metaphor of the tree of life implicitly asserts this fact. Having predictions concerning the evolutionary process is impossible. The causal conditions of mutation and natural selection are rooted in the concept of chance which represents the causal anonymity of natural processes. The arguments for and against determinism demonstrate the possibility of a third way of understanding the reality. That is *biologism* (Laitinen & Maude 1986; Meloni 2013, for the use of 'biologism') where one can describe the aspects of entities (biological) with determinate language by retaining the indeterminism concerning the existence of the same entities. In biologism, we cannot be extremists,*i.e.*, neither determinist or indeterminist. Indeed, we have to agree with the aspects of both determinism and indeterminism.

Determinism assures that everything is determined by appropriate causal relations, because, it is a doctrine that every event must have a preceding cause; the subsequent effect is always uniquely determined, and, if the effect is complex, then it can be analyzed into components (Dotterer 1938, 60). Darwin seems to have retained causal determinism in his theory while arguing for the evolution of organismic features *via* natural selection. Some of his followers try to formalize the evolutionary argument, and this exhibits the retention of the post-Newtonian mechanistic belief that science should be deterministic. Their endeavors precede the Darwinian view of God as 'empirically vacuous irrelevance' (Gardner 2014, 208). From naturalism, it is inappropriate to think of any metaphysical grounding to account for natural phenomena. An uncaused cause is out of the ken of science for which there must be a causal regularity between events or phenomena. The

evolutionary biology replaces the anonymity of causal factor with chance. Unlike this, creationism supposes that God is the causal fact from which the subsequent result, the world, came into existence. In creationism, God is supposed to be the known cause without any ontological commitment for itself. It expresses the implicit belief that 'everything comes from nothing,' but such a belief is impossible in a naturalistic framework. The determinism concerning the natural causality in evolution eliminates the possibility of God in evolution theory. This perhaps does not provide a robust determinism.

In evolutionary biology, questions regarding species and their features entail their reference to history. But, the historical past does not over-determine our understanding. The cause-effect relationship in evolutionary biology [Darwinism] differs from that of the functional biology. Functional biology looks for the *proximate causes* of organismic features while evolutionary biology concerns the *ultimate causes*. The understanding of organismic phenomena, as Mayr (1961) points out, consists of the total of both these causes. An understanding of the historical past is necessary to answer questions related to species. It partially shows that Darwinism cannot be deterministic as thought by the proponents of FDP (Formal Darwinism Project). More justification must be given to understand why the science of biology cannot be the same as the science of physics and chemistry. Besides, simplistic differences between their subject matter, there exists a huge cleavage between them concerning methodology and concepts. Physicalism deals with the inert matter of which the properties are deterministic. Biology (especially, evolutionary biology) deals with living beings which are not deterministic. It is so because we cannot reduce the wholeness of organisms into its parts.

Contrary to determinism, Thomas Nagel (2012, 13-71) had argued that Dar-

win's evolution theory is incomplete with its explanatory lack concerning consciousness and mind. To add into Nagel's remark we can say that Darwinism does not explain life reasonably so that it cannot make an account of mind and consciousness. The reason is that they are highly life-dependent. Darwinism at large does not account for the evolutionary leaps that are explicit with the characteristic differences between different species. Evolutionary biology lacks proper explanations of the ontological diversity among species. As a result, there is no adequate account of the ontology or teleology of human features. The human beings had adapted these features should be explained properly in evolutionary biology as are also part and parcel of the organic evolution, [*i.e.,* part of the rest of nature]. The realization of this unavoidability of *Homo sapiens* perhaps had necessitated Darwin thinking about the puzzles regarding mind. The puzzle is that mind is not an observable entity but we can experience the aspects of mind on a daily basis and due to this it is not easy to avoid the possibility of mind from biology.

His attempts to chase the biological base (that is, the material ground) of mind and consciousness in the instinctual behaviors of animals may take as evidence for the above claim. One reason for this presumably is his inclination to the empiricist understanding that rationality is a product of sensation (Richards 2005, 168). There is a resonance of Lamarck in his assumption that a habit becomes an inheritable instinct due to the overwhelming use. If something is inheritable, then it would be biological but mental properties such as cognition cannot be inherited. Among the Darwin-enthusiasts, Richard Dawkins argued that we [mind & body together] are the product of genes which are the encoded scriptures of organismic development (Dawkins 2006[1976]). He had an opinion that organisms are the carriers of genes. It is not the organism but the gene which replicates in nature

through evolution. Nevertheless, he too failed to prove the biological foundation of mind. Ambiguities concerning the causality of those feature above mentioned demand a re-analysis of the deterministic persuasion in Darwinism. The criticism against the deterministic nature of Darwin's theory curtails it into an epistemic puzzle. It is so because on the one hand the evolution argues that every organismic feature is the outcomes of evolution but on the other hand it is incapable of addressing some human features. The point that becomes clear is that the formalization is not as easy as thought by the proponents of Formal Darwinism Project. Darwinism indeed appears as formally-indeterminate. Hence, restraining it into either determinism or indeterminism would miss the originality – say, "out-Darwined Darwin" (Nutting 1921). What underlines the discussion here is that Darwin's account of evolution is an amalgam of determinism and indeterminism.

Evolutionary determinists incline to reductionism to achieve the scientific status that physical sciences have. This strengthens the physicalist murky belief that biology can be reduced into physical science in ontological, methodological, and epistemic levels. The organisms become the sum of atoms and molecules; the biological phenomena are studied using simplest methodologies which aim at revealing the molecular level of information; the knowledge of biology is rooted fundamentally in the knowledge of physical science. Possenti best expresses this reductionist tendency as "once nearly everything was life; today nearly nothing is: in our universe, enlarged out of all proportion, almost everything is mass, energy, inanimate force" (2002, 38). The impact of such a reduction reflects in the epistemology where the physical matter shapes the possibility of knowledge. The wonderment associated with immaterial aspects of the world is lost; in fact, that feeling of awe is the factor that drives our investigation. This transition from life to matter endorses that the change does not indicate the change in the metaphor;

it is indeed deeper than that. It shows the paradigm shift in all the aspects of the investigation. Such an attitude juxtaposes reductionism and determinism with *ontological physicalism* (Francescotti 2000) – an assertion that everything is physical. Ontological physicalism seems to be a limited view because it highlights the existence only of physical entities. Living beings are not just physical entities, but trans-physical entities. One cannot limit an organism within the boundary of physicality as it has feature which are not purely physical. Organism as life ascribed physical matter exceeds the limit of physicalism. Apart from all these, there exists a difference in the methods of physicalism and biologism. Determinist arguments are inappropriate to cover the methodological difference of biologism. [Physicalist] principles such as essentialism, determinism, reduction and universal natural laws, Mayr argues, are not suitable for biology (2004, 34). He remarked, for example, that no 20th-century discovery in physics could enhance our understanding of the living (Mayr 2004, 35). There is an ontological difference between an organism and a mere physiochemical organization, though the former too is constituted by physiochemical substances. We cannot argue for determinism *via* reductionism in biology. The reason is that if we reduce the explanation of a living being into physical and chemical explanation, then probably we may end up with stating that there is no such thing as living being. It would become self-contradictory; we cannot deny our own existence by arguing that we do not exist. It is so because if we do not exist, how do we argue for our nonexistence? The incongruity of physicalism necessitates an alternative understanding of living forms (Nagel 2012). He rightly states that the standard reductionism faces a serious threat.

For evolutionary biology [organismic, according to Dobzhansky 1964], the features of living beings are the products of evolution. Human beings are the

product of evolution with complicated adaptations such as mind. As the mind is an evolutionary adaptation in humans, biology cannot be physical science (Nagel 2012, 15). Defending the scientific status of biology that systematically organizes knowledge of the living beings is possible. It does not exhibit the kind of determinism that physicalism expresses in its explanations. It is not even a middle path between the vital and the Mechanical but a varied level of understanding. In spite of emphasizing the dual perception of reality, physics and metaphysics, it is required to open up our mind to the third possibility of recognizing the ontological variance of organisms. The organism is *physis*, and the mechanism is *techne* in a Heideggerian outlook (1977; see also in Late 2010); the former acts in a non-mediated way while the latter acts with an external mediation. [The question 'how an organism ontologically varies from a mechanism' will be discussed in the next chapter]. However, Darwin's theory follows the established methods of science. On the one hand, he did depend upon some scientific methods to arrive at the theory of evolution by natural selection, and on the other hand, he had gone beyond that since the subject matter is life-aspects.

## 2.4 The Metaphysic of Life

The discussion of life-related issues in biology would be partial once we avoid conferring the philosophical and scientific understanding of it. The reality of life is always a defiant subject in both these forms of inquiry. The indeterminate nature of life blisters those who strive to conquer it within the limit of either of the subjects. As we have noted already, the question 'what is life?' is as equally problematic as the question related to its origin. Philosophers generally show

interests in addressing the first question which in fact is a metaphysical question. Biologists often try to account for the origin of life. The reason for this is that Darwin's theory implicitly concerned about the common ancestry which logically leads us to the first common ancestor on which life first appeared. Nevertheless, the inherent goal of Darwin's theory is not to provide a naturalistic explanation of the origin of life but of species. The critics attack evolution theory more often by exhibiting the logical contradiction between the vindication of common ancestry and ignorance of the origin of life. For an evolutionary biologist, the priority has to be given to addressing the question related to the origin of life. It retains the legitimacy of evolution theory which is considered as a theoretical base for all the biological inquiries. It seems they try to bring meaning to the existence of life in nature. That means inquiry concerning the origin of life is grounded in the ontology which deals with the questions related to the existence. Notice that the determinist explanations of phenomena in physicalism are the results of downward causation. For example, the description of water is determined by the specific proportion of the molecules of hydrogen and oxygen. Identification of the base elements thus grants a definite explanation of the object/phenomena in question. Unlike this, biologists recognize the existence of life by analyzing the process (of living) not the elements.

Determinism in biology can explain the fundamental material constitution and their proportional correlations in an organism. We fail to observe life as an entity, but, we consider it as the ontological base of living beings. One may even doubt that it is a property of the organization of matter. Such a thought might have developed due to the influence of Kant's view of the organism as an organization. Kant thought that an organism is the locus of the cause and effect of its existence. More specifically, they are the natural purposes which one

cannot interpret in mechanical terms (Watkins & Stan 2014). He also thought that organisms are the teleological ends because they "display not only a purposive organization of their parts within the whole but also a capacity for end-directed self-organization" (Breitenbach 2014, 21). The organization in Kantian biology indicates only the purposive self-organization. The inert matter is devoid of such a capacity of purposive self-organization though some chemical elements exhibit self-organizational behavior. Why did Kant think that the self-organization is purposive? Consider the wings of birds, for example. The proportion of wings in the body helps birds to fly which help to maintain the existence. With the help of wings, it can escape from the predators and cover longer distances for food and reproduction. It means there is a drive element in life, in the way of life, which directs organisms in meeting the ultimate end - completion of the life cycle (Russel 1950, 111). Similarly, Muller argues that

> each living thing as a whole is ever more clearly seen to be one great integrated system, the operations of which are all coordinated in such a way that, collectively, they tend to result in one outcome: the maximal extension of the given time (1955, 1).

A blind purposiveness is necessary in such cases where living beings have an internally defined teleology or teleonomy (Corning 2008, 235). It is not the case in the case of inert matter.

How is the purposive self-organization possible if there is no intentional element in nature? Post-Darwinian biology relies on 'chance' to address the question. Other option, apart from chance, which we usually see in the pre-Darwinian biology is relying on the immanent or the transcendent causes. Aristotle's and

Descartes' biological views are the most stringent examples of such causes in the philosophical biology. Aristotle thought that an organism from its origin to the end is in the process of actualization. He believed that the Soul directs them to progress towards the actual from the potential. The soul is an inner principle of things in nature; it is immanent. The cause of the teleological behavior of features in organisms is the internal reality of the soul. It is appropriate to call this as Aristotelian teleological internalism in biology. As a break from the Aristotelian teleological science, Descartes proposed a Mechanisticl view of life by uttering that 'organism is the mechanism.' His analogical account of organismic functions undermines the Aristotelian Soul as an inner principle. We can articulate the limitation of Cartesian Mechanism [in biology] by identifying the difference in the metaphysical grounding of organisms and artifacts. Though Descartes' Mechanistic descriptions have some epistemological value, an absent account of the cause of self-organization begs philosophical attention to this Mechanistic biology. Descartes was a Mechanist in his science whereas he had metaphysical inclinations in philosophy. His dualism of mind and matter presupposes the transcendent substance - God. The coordination of mind and matter in nature specifies the 'pre-established harmony,' in Leibnizian understanding, due to God's will. God as an ultimate cause had played a substantial role in the Cartesian Mechanism. This unveils Descartes' presupposition of the play of transcendent-subject (God) concerning the teleological nature of organismic features.

The above discussion shows that life cannot be a feature of organized matter but it is the reason for purposive organization. Both Aristotelian and Cartesian views are inappropriate to account for the reality of life in a naturalistic way. Our attention again shifts towards the Kantian biology for the second possibility. His concept of 'formative power' in organisms can be a harmless synonym of life

because it is the cause of the self-organization. We argue that it cannot be an exaggeration to think that Kant used the word 'power' to name the cause [formative power] behind the formation of organisms. By doing so, he had avoided the question regarding the existence of formative power. The 'power' does not have a concrete existence so does the life. But, concerning the empirical inclination life or power has, one may even be doubtful about the idea of the existence itself. Existence is a fluctuating concept in both science and philosophy. The predominance of empirical entities in natural science, for example, underlines physical existence. Philosophy is concerned about both physical and metaphysical entities. So that philosophy has a wider understanding of existence than science.

Due to the irreducibility of life in empirical terms, the propositions of life become 'meaningless aberrations' for the positivists. For positivism, a proposition becomes meaningful only if it is subject to the empirical verification. Even though we experience the life with life-forms, they categorize it as metaphysical. It seems the metaphysics, for them, means not *non-empirical* but *non-determinable* or 'non-definable' in the empirical sense. It implicitly claims that whatever science cannot explain becomes metaphysical irrespective of the empirical inclination. Based on this inability to account for the existence of entities which require a material base for existence but are not material things at all, it is inappropriate to categorize such entities as either physical or metaphysical. Life unveils the fact that this dichotomy of physical and metaphysical is not adequate to cover everything in nature. Life is an entity the existence of which is highly conditional to the physicality. How can we categorize a physically oriented phenomenon as metaphysical? Instead, it makes sense once if we call 'God' or 'Soul' as metaphysical. Life becomes a borderline entity.

Our experience of the living beings is the only source of the recognition of life in nature. That means, without organisms, life becomes a null concept - as organisms are life-ascribed material organizations. Without a material base, life could not have emerged on the Earth. As it is not a pure material entity, it cannot even be a mystic metaphysical entity, like God or ghost. We confront with a dilemma while attempting to categorize life. How do we categorize life is a yet-to-answer question. It is clear that the duality of physical and metaphysical is not enough to accommodate life which is quasi-metaphysical. What is meant by this is that life can be a causal entity with abstract nature and can causally act upon certain concrete entities. It necessitates an alternative category where both material and immaterial aspects can exist symbiotically. This requirement for a new category also intensifies the third way of looking at living things other than physical and metaphysical. In this regard, Lodge opines, "Life may be something not only ultra-terrestrial, but even immaterial, something outside our present categories of matter and energy; as real as they are, but different, and utilizing them for its purpose (1905, 668)." Here, he opens up the possibility of a unique means to understand the living entities and that is 'biologism.' Biology holds an autonomous position in the natural science and in the same way biological entities [organisms] enjoy a unique existence in nature. One should consider pluralist perspectives instead of conventional dualism while dealing with organisms. An organism is a blend of both physico-chemical elements [determinism] and life [indeterminism].

Like the argument that life is a manifestation of matter, there are arguments with nihilist tone that there is no such thing as life but only the process called 'living.' In both cases, the material base is a necessary fact. Not only science but also other branches of knowledge make use of the entities like numbers, figures, etc., though their existence is indescribable. That means their ontology is mind-

independent. Contrary to their wide use in explanations, it is a wonder that there is no universally acknowledged definition for them. The discussion retains the argument that physical/metaphysical binary should be replaced with pluralistic outlooks. While arguing for an alternative category, we also remark that the nature of the existence of life is beyond the scope of both scientific and philosophical epistemology. The ontology of life, therefore, possesses an independent existence away from our conception of it.

The origin of life is a 'chronically difficult' subject in biology as well as in other allied sciences (Ebersole & Shrewsbury 1959, 103). Due to this, there exists 'high degree of controversy' in the science concerning the origin of life (Fry 1995, 389). Spontaneous generation was the prominent idea in the pre-Darwinian biology that accounts for the origin of life. The major pre-Darwinians; Erasmus Darwin and Jean Baptiste Lamarck, had a strong inclination towards this doctrine, noted Ruse (2005, 31). Concerning the ancient biological ponderings of Aristotle, one may even doubt that he had summed up the pre-Socratic naturalistic beliefs of the material origin while expressing a shallow idea of the abiogenesis. Unlike this, a recent work remarks that both Aristotle and Hegel believed that "it is from the divine life that all natural life draws its being and obtain its notion" (Greene 1978, 235). The latter interpretation seems to be more appropriate in the vitalist context of Aristotelian biology. Although the spontaneous generation had supported the anti-creationist arguments, there were wider disagreements among scientists on such a possibility. And, Louis Pasteur brought a death-blow to the doctrine of spontaneous generation.

Though Darwin purposefully kept silence on the origin of life, it seems he had a strong belief on the abiogenesis, that is, the ontological dependence of life

on lifeless matter. (See his correspondence to Hooker 1863). Believing that life originated from inert matter acknowledges the ontological priority of inorganic matter. Later, Oparin (1938) and Haldane (1929, 1954) have retained such a belief of the inorganic origin. For them, life had a natural origin, but that was not an instantaneous event as believed by the proponents of spontaneous generation; life appeared on Earth following some sequential happenings (Ruse 2005, 32). Resultantly, there grew a supposition that the origin of life was not a 'happy accident' as thought by some biologists like Monod (1974), Mayr (1982), and Crick (1981). The understanding of the play of chance at the origin of life has been reshaped. Life originated on Earth by chance, but it does not indicate a miraculous causal event; rather, slow and steady instances associate with it. The evolution of life precedes the progressive development of chemical particles to the origin of life. Addy Pross (2012) thinks that these two processes; the evolution theory and the chemical theory of evolution, indicate the two phases of one continuous process. They are the high-complexity and the low-complexity phases respectively. Some people even think that the origin of the universe has held some secrets of the origin of life. They also believe that the origin of life precedes a long history of cosmic events; meta-level thinking on Oparin-Haldane arguments. For example, Rai (2000) says that

> I have concluded that this is a programmed and planned universe. There are order and uniformity in it. The expanding model of the universe, the Big bang, particles, atoms, molecules, radiation, energy, natural forces have been programmed very nicely to make this universe more fit for intelligent life and for expressing Divinity's sublimation (Rai 2005, 65).

It explicitly indicates that the biological evolution can only be a part of a broader going on process run by an ultimate cause. Altogether it implies that the cause of the origin of life has an intentional aspect.

The supporters of inorganic origin of life are divided and sub-divided further. One among these divisions is, for example, the 'pioneer metabolic theory' which asserts a hot volcanic origin and the 'prebiotic soup theory' stating a cold oceanic origin (Bada et al. 2007, 937). We can group them under the "Law Camp" (Fry 1995, 390) which asserts the usefulness of the philosophical presupposition, *i.e.,* the 'continuity thesis' in the origin of life research. The continuity thesis asserts that "there is no unbridgeable gap between inorganic matter and living systems, and that under suitable physical conditions the emergence of life is highly probable" (Fry 1995, 389). The believers of *panspermia*, *i.e.*, life on Earth from other planets put forward the supposition of the existence of cosmic life. The astrobiological investigations are, in fact, stemmed from such a belief. One cannot even downplay the influence of creationist views of the origin of life in the historical development of biology. Creationism believed that everything living in this universe is a product of the divine will. That means God created each species of organisms independently. Hence, the ultimate cause of the origin of life is God.

Many have accounted for the question of life in a diverse manner, but still, it stands as a yet-to-answer question in both science and philosophy. We start with some recent approach to the question. By analyzing the Hegelian view of life conveyed in *Logic*, Wendel Kisner expresses the uneasiness on bringing life under the category of mechanism because he thinks that life is a kind of 'purposive self-relation' (2008, 114-116). Corning enunciates that life is a 'synergetic effect' of the functional properties (2008, 233-237). Marcello Barbieri (2008, 29) ana-

lyzes the organic codes in the life-world to understand the origin of life regarding biosemiotics and concludes that life is *semiosis* [(for the biosemiotic view of life, see Hoffmeyer 2013; Cahoone 2013)]. Another concept of life is that it is a 'cosmic imperative' (Christian de Duve 1936, 620-623). De Duve seems to be supporting abiogenesis by perceiving life is an 'obligatory manifestation' of a *Vital Dust*. All these examples, except Kisner's, express mainly the explanatory possibilities of materialism regarding life.

## 2.5 Ontology of Life

The discussion in the previous sections makes it clear that the issue of *life* brings some unavoidable metaphysical concerns in biology. It is clear that scientific hypotheses on the origin of life are ultimately flawed because they do not contribute to discovering the exact answer to the metaphysical question 'what life is'. Definite knowledge of the causal conditions of life's existence is a prerequisite to answering this question. Therefore, it is necessary to reinstate the hard fact that ontology and metaphysics are interdependent and it is improper to claim either of which has any priority. Varzi's (2011) argument for independence of ontology is opposed here though we assert the precedence of the 'where from' aspect of the ontological investigation. The demand for a correct definition of life other than the functional ones pushes us to determine its ontology. What is the ontology of life? One cannot simply say that the ontology of an entity in simple terms; it is a complex understanding of the nature of existence, the causal condition behind the existence and the determination of category. Through the descriptions of these factors of life, we try to address the *being* of life in nature. The being here does

not refer to its phenomenological sense, but it simply indicates the *how* aspect of what-it-is-to-be-life in nature.

It should note that our understanding of life is allied with our experience of individual living beings. Life, however, has a dependent existence in nature. Explanations from *hylozoism* to *artificial life* do not undermine the view that life exists with the matter. The prominent approaches in biology; vitalism, Mechanism, and organicism, also do not necessitate an independent existence of life. The continuity thesis proposes that life can be an emergent property of matter. Hence, the characteristics of the 'living' cannot be equated with the nature of life whose existence is dependent on the inorganic matter. Another way of interpretation is that these qualities might have emerged one after the other in the matter and that life can be a total of these features. One might be skeptical about this opinion by referring to the purposive nature of living things. The characteristics of organisms such as *autopoiesis* and *metabolism* help them to improve their existence. The life-induced matter appears to be purposeful in the sense that the part-whole relation contributes toward their persistence of existence *via* championing the struggle for various needs. As they are theassisting factors in the process of living, the sum of them does not refer to life. Researches in the fields such as marine biology, astro-biology, and artificial life suggest different conditions of existence of life in nature (Helmreich 2011). These altogether show that we lack a proper understanding of the nature of existence of life.

The questions regarding the causal conditions of life's existence are also not settled, though there are several opinions about it. The biogenesis cannot account for the origin of life because it is implicit that the life presupposes the living. The argument 'life from life only' does not account for the origin of life; rather, it

explains the existential dependence of organisms on Earth. Darwin's theory of evolution explicitly substantiates this belief on the origin of one organism from, and only from, another organism. The creationists refer to a deity for the first origin, *i.e.*, the origin of life. The conditions of existence of life thus are grounded on the mystic reality of the deity. Biologists after the introduction of evolution theory express a strong belief on the idea of 'chance' which indicates anonymity of the causal condition of certain phenomena. There are scientific endeavors which try to fix the causal factors leading to the origin of life. As Dennet remarked, they try to reproduce the 'primeval soup.' For such researchers, the chance relates to the miraculous event that made the inorganic pool as organic. Some relates the miraculous event with an electric spark; they believed in the sudden appearance of life on the Earth. Unlike this, there are opinions of slow and gradual development of life, for example, from deep hydrothermal vents, or volcanic eruption, etc. The arguments of *panspemia* show that the life has come to Earth from space; establish the existence of cosmic life. Neither philosophy nor biology determines the causal condition of life, and this indeterminism triggers the *given* nature of life. It is clear now that a) there exist issues related to the category of life, and b) we require another category apart from physical and metaphysical to accommodate life. We can categorize organisms as living, but it is not that easy to have a category for life with the conventional categorization of entities in nature. Life has both material and immaterial aspects, and we cannot rule out one while experiencing it. To integrate our understanding of physical and metaphysical aspects of life, one needs to combine both philosophy and science. A trans-positivist principle is required to understand the life. The discussion so far brought us to the point that life remains to exist as an intractable reality until we find a methodology which can explain the symbiosis of physical and metaphysical.

# Chapter 3

# Immanence and the Ontology of Organisms

Discussion about the reality of life-forms in the philosophy of biology is stagnant due to the skeptical attitude over the ontology of organism. One may even find a hindrance to the reality claims due to confusion over choosing between Kantian organizational view, Hegel's concept of organism and Whitehead's philosophy of organism. Any reality claim which aims to provide true descriptions of living entities turns out to be a contingent assertion, as there is no 'model organism' to validate such claims. Descartes was right in viewing organism as mechanism based on the functional analogy between living beings and machines (Hutchins 2015). However, the disagreement with his Mechanism stems from the realization of the difference in their grounding. A mechanism (machine) starts functioning with an *external* influence while organismic functions take place *internally*. The play of the dichotomy of internal/external brings confusion in deciding what ontologically

an organism could be. Leibniz (1709) and Stahl (1707) believed that an organism is not the mechanism (Wolfe 2014, 96); Hegel also expressed such an opinion in his *Logic* (2010). Whitehead (1948) believed that an organism is an 'organized whole.' These post-Kantian views of the organism had influenced the 'organicism' approach in biology. Organicism asserts that "complex wholes are inherently greater than the sum of their parts in the sense that the properties of each part are dependent upon the whole in which they operate" (Gilbert & Sarkar 2000, 1). It means complex systems such as living beings function as wholes (Allen 2001; Needham 1928). Different approaches conceive organism differently and stimulate the persistence of our confusion over the ontology of organism. They have created a pluralistic understanding of the ontology of organism, and that is why organism seems to be "very much to the forefront among philosophical biologists at the present time" (Agar 1936, 16).

With a historical outlook of the issue, this chapter strives to differentiate organism from 'mechanism' in a non-conventional way. Unlike the attempts which are already in place, the focus is laid on the *uniqueness* of an organism by pinpointing the varied nature of organismic motion. We speak of organismic motion in the Aristotelian way, *i.e.,* explain motion regarding activity/function of an organism. Understanding of self-originated nature of organismic activities enabled us to identify the principle of 'immanence.' The principle of immanence, in fact, gives an ontological foundation for the *internal*['from within'] nature of organismic action/function. The concept gets a new look by uniting and generalizing the concept of 'immanence' scattered in the philosophical discussions. Through an introduction of *immanence* in biology, the chapter enables our understanding of *biological metaphysics* by highlighting its non-mystic nature. It opens up the possibility of a biological way of looking at nature/reality instead of the conventional

dichotomy of physical and metaphysical views. The chapter gives an elaborate explanation of the inward nature of causality in biology, it describes the difference between biologism and physicalism (which reminds us of the necessity of a biological understanding of the act of movement), it points out the play of *teleology* or *teleonomy* in biologism and its relation to immanence, and finally it clarifies the crux of the concept of 'immanence,' scattered in the history of philosophy, to apply it in the biological discussions.

## 3.1 The inwardness of Causality and Teleology

Pursuing an account of organismic motion along with a consideration of the Mechanical paradigm by which physicalism ordains the conditions of existence of motion is an exciting effort that would bring, perhaps, a thought about the 'ontological difference' between organism and mechanism (Herrick 1929; Nocholson 2010). We may fascinate to see the relative fact that such an endeavor implicitly prompts a belief on the varied scientific status biology possesses as a natural science. Once, the physical sciences were the only enterprises which came under science. Reductionism was prominent at that time, and physicalists believe that biology can ultimately be reduced to chemistry and physics. In fact, biology became an independent science only after Darwin's (1859) entry with the evolution theory. 'Motion' or the act of movement was a troubling issue in the natural philosophy at least from the Sophist tradition, but the seventeenth-century science had stereotyped it as a physicalist phenomenon (or concept) that follows mechanical laws (Newton 1999). It was a general tendency of the early modern time to describe everything known in Mechanistic terms by possibly avoiding the un-

knowns from the epistemology of science. The ingrained Mechanistic supposition was that fabricating a metaphysics-less epistemology of science. Although Mechanists intend to eliminate metaphysics, they focused mostly on avoiding mystic concepts like God, Soul, etc. from the explanations. The illumination of science with Mechanism and the resultant origin of physicalism happened just after Descartes (1968) had launched a provocative doubt on the ontological difference between biological (organism) and mechanical ('mechanism') entities. He followed a reductionist strategy by arguing that we can give mechanical explanations to the functions of the organism.

Let us illustrate an example of motion in both mechanism and organism. Motion is an all-pervasive phenomenon but seeking a generalist account of it through (Newtonian) mechanical parameters would be inappropriate due to the difference we experience between the motion in living and non-living things. This difference is an outcome of the changing conditions of existence that organism and mechanism possess in nature. And it could be expressed with an explanation of motion, regarding activity/action/function in biology. *Activity* here means the physical activity of organisms. These conceptions specify the role of the conditions of existence. The nature of a phenomenon seems to possess a proportional relation to its conditions of existence. To clarify this, consider, for example, 'gravity' which is a unique phenomenon but the rate of gravitational force varies in different planets because the surrounding conditions have influence on it. Metamorphosis in biology, for example, has a unique meaning though it has different manifestations (there is 'complete,' and 'incomplete' Metamorphoses). It means merely the transformation or change in shape. The different manifestations in the above cases signify the difference in the ontology of phenomena. Organisms have a specific life cycle; born, sustain, and die. Contrary to this belief when confronts

death an adult jellyfish can transform itself back to its infant stage and starts the life-cycle again. So that, it is impossible to have a generalist explanation of a definite life-cycle of the organism. The impossibility is rooted in the ontological difference this particular organism possesses in nature. Thus, the (Newtonian) Mechanical principles altogether cannot be the ground of an account of organismic motion/activity. The Newtonian mechanics(Newton 1999), which accounts for motion, can substantially address the activities in the 'inorganic' framework. It could be an inference to the best explanation of the mechanical-movements. It is so because it rightly describes our experience of the machine movement. The post-Newtonian perception of motion as an externally-induced phenomenon does not cover the motion that which produces activities in/of living beings. The reason for this lies in the ontological difference organism possesses from mechanism. For mechanistic motion/activity is mediated while that of an organism is non-mediated. It is so because organisms perform self-actions which is absent in mere machines.

Activities in the biological realm are manifested differently in the following manner. An organism's intentional activities such as a tiger's attack over the weaker animals; the non-intentional internal activities such as *autopoietic* activities; movements caused by the external intrusion and finally, evolutionary activity by which organisms and their features originate. Mayr (1992) had given scientific terminologies to all these biological activities. These four categories come under 'teleology', as *teleomatic*, *teleonomic*, *adaptations*, and *cosmic teleology*. Taking this multiple understanding of biological activities into consideration the prime concern here is to show how physicalism fails to account for the biological activities with Mechanistic parameters. This failure also underlines the ontological difference between organism and mechanism. An organism is a life-ascribed material

organization and the 'being' of which varies from the inert material organization of a mechanism. The use of 'being' here indicates 'what makes a thing as it is' and one must not confuse with its phenomenological sense. We should realize the priority of life in articulating the ontology of organisms. Life is not a negligible fact in biology so that the activities of life-induced things [organisms] can neither be avoided nor reduced. Hence, a Mechanist/Physicalist cannot reduce the motion of living beings into mere mechanical motion. Recognition of this dual nature of motion/activity [mechanical and biological] threatens the mechanistic overestimation of motion as a mechanical phenomenon. Unlike mechanism, an organism seems to move without any mediation (Possenti 2002). It moves by itself. The cause of an organismic movement (action) lies in the organism. It does not mean that Mechanistic principles are inapplicable in biology; rather, it reminds us the fact that organisms can act without following such laws. Possenti (2002) has taken a leap on this matter in "Nature, Life, and Teleology" arguing that there are two kinds of actions in the biosphere; *natural* which comes from within and *artificial* which comes from without. The causal inwardness leads us to the possibility of *immanent causation* implicit to life.

Based on Possenti's remark above, it is substantial to address the question that 'how does organism differ from mechanism in causal terms?' or 'how do we account for an organism's action differently from that of a mechanism.?' We are acquainted with many machines which are meant to lighten our everyday life tasks. In that sense, both a simple screw and a supercomputer are mechanisms. The intelligent systems are special kind of artifacts because they behave like intelligent organisms; of course, they are higher level artifacts but their existence presupposes anthropocentric teleology. Every mechanism works in the same manner; on the principle of mechanics.

The causality of an organismic activity refers to the internal factors. Consider photosynthesis in plants, for example. The leaves of a plant receive sunlight directly without any mediation and convert it into chemical energy. The plant behaves like a mechanism which converts one form of energy to the other. Plants convert light-energy into chemical-energy which ultimately act as fuel for their growth and activities. The plants themselves are capable of resuming the energy flow directly from nature devoid of a human subject. The presence of life perhaps is the reason for this ability. Growth as activity happens in organisms due to the persistence of energy by their actions. A common element that connects organismic action with mechanistic one is that the purposive nature of the activity. In the case of mechanism, humans decide the purposiveness of its action (function) while in the case of an organism, it is intrinsic.

The causal inwardness and the teleological nature of the outcome of organismic activities altogether made us believe in the *immanent causation*, *i.e.,* the cause and effect occur in the same phenomenon (Zimmerman 1997, 433-434). [For the discussion of immanent causation see, Emmet 1984]. In the history of biology, from its ancient vitalistic principle to the modern molecular biology, there are many indirect references to the principle of immanent causation. Molecular biology is more comprehensive and has higher methodological rigor than Aristotelian biology. Those who look at Aristotelian biology through molecular biology may end up with claiming that it is rudimentary in understanding organisms. However, if we look at the ontological issues concerning biological entities, Aristotelian biological explanations seem to be one step ahead of the functional nature of molecular biological explanations (See Lennox 2017, an elaborate discussion of Aristotle's biology). Even though metaphysical concepts had played a major role, ancient biology had tried to address ontological questions concerning living be-

ings. Aristotle thought that the organismic motion has an extended scope from simple movement to self-imposed activities. He endorses the possibility of an *inner principle* that causes organismic activities. He had retained the presence of a vital factor throughout his biology. The apprehension of explanatory regress concerning the ground of organismic activities had made Aristotle relying on an 'unmoved mover' (Gill 2003, 244). His concepts of 'Soul' and 'nature' are related. Nature is the Soul; the very substance of life, for both Aristotle and Plato (McClure 1934, 13). The inner directive power (Soul) then was considered as the locus of all activities (Plochmann 1953, 172; Possenti 2002). The organismic activities emerge or depart from inside of the organism.

There were remarkable attempts to overcome Aristotelian vitalism in the history through Fabricius, Galileo, Harvey, etc. They tried to generalize the nature of motion because a new methodology indeed was required to understand motion in the biological realm. Descartes had fulfilled the requirement of a generalized account of motion by depicting the analogy between organisms and hydraulic sculptures at the beginning of the modern period (Jaynes 1970, 232). One of the two approaches that had described the aspects of life in the modern period was the 'organism-the machine' view of Descartes; the contemporary molecular biology is a counter-part of it (Dobzhansky 1964, 442, 449). Cartesian machine metaphor purports the belief that organisms are machines (Ruse 2010, 57). He seemed to have reduced the totality of motion into the local motion (locomotion), and this created the niche for Mechanism. Unlike machines, an organism is a complex living entity capable of keeping itself in action by regenerating input energy. Cartesian machine metaphor turns out to be ambiguous concerning the self-referential nature of biological activities. Biological activity has an origin (cause) and an end (effect) in the same place-the organism. Thus, the causality is immanent-to-itself. The

Cartesian attempt, however, should have described the organismic motion with the mechanistic paradigms. Descartes' effort to de-spiritualize matter through a mechanistic philosophy had resulted in 'reductionism' which expunges the inner influence. The physical phenomena, for Cartesian Mechanism, were the result of direct contact between corpuscles (Wendel 2007, p. 2). The causation becomes downward causation in the Mechanistic philosophy.

Molecular biology in the contemporary scenario reiterates the adage of this seventeenth-century Mechanistic reductionism differently. Descartes' corpuscles supplanted the DNA in molecular biology. The ontology of an organism, but, does not rest only in these fundamental parts, whether it is corpuscles or genes or DNA. This overwhelming attention to molecular entities signifies the 'ontological reduction' of the organism in biology (Wolfe 2010). Organisms are actually 'wholes,' thereby, we should study them as wholes and not as the sum of their parts (Ayala 1974, p. 5). An organism has some unique properties or features which we cannot find in its parts. The parts have specific roles/function in the whole. These functions of parts may not have any correspondence to the functions of the whole. Though the parts constitute the whole, the latter transcends itself from the former. They are unique in their way. The reality of the whole cannot be located in the mere parts due to their irreducibility to the former. The conventional reductionism seems to miss the essence of the whole. The holism of organism here, however, is entangled with ontology. Erwin Schrodinger foreshadowed this in *What is Life*, stating that "the structure of the vital parts of living organism differs from that of any piece of matter that physicists and chemists ever handled" (1992, 3). This understanding of the internal variance of organisms and their actions may use as a postulate for the autonomy of biology. Descartes' Mechanistic biology was confusing due to the assessment of life-forms as *res ex-*

*tensa* which resulted in the incoherence of the fact of life (Jonas 1965, p. 43). With an analogy of the mechanism of the combustion engine and that of an organism, Descartes had put forth the belief that heat produced by the burning of food ignites the activities in organisms. They are internal processes of organisms. "Metabolism... is the constant becoming of the machine itself-and this becoming itself is a performance of the machine but for such performance there is no analogue in the world of machines", said Hans Jonas (1965, p. 47). The observation that metabolism is a method of self-construction, not a mere phenomenon of energy production, debilitates the machine model of an organism (Jonas 1965, p. 47). Mechanistic approaches fail to account for the 'from within' nature of activities in an organism.

Besides the Cartesian understanding of the corpuscles' interplay in biological phenomena, Kant believed that organisms are organizations in nature. An organism is both means and end of its existence (Cohen 2009) so that its organization is devoid of an extraneous agent. Kant calls this built-in condition of an organism as 'intrinsic purpose' (Cohen 2009, p. 15). He expressed it in another way by introducing the 'regulative principle' as an *a priori* condition. The *a priori* nature of regulative principle keeps a reference to metaphysics while the intrinsic purpose retains the reference to the internality of organisms in his biology. The metaphysical aspect is bound with the transcendent existence of regulative principle. The regulative principle as an *a priori* condition is beyond the phenomenal level of experience. The internality mentioned above is the condition to which Hume was pointing in his account of causation (Hume 1999, 2009). For Hume, there is a 'secret connexion'(Strawson 2014) between two events, *i.e.,* cause and effect, other than the regularity of causal events (Glennan 1996, p. 49). There exists a mechanical theory of causation other than the regularity theory. Hume's

skepticism seems to consonant with the brute facts of nature concerning the regularity of events. These facts are the laws of nature or Humean 'secret connexion' that connects phenomena to each other. This secret connection is not extrinsic but intrinsic. From the analysis made so far, it can be inferred that metaphysics had been retained in each stage of the development of biology.

All these accounts of the organismic aspects in some way entangle with the inner principle or the internal force which influences the organismic motion/activity/function. Though there cannot be any physical activity without movement, all organismic functions/actions substantially linked with the motion. Causation concerning the biological entities expresses an inward rather than outward nature. That means the causal investigation goes into the ontology of organisms. In other words, we have to think about the *organismic-introversion* rather than *mechanistic-extroversion* concerning causality. The distinction between organism and mechanism can be expressed as "that thing whose movement is from outside, is inanimate, but that to which it is intrinsic to itself to be moved by itself, is alive" and this instigates us to believe that the prime factor of an organism's motion is the "proper office of life" (Byers 2006, p. 726). We suppose that life can be the force that inherently makes organismic actions possible. Thus, search for the reason behind any organismic action (motion) goes inwardly into the innate empirical fact of the organism. At least in the biosphere, there is a reference to the inner condition (of living beings) where the action takes place from within. Since it comes from within, the internal influence (probably, life) cannot be either super-natural or supra-natural. It could hence be a natural fact but the ontology of which possesses an empirically irreducible nature. That means independent of naturalistic epistemology.

Apart from *vitalism* and *Mechanism*, the *organicism* approach was also proposed to determine the ontology of the organism. Organicism, as materialistic holism, rests between the principles of vitalism and Mechanism. It calls off reductionism as well as discards the vital concepts such as *elan vital* and *entelechy* from the purview of biology. The properties of complex entities (organisms) emerge only through the interactions of their constituent parts; therefore, they cannot be ascribed to the parts (Gilbert and Sarkar 2000, p. 2). Biology cannot progress in a reductionist way not because there is something irreducible in biology but because of the necessity of a different strategy to explain the aspects of life (Dobzhansky 1964, 447). The living beings exhibit the kind of existence (between metaphysical and physical) so that biology (broadly, biologism) is required a unique approach for itself to understand the organism in its full sense. The organicism considers organism as 'organic whole,' hence, deviates from both vital and Mechanistic principles. Its rejection of old type metaphysics and the assumption of 'emergence' of properties altogether point towards the supposition of the presence of an immanent action.

If Dobzhansky was right in his claim that Darwin's approach was organismic, then evolutionary biology can substantially contribute to this discussion of immanent organismic action. Darwin focused on the available features of organisms or species to unmask the causality behind them in a naturalistic way. He understood that those features which provide more reproductive fitness would be selected and transformed into the next generation. Firstly, he attempted to grasp 'what for' of organic features and then rummages through the lineage of species to answer 'how come' (Mayr 1961, 1502). The nature of causal backwardness in his evolution theory underlines the fact that biological explanation would not be possible without reference to the past. His argument from analogy goes inwardly

into the adaptive history of species and gives justification to each stage with the mechanism of natural selection. For him, natural selection is the "preservation of favorable individual differences and variations, and the destruction of those which are injurious" (Darwin, 2009 63). Darwin's fitness-oriented answer satisfies the functional biologist's urge to know the 'how' aspect of the existence of an organic feature in a population. The conditions for natural selection, however, necessitate the preexistence of variations. Natural selection performs over variations and cannot itself be the cause of those variations. Darwin did not give a satisfactory explanation of the cause of variation, but neo-Darwinians try to fill that gap with the ideas like mutation, genetic drift, etc. Whatever it may be, variations refer to the 'from within' condition of organisms because, for Darwinism, the organisms are the seat of variations. The changes take place internally in organisms, and one cannot make any causal claim from without concerning this change. It is substantial to remember Bergsonian remark about the necessity of intuitive methodology here (See Lawlor & Valentine 2016). For him, the scientific methods cannot reveal the internal changes of any phenomenon in nature. Evolutionists consider the causes of variation as 'chance' occurrences or accidents. The internal changes occur in the organism do not refer to any transcendental element but an inner influence in itself.

We should remember that natural selection also works as a feedback mechanism in evolution considering Darwinian and neo-Darwinian theories. As a feedback mechanism, natural selection cannot be a chance process. Chance seems to be a cementing factor that fills the ontological gaps wherever applicable in the evolution theory. In this sense, biologism preordained with two real chance events, *i.e.,* the origin of prime matter as well as the emergence of life in it. An articulation of the relation between 'how come' and 'what for' aspect of the *why*

concerning organism is required to reach the argument for an immanent action in organisms. We have to move further to show how their relationship connects the causal inwardness in biology. 'What for' is qualitatively ascribed with the purposiveness; with intention; with finality; or more generally, with teleology. The term 'teleonomy', instead of teleology which is an 'anathema' (Agutter and Wheatley 1999) to scientists, is often used in contemporary biologism to indicate the purposive nature of biological phenomena. Before getting into the teleological issues, it needs to clarify how biologism varies from physicalism.

## 3.2 Biologism and physicalism

The *all-in-one* explanatory nature of physicalism seems to be treating both organic and inorganic objects alike to universalize its methodological principles. Whereas attempt to explain an organism with such methodologies brings a feeling of uneasiness in biology. This discomfort eventually exposes the conceptual change between biology and physical science. The absence of features like self-replication, heredity, homeostasis, metabolism, etc. in inorganic objects legitimizes the ontological variance of 'non-living matter' from 'living matter.' Biology varies greatly from physical science regarding methodological incompatibility. Here, we specify the distinctiveness of physicalism and biologism by showing the organizational and functional dissimilarity between organism and mechanism. For that, we rely on Haldane's account of Life and Mechanism.

Haldane's (1884) comparison of an organism with machine substantially elucidates the distinctiveness of organic activities. By establishing the uniqueness

of the organism, Haldane offered a different understanding of the relation between states of affairs in biology. The mode of cause-effect relation in physicalism seems to be inadequate to describe the organismic features which are more or less reciprocal. The organismic adaptability to novel situations shows a kind of self-purposiveness in organisms and to establish this fact Haldane relied on Darwin's experiment with earthworms. He moves on to the discussion by comparing the earthworm's 'purposive' behavior with the falling-back nature of a propelled stone. Earthworm closes the mouth of its burrow with available materials, and a stone falls back on the Earth every time if we throw. There is a commonality between the two events, *i.e.*, the constant nature of the outcome. Earthworm ultimately attempts to close the mouth of its burrow by adapting its behavior to the changing surrounding conditions. Likewise, a stone ultimately reaches falls back in whatever direction it is propelled. The outcome remains the same with the changing conditions in both these cases. Gravity plays a crucial role in the 'falling –back' behavior of the stone. Based on this understanding, Haldane supposed that there might have any such force acting on or influencing the earthworm indirectly in its behavior of adaptability to unusual situations. Though it is unknown, he comprehends that a force is acting from nature. In fact, such force is indescribable by empirical (material) means. It is a force like the force in Kantian Copernican Revolution that influences perception. [Kant opined that our senses are attracted by the objects in nature and not in a reverse way. That means some force in the object itself drag our attention to them (Thilly 1925)]. Haldane further established his argument for the 'reciprocal relation' that exists between the parts of the organism and the organism's relation with its surroundings. The force (though it is anonymous), in this sense, would not be a transcendental or supernatural one. Hence, he argued that there is no room for vitalism in his view of the organism.

Haldane's view seems to be analogous to the thoughts of Aristotle on organismic development only if we omit the metaphysical part of the latter. For Aristotle, an internal force influences an organism in its development from potentiality to actuality (*De Anima* - Aristotle 2011). The internal purposiveness and the implicit presence of an *unmoved mover* gives a teleological outlook to Aristotelian biology. The role of *finality* and the concept of *Soul* altogether modeled his biology vital. Aristotle and Haldane necessitate the presence of a force in the organism. Apart from this, Haldane's view also corresponds to Spinoza's God-nature relation; *pantheism* (Nadler 2006; Spinoza 1994). That is possible only if we omit the metaphysics of the latter. Spinoza thought God relates to nature immanently. The phenomena in nature are to be understood only with the immanent substance. God seems to be the influencing force in nature. Both nature and God work together for their manifestation. Hence, Spinoza depicts a reciprocal relationship between them. Apart from the metaphysical inclination, the views of Aristotle and Spinoza admit the existence of an influencing force in organic activities. Spinoza was concerned about the whole world including the living world; Aristotle's view rests on the organic realm so does Haldane. The analysis of Haldane's account illustrates that through the principle of reciprocity the organismic actions emphasize the fact of self-maintenance. Mechanical actions, in fact, do not refer self-maintenance using output energy; the reason for this may be the absence of an inner influencing force in mechanisms.

The discussion of biological variance extends or suffuses with a stratagem, *i.e.,* organism. It is a hybrid concept with multiple understandings ranging from metaphysical and empirical to ideological and biological (Wolfe 2010, 196). Apart from all these manifestations, the first and the foremost view associated with the organism is that it is a *complex self-organization.* The remarkable interest of

biologists on the possibility of self-organization asserts that it could be the *mechanism* (in the sense of function) in organisms that generates adaptive features. Not only life-oriented matter but also inert chemical molecules express self-organizing behavior. It is not the self-organization but the resulting 'form' which is the matter of discussion here. Self-organization in chemical molecules ends up with geometrical forms while the form emerged from the self-organization in biology exhibit non-geometrical but adaptive nature. The materials in the investigations of physical science, even in its fundamental level, have a definite structure or form. Biology's one of the materials for investigation is an organism which possesses an indefinite geometrical structure; at its fundamental level, biology deals with life which is formless. This formlessness is the prime hindrance in the search for the ontology of life in biology. Life is not an observable entity. We detect/identify its presence through our experience of heterogeneous living beings. Life seems to obtain different forms in different organisms. However, the plasticity of life does not specify that there is no such entity in nature. Unlike the chemical structures of self-organized molecules, the adaptive form of organisms emerged from or caused by the form-less life. Kant (2007), for example, thought that life as the capacity of a substance to determine itself to act from an inner principle. The substance in the Kantian view is the organism and nothing else. Unlike physicalism, biologism keeps a kind of monism concerning the fundamental subject matter, *i.e.,* the life which binds all the discussions in biology.

The concept of existence in biology may also enrich the current discussion. How does biological existence differ from physical existence? Organisms have limited but progressive kind of existence; they are born, grow, reproduce and die. The duration of organismic existence has a limit and is spatiotemporally relative. Dawkins (2006/1976) and Stephan Leduc (2010/1911), for example, argue for the

'carrier' behavior of organisms. For Dawkins, organisms are the vehicles of genes. Leduc (1911) says that an organism is a transformer of energy and matter with an evolutionary form. In his opinion, 'living' is a transformation process of energy and matter from the infinite duration of past to the infinite duration of future, so that follows both the law of continuity and the law of conservation.

The definitive nature of the causal relation, emphasized in physicalism, is replaced by teleology in biology. Teleology thus is to be seen as an outcome of human beings' "reflection on the circumstances with [their] own voluntary actions" (Ayala 1974, 8). The explanations of human activities would be flawed except the understanding of their anticipated results. Likewise, evolutionary adaptations cannot explain without considering their contributions to the survival and reproduction. The collective account of the existence of adaptations of an organism determines its 'fitness' in a given environment. Adaptations in this sense are the contributors of evolution which is their 'ultimate' arrival point despite their 'proximate' functional references. Organisms as 'natural systems' possess teleological behavior regarding means-to-end relation rather than looking at an intensive subject outside. Aristotelian biology viewed organisms as 'end-directed' substances with an internal teleology within themselves. Kantian understanding of the 'formative power' in organisms further indicates the modern belief in natural teleology. If the intrinsic natural power of organisms in Kantian thought does not refer to the kind of teleology Aristotle proposed, then it would exactly be a reference to the evolutionary kind of teleology. Since the concept of formative power is self-propagating, self-explanatory, self-evident and the end-setting, Kant's view of teleology out-grows from Aristotle's and then give the hints of its immanent nature. Organisms are 'organized wholes' where the part-whole relation is reciprocal and not exactly causal. He discarded the Cartesian Mechanistic account of

the organism by accommodating the organic forces along with mechanical forces in the descriptions of living beings (Kolb 1992, 23).

## 3.3 Immanence

From the discussion above it can be inferred that the organism contains in itself both ontological and teleological ground of its actions. A mechanism requires outside factors to assist its actions. Apart from considering living beings as mechanisms, modern biology views analogy between biological and machine activities and then tries to explain phenomena mechanically. This approach also ultimately takes us to the reality of life which is the immanent ground of anything that is living. How does life exhibit itself as a reality more than the mechanical organization of matter? Life can only be an emergent property of matter concerning the continuity thesis. Also, life is not an innate condition of the prime matter; otherwise, there would not be the distinction between organic and inorganic matter. If life originated from matter, then the cause of life must be laid within the purview of matter. There would be an inner self-action when an inanimate matter turns out as animate. This first movement or action during the transformation of inert matter to organic or the given prime stuff to the well-ordered nature we call 'immanent action.' One certain fact is that without an action life cannot have emerged from matter. A primal internal change in the inert matter transforms itself into a living matter, and the reality of this phenomenon might be immanent-in-itself. Such an outset action or the primal change is what essentially evolutionists termed as chance or accidence. Therefore, an ontologically immanent movement is a necessary condition for the existence of life on Earth.

The 'given' condition (of matter) is a substantial necessity of immanent action concerning life. Immanent action, then, is conditional with the physicality of the ever dynamic universe. It also means that *immanence* is a state of nature where actions take place without external mediation. To bring clarity to this statement, we need a short but substantial understanding of the meaning of immanence in the history of philosophy.

*Immanence*, discussed here, maintains a difference from the scholastic use of it. However, the conceptual crux of it one can even find in the classical philosophy of Plato and Aristotle (Marc Rolli 2004, 50), or before that in the pre-Socratic Democritian atomism (Egan 2012). The pedestal of Plato's concept of the idea is the subjective experience of individual instances. His belief in the ideal world and its transcendence from the world of experience altogether make him a realist of a unique kind. The transcendent attribute of the Platonic idea [Concerning 'experience' and 'beyond'] Aristotle had brought down to an immanent level by articulating the inseparability of form and matter. What role the idea played in Plato's philosophy, so did the form in Aristotle's philosophy. For Plato, the idea is that which causes the *being* of things. It is the essence of particulars. The idea is real, the custodian of its dependent instances. One never gets a grip with it through mere sense-datum so that it demands an intuitional cognitive up-gradation to intelligibility. The intelligible and the sensible are the elements of a bottom-up epistemological process. Hence, there is no unbridgeable gap between them. This intuitional up-gradation of cognition that provides the knowledge of ideas has ground on the experience of sameness-in-particulars. For instance, one's answer to the question 'what Descartes, Shakespeare, and Picasso are?' would undoubtedly be human beings. Here, 'human' is the idea those three historical personalities commonly share. The practical impossibility of a cognitive leap onto

the idea 'human,' without stepping on the experience of particulars, however, suggests that there is a progressive principle of understanding.

The forms or ideas do not possess independent existence without instances, so that, they are the 'immanent universals' (Perl 1999, 341). The 'human' (the idea) that shared by every human being is not 'one-over-many' but 'one-in-many.' Upon the ultimate apartness of the idea, Plato had developed his argument for an ideal transcendental world. The understanding of idea is a trans-experience, but it does not mean that a particular idea is independent of its instances. Independence of ideas in Plato's thought does not mean that they are 'able to exist without' instances. In Plato's philosophy, the intelligible content of a thing immanently relates to its sensible content.

For Aristotle, the form is not independent of the matter. This principle of inseparability is the primary strategy of immanence in Aristotelian thought. The substance is a blend of form and matter so that he meant the concrete particulars by the word substance. For things, the body is the matter, and the soul is the form. The immaterial Soul is the structure, function, or organization of things. Aristotle's knowledge of the variance of things regarding potentiality and ontology [of things] had led him to argue for the degrees of Souls. The Soul in this sense is identical to his concept of internal teleology - the triggering factor in the process of actualization. The organismic development from a zygote to a well-adapted human being is an organizational process. Aristotle saw it as either a soul-directed or a purpose-directed progression. That means an internal push causes the formation of a thing's *being*. One may find the process of actualization is a violent movement due to the internal push by taking his cosmological views such as natural motion as free-fall into consideration. The force that comes from

within [corresponds to the Newtonian gravitation] naturally accelerates the potentiality to move towards actuality. The immanence possesses a double nature in classical philosophy; it was passive in Plato and became active in Aristotle.

Spinoza is the first and foremost to the champions of immanence which he used to express the inseparable relation between God and nature. Spinozian pantheism is a proclamation of the internal boundedness or the co-existence of ontologically differentiated entities. He presented God as the immanent intrinsic force that efficiently causes the whole world. The immanence here does not mean 'immanent to something,' but God as a substance is immanent-in-itself. Spinozian substance, a monistic cause, immanently act as a sufficient reason for everything that exists but transcends from them. Here the transcendence does not indicate the complete independence of substance from its modes. They are inseparably one. The immanence thus refers to a *relation* [in classical idealism and rationalistic theism] where the abstract universal possesses an inherent inseparable relation with concrete particulars. This inseparable oneness is the ontological ground of the *being* of things. The parallel line of arguments in these philosophies is pointing towards the fact that the transcendence is an aspect of immanent abstractness. Between the scholastic introduction and Deleuzian renovation, the concept of immanence appeared differently. It oriented towards the spiritual 'being-with-itself' in medieval theology. It became the immanent cause of the world in Spinoza's necessitarian monism. Kant relates to it in the transcendental dialectic by assimilating reason and the sphere of possible experience. It appeared in the post-Kantian German idealism with the shroud of the 'absolute'; and then, becomes the plane or the ground of the creation of concepts in Deleuze for whom it is the 'very vertigo of philosophy.' Its characteristics, inseparability, intrinsicality, and internality, bind all these diverse conceptualizations of immanence together. The

philosophical, conceptual schemes of immanence have significant roles to play in biologism. A Darwinian kind of selection is required, to reintroduce the immanence in the biological way of thought, throughout the history of the concept or from its philosophical destinations to make it fit in the purview of biology. The reappraisal in a different realm of thought, *i.e.,* biologism [which has both philosophical and scientific inclinations] demands a generalized account of immanence. The necessary convergence of distinct philosophical understandings of immanence perhaps leads to the inner core of immanence which had a non-linear progression in the history. Spinozian view of immanence seems to be more apt for the present purpose as it is more 'Natural' than conceptual.

In Spinoza's philosophy, the existence of the world has its root in the necessity of a *causa sui* [self-caused] substance (God). This monistic pantheism relatively asserts that all modes; the world of possible experience, are in the substance. Spinoza's consideration of God as the 'immanent cause' expresses the invariable bond of Nature with God. Immanence here indicates the state where modes necessarily relate to the substance that is the inherent and sufficient cause of their existence. Immanence hence is rooted in the causal dependence of modes on substance. Deleuze seems to agree with Spinoza on this point, though his idea of immanence is mostly Kantian than Spinozian. There is something common between the phenomenological 'plane of immanence' and the rational 'immanent cause.' Spinozian 'modes' and Deleuzian 'concepts' exist in the ground or a plane without which they neither exist nor non-exist. The expressions such as modes are 'in substance' (Spinoza), and 'ex nihilo creation' of concepts (Deleuze 2001) refer to the same concept, *i.e.,* 'immanence' – a phenomenal concept that does not refer to anything *beyond*.

Immanence correlates with *inherence* (Melamed 2006). However, the latter is not identical to or equated with the earlier. We can understand inherence with some examples in the history of philosophy. The perception of universal in particulars is a classic example of inherence. Plato's Ideas are universal, and one cannot have an understanding of it except the experience of particular instances (Rasmussen 2009). The universal nature is not 'inhere' from particulars, but it exists and expresses itself in the particulars. Aristotle's form-matter unity also indicates that neither of them enjoys an independent existence. Kantian synthetic judgment will be an utter impossibility if we omit either *a priori* or *a posteriori* (Kant 1998) from our understanding of phenomena. Hegel's *absolute* (Hegel 1977) in the same way, is nothing apart from 'thesis-antithesis-synthesis' triode. Inherence manifests under the shadow of immanence without any external intrusion. The biological concept of 'species' one may understand regarding inherence; the species (for example, *Homo sapiens*) become a meaningless verbalization without any correspondence to populations (human population). At the same time, understanding the relationship between matter and life in association with the concept of inherence will become a false move because matter exists without life, but life does not. The relation is 'one-way,' which we have discussed in the second chapter elaborately, and we would discuss concerning of immanence which is the ground of all kinds of relations.

Let us examine how we can connect immanence to biologism concerning 'inseparability, internality, and inherence' on the one hand, and 'ground or plane' on the other. In biology, life is the thread that binds all the thoughts about organisms together. Without the pre-conception of life, no one can conceive of any system of organismic thought. It reveals that the best way to apply immanence in biology is to attribute immanence on life which is the 'ground' of the subject.

All living beings and their attributes are grounded in life so that it is the *plane*, as Deleuze opines, where the concepts (of the subject) have an existence. For example, concepts such as species, autopoiesis, inheritance, metabolism, etc., are those who cannot get meaning regardless of an understanding of life. Life is the *plane of immanence* in biology. Apart from this, life is the ground or the substance of all its modes - the living beings. Life relates to the matter in the same way form relates to matter. Here we focus only on the biological motion regarding the organismic action although all attributes of organisms relate to life. An account of the organismic phenomenon (or movement) may explain its ancestral causal condition. Spinoza (1994), unlike this, notes that the existence of a phenomenon can be explained or understood through an understanding of its causality. The perception of an organismic act of movement, thus, necessitates an account of its causality. As biology does not refer to anything 'beyond,' all the four Aristotelian causes seem to be presented in the biological phenomena themselves. Life as the ground of all that is 'living,' then, works like an Aristotelian efficient cause.

Metabolic or autopoietic activities of living beings do not refer to any external intermediation and hence, possess the intrinsic causality. The cause which produces effects in the organism by acting 'from within' is intrinsic. It would be paradoxical to assign an external cause to a phenomenon which comes into existence due to an internal cause within itself. This unfeasibility of a 'from without' cause reveals the necessity of an internal or intrinsic cause for the self-action in the living realm. This invariability of intrinsic actions and ontology of organismic phenomena bring forth the idea of immanence in biologism. The organismic phenomena are, thus, caused by an immanent action of life which is the 'ground' of all that is living. The play of immanence is in the thoughts of, but not limited to, Democritus (Egan, 2012), Plato (Perl 1999), Spinoza (Hawes 1991; Lucash 1994),

Leibniz and Berkeley (Davenport 2010), Kant (Rolli 2004), Hegel (Min 1976), Nietzsche (Egan 2012) Deleuze (de Beistegui 2010; Mutsaers 2016), etc., retrieve its importance and instigates us to seek the possibility of immanence in biologism.

### 3.3.1 Immanence and Teleology

Chance-influences in evolution theory recognize the mechanistic outlook of natural selection developed. Chance plays a pragmatic role in Darwinian epistemology. It keeps Darwinism as a reliable scientific enterprise with a naturalistic outlook by pushing out teleology from its provenance. Teleology is intolerable for science because of its historical inclination toward metaphysics. The possible chance occurrences which we noted above are in the 'pre-phase' of Darwinian evolution (Huxley). For Huxley, Darwinian evolution has its 'pre' and 'post' phases or sectors; the inorganic and the psycho-social (human) phases. Darwin's delineation of chance in his theory of evolution seems to be, surprisingly, meta-semantic because of the incompatibility of selection and chance. The word 'natural' in the evolutionary biology means unintentional which correlates with the chance. Hence, natural selection can treat as 'chance selection.' Selection, as it is depicted in Darwinism, is a process in the biological realm. One may ask 'what is meant by chance in the context of evolution?' by keeping these views in mind.

'Chance' is a substitutive concept imposed upon the 'indeterminate' aspect of the causality of phenomena in nature. In this sense, chance gets multiple realizations concerning the two prime origins, *i.e.*, the origin of prime matter as well as the origin of life in it. Let us see how chance manifests differently concerning these historical chance events. In the case of 'origin of life,' the causal factors in

their material form present in prime matter. It could be either an inert matter or the 'stuff' with innate potentials. Whatever it may be, the causal factors of life would not be external to that prime stuff, unlike the creationists' argument. The potential causal factors for the origin of life might have necessarily and sufficiently present in the prime matter. However, the causation behind the origin of life is a mysterious truth for us even now. With the advancement of technology, molecular biology explores the possible material factors which might have caused the origin of life. It is not the material causal factors but their assimilation which indeed had led to the origin of life. It might have happened accidentally. Thus, chance seems to replace the 'intentional' element behind the formal, efficient, and final causes in the Aristotelian sense. Chance in Darwinism has a sporadic nature; that means, the causal factors accidentally integrate together the result of which would be a unique phenomenon/entity.

Darwin's account of open-ended evolution had made a paradigm shift, in biology, from the earlier 'finality' assigned views. His argument against the linear view of evolution attacks the traditional 'finality' sense of teleology, but it cannot avoid the teleology with its 'functional' sense. The terms such as 'finality,' 'purpose,' etc. represent teleology with a slight variation in their sense of representation. Darwin's predecessors, most of them, had possessed the creationist metaphysics of linear progression. Darwin's rejection of teleology primarily targeted on the belief that the evolution progresses toward a specific end. This rejection does not cover 'what for' aspect of organismic features. The question concerning the teleology of evolution would be inappropriate in the context of Darwinism. Instead, one can ask questions regarding the 'use' of different organic features which are the outcomes of evolution. For Darwinism, every organismic feature has some function which makes the organisms 'fit' to survive and reproduce in a certain

environment.

Teleonomy, as a substitute to teleology, opposes the laws of nature; nature has a causal order (Pross 2011). As a biological possibility, teleonomy does not follow the laws of nature. Human inventions violate the laws of nature; the car up hills against the gravitational force or the refrigerator cools its interior while the atmosphere is hot. In this manner, teleonomic features are against the natural laws. The fur of a polar bear, for instance, keeps the interior of its body warm while the environment where it lives is always low in temperature. Addy Pross considers that the origin of life is a teleonomic activity. He reframed the question of the origin of life from non-life as 'how do thermodynamically unstable systems emerge from thermodynamically stable systems and how they maintain the instability'? The discussion so far reveals that teleonomy is used in biological thoughts to express 'what for' of the evolutionary features. The features with teleonomic nature are those who contribute to the survival of living things or life in nature. As Darwinism accounts for progressive evolution, the question concerning 'how come' of a teleonomic feature necessitates an understanding of its causal mechanism. It drags us into natural selection further; other mechanisms such as genetic drift are the tributaries of natural selection.

The functional explanation of organismic features connects natural selection to teleonomy. Evolutionist's preoccupied duty is to find out the causality behind the existing biological phenomena. Causality has three aspects, *i.e.,* explanation, prediction, and teleology (Mayr 1961). Evolutionary epistemology seems to be silent in the case of 'prediction' concerning the evolutionary process (Scriven 1959). Darwinism accounts for the organismic features in two ways. It gives *a posteriori* as well as the teleological explanations of organismic features (Mayr

1992, Ayala 1998). Taking these two for granted, it seems, causality does not go outside of the play of 'proximate' and 'ultimate' reasons. This apparent purposefulness may term as teleonomy. The teleonomic features are found relatively in the biological realm; no mechanism develops any feature to maintain itself. This kind of 'purposive self-relation' accounts for the existence of life in organisms (Wendell Kisner). Concerning the usefulness of features, organisms exhibit some purposiveness. Biological phenomena which call for teleological explanations are adaptations. They are useful to the organisms in their essential functions of survival and reproduction, and this usefulness justifies their existence (Ayala 1998, 43). Both Mayr and Ayala agree on the point that teleological explanation regarding function is invariable for a complete biological explanation. The descriptions of organismic functions do not posit supernatural or human mediation. The organismic functions are natural in the sense that they come 'from within.' The function of an artifact, for example, is artificial because of human mediation. Hence, they are causally determinable. Biological explanations have causal and teleological factors which we cannot express in a determinate language.

The varied nature of biological explanations stipulates the ontological gap between mechanism and organism. The reason behind this biological uniqueness is the play of 'life' without which an organism (biologism) is nothing but mere physical and chemical organization (physicalism). The nature of biological explanations is rooted in the ontology of life itself. The reality of the origin of organismic features has a close correlation with the reality of life. The reality of life indeed possesses an intractable nature so does the ontology of organismic features. We are unable to account for the ontology of life because of the practical impossibility to determine its ontology. The ontology of a thing consists of at least its full aspects. Life wonders us with all its known aspects, and there would be more

anonymous to us. Life seems to be a pluripotent reality; it exists in the oceanic hydrothermal vents, and there are signs of it in the extraterrestrial planets. The indeterminate nature of life-aspects does not support any account of the ontology of life. The ontology of life, hence, keeps independence from our understanding. The dynamic goal-directedness of life makes it an efficient cause that acts from within the organisms. To recognize the 'from within' nature of an organismic action, let us consider the example of *Turritopsis dohrnii* – the immortal jellyfish. The cause of immortality is its revert-back behavior. This small marine organism grows and propagates naturally like other organisms, but it reverts to the polyp state when it confronts death. Jellyfish chooses back its sexually immature stage of development instead of facing a natural death. No known organism other than jellyfish exhibits this choosing back behavior, so that, the causality behind this phenomenon resides with the organism. The genetic makeup of jellyfish where the program for this particular activity is encoded exists not outside but inside of the organism. The action, therefore, comes from within. The discussion has brought us to the conclusion that the teleological, or teleonomical, nature of organisms is relative to their immanent inner conditions. Hence, the purposiveness is relative to the immanent causation. As we saw, the immanent causation specifies the intrinsic state of a natural entity where the action takes place without any external assistance.

## 3.4 Conclusion

The growth of the belief that 'physical facts fix all other facts' is not a direct impediment to 'ontological physicalism.' Rather, it questions the ultimate reli-

ability of physicalist determination. The organismic self-actions are problematic to Mechanists both in physicalism and biologism not because biological entities are mysterious natural kinds exist 'outside the box.' However, organisms possess invariable ontological differences from mechanisms regarding the nature of causality. The analysis of organisms using mechanistic parameters exclusively vindicates the role of downward causation and reduction in physicalism. These ardent materialist theses, but, ultimately take us into the ontology of life which plays an immanent role in the organismic act of movement. Immanence becomes analogous to the state of nature from where, Possenti (2002) says, actions come from within. The causal-inwardness in biologism, contrary to the Newtonian understanding, legitimizes the possibility of an immanent action in nature. By exhibiting biologism as a third way of understanding, we eradicate the possibility of external mediation both in the physical and metaphysical sense. What has been arrived from the discussion necessitating immanent action in nature is that the 'ontology' is a prerequisite of both metaphysicalism and physicalism. The ontology here refers to the conditions of existence. Quine's (1948) account of 'on what there is' can substitute with 'everything' with an emphasis given to the 'conditions' of the existence of things. The conditions or the states of affairs, perform a causal role, are the antecedents while the existing things are the consequents. The prior existence of conditions is a logical necessity and an epistemic requirement in any search for the reality of phenomena.

Setting aside the 'given' prime matter or the mystic concepts along with the explanations of phenomena both physicalism and metaphysics unintentionally paved the way to ontological realism. Different thinkers have diverse understandings of the causal 'condition' of the outset. For example, the Platonic *demiurge*, Aristotelian *entelechy*, Cartesian God, etc. are the historical 'full-stops' of back-

ward causation. The infinite regress is a tautology in the search for the reality, but, when dealing with biological phenomena, we do not require relying on the mysterious metaphysics to overcome it. All biological inquiries finally rest on questioning the reality of life; the guiding questions 'what is life' and 'how did it origin' still excite us. Apart from these, we should extend our knowledge of biological entities by recognizing teleology's orientation of 'backward factors' rather than merely looking forward to the functional finality. By relating teleology to 'effect,' 'function,' 'end,' etc. we fail to understand our negligence of the 'conditions' that precedes purpose. 'Chance' seems to be the substitute for ontology in biology.

Apart from the 'accidental' stories, physicalism with its methodologies has superseded the unstable myths about the reality of natural phenomena. On the other side, the organism with its unique nature perpetuates biological inquiries away from the Mechanistic framework. It is of course not the case that biologism forbids the validity of physicalism as such; instead, it unobtrusively impedes the superimposition of upstanding methods of Mechanism in biology. Newtonian exhibition of (a) motion and rest are the two *a priori* conditions of nature and (b) the understanding of externally mediated mechanical action do not accommodate organismic actions (particularly, the self-activities). The organisms act in such a way that they are the edifice of their actions regarding ontology and teleology. Instead of providing a support to the mechanical nature, the yet to ascertain concept of 'chance' in biologism dictates the requirement of an understanding of living phenomena regarding the immanent action. It is not the final solution of the problem but it can be an unavoidable possibility in ontological enquires in biologism. All these together accentuate the entangled apperception of a natural state which is ontologically real in every biological inquiry.

# Chapter 4

# Species, Ontology, and the Intractability Issue in Biology

Understanding nature is relative to the fact that it consists of distinct objects and the idea of classification. The classificatory practices historically connect themselves to the ontology in philosophy. Ontology tries to understand nature by categorizing objects based on their conditions of existence. Ontological enquires proceed with the question 'what there is' which is the copula that connects ontology to classification. The modern classificatory practices including taxonomy in biology follow this general spirit of ontological inquiry explicit in this question. It is reasonable, in the sense that ontology is the forefather of classificatory practices. Carl Linnaeus (1735), in the eighteenth century, brought a taxonomic revolution by proposing a hierarchical order of arrangement of biological entities which more or less is the basis of biological classification even now. In biological classification, 'species' comes at the bottom line and is considered as the funda-

mental unit. Disagreement in arriving at a universal definition stems from the intractable ontological nature of species. Not only biologists but also philosophers are engaged in the endeavor to understand species. The former attempts to define species while the latter tries to determine its ontology. As a result, antinomies such as monism & pluralism, and realism & antirealism come into the picture. Our sense of *intractability* grows along with the increasing debate between these antinomies. The chapter sketches out the intractable nature of species through a historical account of the species problem. Through this, we have tried to decipher a common thread that, perhaps, binds all our ideas of species together.

## 4.1 Understanding Species

Species is a modern term, but the idea can be traced to antiquity. Considering the evolution theory as the dividing point in the history of biology, we can divide the time periods of the debate as pre-Darwinian and post-Darwinian. Due to the inclination towards essentialism, the pre-Darwinian species concepts are mostly considered as fixity-concepts. For them, it is the essence which binds the organisms in a particular species together. Aristotle is the key philosopher in this line of thought. He believed that species are fixed because their essences are unchangeable (Ereshefsky 2017; Hull 1967). This immutability of species favors the creationist argument which posits that God has created every species together. This strand of essentialism was dominant until the emergence of the enlightenment, but we can find its influence even in modern times. John Ray, in the 17th century, proposed that species are immutable; he says "one species never springs from the seed of another, nor vice versa" (Ray 1686). Linnaeus, by following Ray,

distinguished organisms from species according to their physical similarity. We can term their concepts of species differently as 'typological' which also emphasizes the immutable nature of species. For him, God [The infinite] had created all the species in the beginning (see Larson 1968). He also believed that there are irreconcilable gaps between different species. Not only they but also all the creationists are advocates of the fixity of the species.

The eighteenth century was a breakthrough in this biological tradition; biologists started thinking about the emergence of species. It means that they viewed species as *mutable* related to the changes in space-time and environment. For example, Buffon's idea of species falls in this line (Farber, 1972). It is substantial to understand how De Candole; who first introduced taxonomy, understood species. His definition of species indeed goes into morphological and lineage concepts of species. He says that

> a species is a collection of all the individuals who resemble each other more than they resemble anything else, which can, by natural fecundation, produce fertile individuals, and which reproduce themselves by generation in such a manner that we may, through analogy, suppose them all to have sprung from one single individual (De Candole 1813 in Aldhebiani 2017).

Jean-Baptiste Lamarck's idea about the transmutation of species was a radical turning point not only in species-thought but also in evolutionary thinking (Galera 2017). The changing nature of species in the Lamarckian theory of evolution is allied with his argument for the changes through 'use and disuse' of parts of organisms (Burkhardt Jr. 2013; Lamarck 1830 [*Philosophie Zoologique*]). In

Darwin's (1859) theory of evolution, he established the changing nature of species. He laid a naturalistic foundation for his theory by vindicating the causal role of natural selection in evolution. Darwin and his accomplice, Alfred Russel Wallace, thought that species are the outcome of evolution (Ruse 2013; Wallace 1960; Lloyd, Wimpenny, & Venables 2010); this belief is implicit in Darwin's work *The Origin of Species* (1859). Though a major shift had happened in biology with Darwin's theory, it brought a radical change in the way biologists think about species. The 'species question' turned out to be the 'species problem' in biology (Wilkins 2010).

Species are outcomes of a selection mechanism performed by nature *non-teleologically*. The immediate question that comes to our mind is, 'what does the term 'species' mean?' Unfortunately, one cannot find an impeccable answer among the pluralist accounts of species in biology and its meta-theoretical domain - the philosophy of biology. Literature suggests that pre-Darwinian conceptions of biological phenomena changed ontologically relative to the paradigm shift that happened with the introduction of the 'revolutionary' (Ruse 2009) evolution theory put forth by Darwin in the *Origin*. The problem with this view comes from the epistemological impacts it has generated: evolutionary alteration of the semantic aspect of theoretical terms. For example, the word 'selection' in the historical sense refers to a process which presupposes subjective assistance, but in the evolutionary context, it remains a blind process, *i.e.,* with the exclusion of subjective element. Though evolution theory creates a new paradigm, it does not imply that evolution theory is independent-in-itself. Evolution theory has a holistic impact on biology; specifically, the evolution theory shaped the post-Darwinian biology. Let us remains Dobzhansky's (1973) claim once again that "Nothing in biology makes sense except in the light of evolution." Before Darwin, species were under-

stood as groups of organisms which share an immutable essence (see Hull 1967). These static species concepts comply with the argument of creationism: God had created all the species together. For evolutionists like Darwin, these species concepts emulated flaws mainly because of their ontological dependence on God. The immutable, essentialist, and static nature of species become justify the creationist perspective. Based on the fossil records and the geological information about the age of the Earth, evolutionists abandon the possibility of metaphysics associated with creation. Through the evolution theory, Darwin suggests that evolution is simply the emergence of a new species from the existing one which indeed helps to justify the title of his work as *The Origin of Species*. Understanding of species remains the same even in the post-Darwinian biology. Darwin did not define species despite the innumerable use of the word species in his book. In his letter to Joseph Hooker, Darwin communicates the impossibility of defining species. Ereshefsky (2010) reached the same conclusion similarly by referring to the post-Darwinian concepts of species. Both of them agree on the retention of the term 'species' prevalent in biological literature for pragmatic reasons. This perspective indirectly provides a green signal to the fact that pluralist views of species do not abandon the claims of evolutionary biology.

The *Modern synthesis* is the turning point in biology where Darwin's theory has altered with Mendelian *genetics* (See, for example, Fisher 1930). Up until this point of history, biology remained silent about species, although evolution theory presented species as its core concept. The reason is that, (a) biology was engaged with the discussions supporting naturalism in evolution theory or (b) biologists were striving to accumulate arguments to establish the autonomy of their subject or (c) biology had temporarily held Darwinian nominalism concerning species. Since this synthesis, species has received enough attention because

it is necessary to define species to hold the argument for the units of evolution. Evolutionists consider species as the units of evolution, though there are broad debates on it. (For an elaborate discussion of the levels of selection, see, Lloyd 1992, 1989). This overwhelming attention has paved the way to arrive at multiple species concepts/definitions in biology (de Queiroz 2007; Zachos 2016; Wilkins 2009).

We can see a shift in the philosophical pondering over the idea of species parallel with the shift in the theorization of species in biology. Philosophers' attention seems to shift toward the concern of the ontology of species. For Plato and Aristotle, species are kinds with immutable essence (Hull 1967). Though Descartes and Kant were the other notable thinkers, after Aristotle, they did not engage much in the discussion of the ontology of species. In the post-Synthesis phase, philosophers came up with different ontological arguments about species. A radical ontological argument was that species are individual and not kinds. Through the proposal 'species as individuals [*SAI*], Ghiselin (1974) and Hull (1976) established the philosophical affinity towards evolution theory. Some arguments specify the ontology of species differently like 'sets' and 'relations.' In sum, the different ontological determinations are made compatible with the evolutionary biology. And this gives a hint about the internalizations in general scientific paradigms. The truth-claims of entities (relatively made concerning the internal subdivisions) may appear incompatible with each other. If they are compatible with the generalist claims of the paradigm which share, then they have a positive attitude toward the realist aspects of the paradigm.

## 4.2 The species problem: Certain Ontological Issues

Species problem seems to be a blend of definitional and ontological aspects. It is clear that both biologists and philosophers engage with the species problem. A first look at Darwin's account of species may give the impression that Darwin was a nominalist [ he says "I look at the term species as one arbitrarily given for the sake of convenience to a set of individuals closely resembling each other..." (1859 52)]. David Stamos expresses a different opinion about Darwin's species account where he argues that Darwin was a realist and not a nominalist regarding the species (1999, 2007). Since it is irrelevant here discussing whether Darwin was a nominalist or a realist, we restrict ourselves to see how Darwin defines species.

The question one may ask is what does Darwin refer to in this definition? Here the term 'species' does not refer to any particular group of individuals such as *Canis familiaris* (Dog). This is so because (a) there are innumerable species existing on Earth, (b) it is impossible to apply the definition of a particular species (*Canis familiaris*) to another species (*Homo sapiens*), (c) species are ontologically different and (d) the definition of a particular species is strictly bound with the ontology of that species. The term 'species' manifests itself differently; it refers to both 'category' and 'taxa.' The first one indicates a rank or a category while the second one refers to the concrete particulars such as *Felis domestica* [cat] or *Pisum sativam* [pea plant]. Species category is the one to which all the species taxa belong. Those who do not recognize this distinction may end up being confused (Mayr 1996 ). The locus of the species problem is the species category and not the species taxon. It is substantial now to make the point clear that 'species'

in our discussions indicates the rank in the Linnaean taxonomy. It is not the case that biology lacks a definition of species which causes the species problem. There are a plethora of definitions of species in biology, but they all lack universal agreement. Biologists define species differently based on different grounds-theoretical or ontological. The species definitions based on the determinants of speciation are also known as species concepts. There are at least two dozen species definitions/concepts currently in use in biology (Wilkins 2006).

There are arguments that species are sets (Kitcher 1984a; 1984b), kinds (Boyd 1999a), individuals (Ghiselin 1974; Hull 1976) and even relations (LaPorte, 2006). All these views can be both true and false at the same time. Even if this point looks odd, a close analysis of each account reveals that it is true. It is the theoretical context that decides the validity of a certain ontological position. From evolution theory, species as kinds or sets appear paradoxical. Instead, 'Species as Individuals' goes along with it. Dupre (1993) argues that if we consider the theoretical contexts to determine the ontology of species, then we end up with pluralism. This underlines the point that the validity of different ontological positions in biology. Ontology has a wider province of investigation than taxonomy. The former describes or tries to describe what constitutes the reality as such *via* classifying and categorizing entities in nature; while taxonomic practices in biology, for example, look only at the biological entities for consideration. The focus of ontology is explicit in the question - "What is there?" (Quine 1948, 21). Unlike the specificity of study in other subjects (such as biology which aims at "something") ontology studies "everything" in nature, *i.e.,* its concern is the reality as a whole (Berto &Plebani 2015, 1). If we consider metaphysics as the heart of philosophy then, ontology is the heart of metaphysics (Lowe 2006, 3). In general, ontology is historically bound with metaphysics in all the ways.

Noticeably, with its usage in some (if not all) current biological practices, the term ontology has lost its inherited meaning as well as the metaphysical inclination. The reason is that those biological practices which bring semantic disintegration through terminological overlap are indebted to non-philosophical fields such as information and computer sciences in their usage of the term ontology. It means there are two practices of ontology concerning philosophy and non-philosophy. One may see the non-philosophical practice of ontology from multiple focal points. It might be an outcome of the overwhelming attitude to out-philosophize the philosophical issues through science, or it could be the result of an emphasis on the metaphysics of science in the current literature or both. Whatever may be the case, the resurrection of ontology in the 'data-intensive' areas of biology jointly assigns a predetermined task to researchers working in the field of philosophy of biology. That is, to provide a semantic clarification of ontology. Here, our attempt is to analyze the two-way practice of ontology, in biology, and aims at showing the presence of philosophical sense (of ontology) in the meta-biological analysis. Here the term 'meta' indicates the philosophical pondering over biology.

There happened a historical split in the path of ontology almost three decades ago when the proponents of Artificial Intelligence began to use the term ontology "to refer to both a theory of a modeled world and a component of knowledge systems" (Gruber 2009, 1964). Then onwards ontology is presented, in literature, in two-ways concerning philosophical and computational practices. Ontology became "a technical term", states Gruber (2009, 1964), "denoting an artifact that is designed for a purpose, which is to enable the modeling of knowledge about some domain, real or imagined." For him, ontology is an "explicit specification of a conceptualization" where the "conceptualization is an abstract, simplified view

of the world that we wish to represent for some purpose" (Gruber 1993, 199). In this regard, ontology denotes either an informational object or a computational artifact. Ontology is used, in the non-philosophical contexts, with an intention to enable knowledge sharing without semantic confusion over the terminologies in a specific context. This type of ontology, as Barry Smith remarked, is a part of the science practice. This science-based ontology gains popularity in data-intensive subjects such as life sciences because of its promise towards a common understanding of the meaning/definition of terminology. "An ontology is in this context a dictionary of terms formulated in a canonical syntax and with commonly accepted definitions designed to yield a lexical or taxonomical framework for knowledge-representation which can be shared by different information systems communities" (Smith 2003,158). This new ontology we can generally call as computational-ontology, hereafter C-ontology, which has no philosophical interest and is perfectly technical.

The primary task of C-ontology is to settle the semantic disintegration concerning the terminologies in different contexts of data-oriented subjects. Those subjects which use huge data probably depend on technologies, especially computers, for their analysis. Computation helps researchers in analyzing and interpreting data precisely, so that, it requires highly formalized language. It is necessary for C-ontologist to fix one-to-one correspondence between a term/concept and its meaning. Otherwise, the outcome of the computational analysis of data will be erroneous. The C-ontology has to perform a minimal-reduction to fix the meaning of terminology accordingly. Unlike the conventional understanding of reductionism, minimal-reduction here means that the selection of meaning/reference of a term/concept among the alternatives, if any, available within the subject. This kind of reduction, which underlies pragmatic purposes, is performed concerning

the specificity of the context. These altogether grant a common agreement on the meaning and definition of the terminology in a given context. The resulting semantic integration makes the communication between people as well as information processing effortless in a non-philosophical context. Consider the word 'species,' for example, which does not have a commonly agreed definition/meaning in biology. Concerning specific biological context such as paleontology, it is necessary to choose and fix the meaning of species uniquely by paleontologists to analyze data accurately and communicate information successfully so that, paleontologists may perform a minimal-reduction by choosing one among many and have a common consent on the meaning of the concept.

Both philosophical and non-philosophical fields retain ontology to analyze the phenomena in nature – that is, entities, ideas and processes along with their interrelations. The difference indeed depends on their focus of attention; philosophical ontology, hereafter P-ontology, focuses on the 'essence' of phenomena and the issues related to their fixity while non-philosophical ontology [C-ontology] delves into the fixity of 'terminology.' A metaphysical reduction has happened with this paradigm shift from essence to vocabulary. The direction of ontological investigation has been changed from the meaning to the word. Ontology traditionally was trying to categorize phenomena in nature via understanding the essences. Unlike this, contemporary ontological practices in non-philosophical fields emphasize the terminology. The nature of ontology becomes reduced from generality to particularity. The specialists of p-ontology try to generalize the essence of a category while those who belong to c-ontology try to reduce the meaning of the vocabularies relative to their domain.

## 4.3 Two-way practice of ontology in biology

Historically, ontological inquiries in biology were carried out concerning a) life, organism and species and b) their properties. Since the 4th century B.C [from Aristotelian biology] the first order ontological discussions in biology tried to reveal the objective facts about the nature of existence of life, organism and species. Among these three fundamental concepts, life is crucial and gets more ontological attention. Ancient puzzles concerning life in biology were associated with the question 'what is life?'. One cannot find a direct answer to this question in pre-modern biology. For example, in Aristotle's biology, the understanding of the facts of life is associated with his concept of the soul. He tries to address the question through an explanation of the facts of the soul. When the ancient biology gave way to the modern biology through Darwin's evolution theory, there happened a dramatic change with the nature of ontological puzzle. The focal question becomes that 'how did life originate?'. Even though Darwin had established the autonomy of biology, as Mayr argues, he also could not answer both these questions. In a later edition of the *Origin* Darwin had added a remark saying that "it is no valid objection that science as yet throws no light on the far higher problem of the essence or the origin of life" (Darwin 1861 in Pereto *et al.* 2009). Of course, in recent times researchers put overwhelming attention to address these questions. For instance, Wendel Kisner (2008) comes up with an argument that the life is a kind of purposive self-relation; another thinks that life is a synergetic effect of the functional properties of the organism (Carning 2008); Another concept of life is that it is a cosmic imperative (de Duve 1936). Marcello Barbieri (2008) at the end of his pondering towards the origin of life assumes that life is simply semiosis. None of these accounts can bring a common agreement on the answers to the

aforementioned questions. The reason lies with the fact that the objective reality is not yet revealed through these subjective interpretations of the reality of life.

Likewise, the ontological discussions concerning species are associated with the nature of essence. For most of the creationists, the essence of a species is static. While an evolutionist, especially Darwin, believes that the species emerge from a common ancestor, and they will continue to emerge further. The total of ontological issues makes the persisting 'species problem' in biology and philosophy of biology. Wilkins (2006, 2010) notes that there are at least twenty six concepts and corresponding definitions of species in the literature. All these bring some aspects of the conditions of existence of species in nature. Thus, the absence of agreement over these existing accounts indicates that there would be a unique way of existence of species independent of our subjective interpretations. In the case of species, the proponents of c-ontology strive to formalize the existing species problem with an assumption that it is rooted in the terminological disintegration in biological literature. For example, a recent research paper argues that its proposed ontological approach to biological taxa bypasses the controversy over species concept (Schulz *et al.* 2008, i320). The 'ontological approach,' as discussed in that paper, belongs to the c-ontological practice because it uses 'BioTop' which is s a "top-domain ontology that provides definitions for the foundational entities of biomedicine as a basic vocabulary to unambiguously describe facts in this domain" [http://biotopontology.github.io/]. These altogether project the constricted meaning of ontology in its use in some biological practices.

The ontological discussion of an organism is also not diverted from the historical way of ontological practice. Organism became the focus of ontological discussions in biology only after Descartes' machine conception. There are several

ontological claims made about the reality of organisms. From Cartesian mechanistic conception through a Kantian organizational view, Darwin's perception of the organism as the locus of variation, Dawkins' (2006/1976) vehicle of selfish gene to Dupre's (2012) vision of organisms as processes, there were innumerable ontological attempts to shed light on the reality of organism, but none succeed. Apart from the ontological inquiry which has a rigor to address 'what-it-is-to-be' of phenomena, the other ontology enquires 'what is right about what-it-is-to-be of phenomena in a given context.

In the new phase of ontological practice, pluralist ontologies are used, by which c-ontologists make a comparison of data, to translate a given knowledge in a specific context to other contexts. Overall, these ontologies seem to be appearing as the semantic tools for epistemic integration. "Biological ontologies define the basic terms and relations in biological domains and are being used among others, as community reference, as the basis for interoperability between systems, and for search, integration and exchange of biological data" (Lambrix *et al.* 2007 85). Some examples of biological ontologies are GO, PO, and APO. All these ontologies under the computational ontological practice concerned about the semantic uniformity of terminologies and concepts in biological domains. The c-ontology in biology tries to establish epistemic determinism via controlled vocabularies with a unique reference. The formalization of vocabulary brings and underlines the requirement of an *ideal* language in scientific practice. The concept of an ideal language, proposed earlier by analytic philosophers in the phase of linguistic turn in philosophy, seems to be an epistemological solution to overcome metaphysics. By fixing the meaning and relationship of terms/concepts in a particular domain, the C-ontology goes on par with those arguments for ideal language in analytic philosophy. As this chapter's concern is different, it is not relevant to discuss what

those arguments here are. In total, the term ontology drops its philosophically inherited metaphysical shroud and hence, paves and rivets its way to science. What C-ontologists hope to achieve through this ontological practice is the epistemic integrity by ordering the terminology/concepts and their meaning/interrelations according to the specific schemes of a particular domain of research. Further, it targets the congruity in research practice within a specific domain of extra-philosophical interest.

In the philosophy of biology, the ontological investigations always come in the contexts of basic biological terminologies. As noted above, philosophical ontology (p-ontology) provides the researcher freedom to approach the objective truth in multiple ways. Each alternative account of the ontology of biological entities reveals different aspects and hence enhances our knowledge with novel outlooks. The flexibility of p-ontology is bound up with the intractable nature of reality. That means, there always would be an independent aspect of reality apart from our understanding. There are strong cases in the history of science and philosophy which admit the point. For example, Newton's laws of motion reveal more facts about the reality of motion than Descartes' laws of motion. It is so because Newton understood more facts of motion which were absent in Descartes' understanding. In the same way, Einstein reveals more facts about gravity apart from Newtonian understanding. One can even see in biology the difference in understanding how life progresses in nature. A naturalistic understanding of evolutionary biology replaced the creationist understanding. It is clear now how Darwin differs from Lamarck and Erasmus Darwin. The exclusivity of Darwin's theory exhibits that he had found more objective truth than his predecessors.

Ontology as an age-old philosophical enterprise investigates what constitutes

reality as a whole and how the constituents exist in relation with others. Its motto is to produce objective knowledge which represents the reality. Semantic fixity as well as formalization [of terminology] in the practices of C-ontology also aims at the production of communicative knowledge. The difference is that P-ontology, as stated above, attempts to address the reality as such while the C-ontology tries to represent the knowledge of reality. As former is the reality-representation, latter is knowledge-representation *i.e.*, representing the knowledge of reality. It can also state differently as; P-ontology ponders about the objective nature of reality while the C-ontology considers the objectivity of subjective interpretations of reality. An example of life may simplify the effort to understand the difference. The ontological questions regarding life, in the historical sense, are framed based on the objective aspect of its existence in nature. These questions contribute to the endeavor of revealing what-it-is-to-be life in nature. The various definitions of life are in fact the outcomes of this kind of ontological practice in philosophy and biology. All these contributions have turned out to be relative accounts which possess subjectivity in their interpretation of the reality of life. Alternative definitions reveal different aspects of the conditions of existence of life and open up further ontological questions. Do we have a unique definition apart from the available alternatives? Does the total of all aspects explain give life a universal identity? However, these questions also point towards the objective nature of the existence of life. In general, the ontological practices of this kind provide the practitioner's chances to explain the reality depending upon their understanding. The literature exposes different possibilities of existence. Among the alternative definitions or theories about the origin of life, the C-ontologists choose one single definition and corresponding theory of origin that suits to the given domain-specific research.

The philosophical search for the reality of life, for instance, allows researchers to express the disagreement on any particular, or all, definition(s) or concept(s) in the existing literature. Although its ultimate target is to capture the objective nature of entities, the outcome of this ontological practice is the plurality of subjective interpretations. It seems that the objective nature is independent of the subjective descriptions of it. This independence is the factor that prevents science practitioners from choosing 'philosophical sense' of p-ontology. Independence from our cognitive and epistemological domains, a philosopher may argue, expresses the 'real' nature of entities in a metaphysical sense. C-ontology requires determining the reality of entities pragmatically according to the nature inquiry. It fixes the meaning of the terms in a domain and does not permit the researchers to propose alternatives. It compels itself to reduce the concepts and definitions to a minimum without giving a chance to multiple references. The research in particular areas like functional biology may carry forward successfully even without an objective understanding of life. The use of the term life in those researches would be arbitrary and do not help in determining what-it-is-to-be life. If the essence of ontology lies in the objective nature of reality then, philosophical ontology is the better choice. having said all these, we now return back to the ontological puzzles concerning species in biology and philosophy of biology.

## 4.4 Species concepts and the implicit relativism

The Biological Species Concept (BSC), proposed by Mayr (1940, 120), argues that the species "are groups of actually or potentially interbreeding natural populations, which are reproductively isolated from other such groups." It is certain

from this definition that reproductive isolation scores high in the determination of whether a population (or a group of populations) is a species. Mayr (1996) had established the meaning of species in biology by responding to the Darwinian question – "Why are there species in nature?" Through a thought experiment about the living world without species, he concluded that species are systems of superior gene combinations which are useful to be adaptive to specific environment or ecology, and which ultimately prevent the unrestricted outcross resulting in the existence of disharmonious incompatible gene combinations. The preservation of a gene pool which has a greater adaptive advantage in a population. Or, species enjoy higher selective significance.

Reproduction, thus, is a necessary condition for the preservation of such gene pools thereby species continues to exist in nature. Interbreeding of organisms from different populations disturbs the genetic integrity of each population that would result in the production of less viable or even sterile organisms. The reproductive disjunction by the 'isolating mechanisms' delimits different populations as species taxa. Although this species concept has received more popularity, it has certain unavoidable difficulties in its application. It performs well with the groups of organisms which can interbreed, and at the same time the proponents of this concept require to consider the exceptional cases; asexual organisms, as 'aberrant.' Not only for Archaea and bacteria but also for many of the existing plants and fungi, asexuality is the basic way of reproduction. From the above discussion, the fact that BSC excludes some forms of organisms from its definition becomes more transparent. One can use this particular concept only when the organisms being studied to reproduce sexually. Consider the studies in paleontology which studies fossils to illustrate the history of the organism. Fossil records play dominant roles in arguments which defend evolution theory. Paleontology can show us the

physical similarity between different fossil organisms; analysis of this data enables biologists to make possible predictions concerning the evolutionary lineages of organisms. The important point is that fossils do not provide any clue about the reproductive compatibility between the two specimens which it studies. It seems we cannot follow BSC's general criteria of reproductive isolation in this kind of studies. There are many cases where BSC succeeds in a considerable manner. Kitcher (1984, 317) notes that BSC's tenets were successfully helped biologists to separate the siblings of Anopheles complex of mosquitoes and determine their distributive role concerning the malarial infection in Europe. The scope of this species concept is bound up with the specific factor exist among organisms. We can say that BSC is relative to some studies in biology.

The biological species concept had a profound influence in evolutionary biology, since the modern synthesis, mainly due to the emphasis on gene transfer through interbreeding. The dissatisfaction with BSC for several reasons became an 'impetus,' as Ereshefsky (1989) says, to put forward different alternatives in biology. Among the different species concepts, the Phylogenetic Species Concept (PSC) arose as the rival alternate to BSC. The PSC, by Cracraft, alludes that "a species can be defined as an irreducible cluster of organisms, within which there is a parental pattern of ancestry and descent, and which is diagnosably distinct from other such clusters. Species are thus basal, differentiated taxa" (1987, 341). The foci of this species concept hence are the heritable and diagnosable 'intrinsic attribute(s)' and the 'reproductive cohesion.' The former is necessary, and the latter is not but useful to understand the species boundary. The historical relatedness and the distribution of characters are those which individuate and delimit the species. The 'diagnosable' here reflects the fixity of attributes in reproductively cohesive units. The group of organisms that are connected genealogically and

also share any diagnostic attribute qualifies the designation of species. Another phylogenetic approach put forward two conditions for demarcation; 'grouping criterion' and 'ranking criterion.' However, this approach tells us that species are 'monophyletic lineages' of organisms in nature.

Neither BSC nor PSC succeeded in their attempt to provide a universally accepted definition for species. While discussing the two different species concept, what we intend to show so far is the relative nature of species concepts in evolutionary biology. The question that we must address here is, whether species concept relativism has any negative impact upon the truth claims of evolution theory? Evolution theory of Darwin claims that species originate by an accidental process known as natural selection. Darwin had used the term species in his theory, for pragmatic reasons, to indicate the group of the population having the most phenotypic resemblance. The arguments of evolution theory, in general, do not rely on the ontology of species. To understand the tenets of evolution theory, one need not require clarifying whether species are interbreeding or monophyletic or any such group of organisms. Rather, species concepts need to be compatible with the evolution theory. For example, believing species as natural kinds is incompatible with the evolutionary arguments because natural kind includes non-living things which do not have the capacity for natural evolution. The species problem whether it is epistemological or ontological, hence, falls outside the evolution theory. For any species concept, there would be a thorough relativism explicit with the possible application. The organic determinant – the features by which biologists delimit species - decides the possibility of a species concept. The different species concepts have taken different features into consideration. For example, biological species concept considers reproductive isolation as a determinant while evolutionary and phylogenetic concepts choose lineage separation

and monophyly as determinants respectively. As these different features exist (specifically in organisms), they can all be part of the conditions necessary for the existence of species in nature. So there are different ontological determinations of species concerning different species concepts. Given two groups of organism, BSC may claim that they are two different species because one is reproductively isolated from other; while PSC may claim that there are only one species because they form single monophyly. Due to different ontological determinations, different species concepts refer to different levels of organizations of organisms for the word species.

Why do biologists often propose novel ways to define species? Why do we still lack a clear definition of species even though at least two dozen alternative definitions are available in the literature? These two questions reflect the epistemological challenge biology faces about species even in this era of molecular biology. Biologists who engage with species problem locate themselves in either side of the opposition - monism and pluralism. For monists, the "aim of biological taxonomy is to identify the single correct species concept" among the available alternatives or else, keep an optimistic attitude towards the future progress of biology in the said direction. The pluralists, contrary to monists' belief, argue that biology "contains some legitimate species concepts" (Ereshefsky 2016). Though they are rival viewpoints, both parties strive to avoid the metaphysics associated with the explanations of ontological determination of species in biology.

The analysis of species-monism coveys the following suppositions; (1) it is possible to have only one correct definition of species in the biological literature, (2) the biologists must choose the one correct definition among the available alternatives and, (3) if nothing correct then, wait for it until the future biological

progress reveal it. The first one showcases monists' inherent tendency towards determinism, thereby biological explanations of species become on par with physical science explanations. Physical science describes the atom and molecules in a deterministic way because of the unique ontological structure. Determinism, thus, necessitates a unique way of existence. The second supposition is an indication of the internal difficulty in choosing the correct one. As monism does not specify the 'correct' one among the alternatives, we should be able to discern that biologists have different opinions about the way species exist in nature. The third one exhibits the enthusiasm towards the consideration of the mind-dependent existence of species. If biologists find no correct definition of species among the available ones then it can be logically concluded that the actual truth claims of species exist independent of the biological epistemology. This kind of 'objective' existence is the niche where the metaphysical realism finds its abode. The monists' worry of this metaphysical aspect of realism, indeed, is expressed in their optimism about the future biological progress. The species-pluralism, on the other hand, is a direct approval of the legitimacy of alternative species definitions (concepts) in biology. It observes the contextual use of different species accounts in biological practice. Pluralists understand multiple ways of species-existence in nature, and they define species accordingly. Pluralism then recognizes species differently and proposes diverse definitions to determine its ontology. It avoids the necessity of 'objective' existence, as explained above, through the subjective interpretations. Both monism and pluralism in species problem, in fact, implicitly agree on this point that species possess the mind-dependent nature.

Monism and pluralism hold a shared belief that there exists definitional pluralism and corresponds to conceptual multiplicity about species. By necessitating the single correct definition for species, the epistemological concern of monism

turns out to be ontological. A small thought experiment may reveal the point. Consider biology has found a correct definition which according to monist explains species holistically and nothing is left outside. What biologists ultimately achieve through such a definition is the ontological determination of species. Their suggestion to find out one from the available definitions seems to be a call for a reduction on which pluralism has an apparent dissatisfaction. Pluralism acclaims the diversity of species concept without stipulating whether those definitions altogether holistically determine the way species exist in nature. Once again we are reminded that the conceptual pluralism of species, apart from the monistic and pluralistic claims, signifies the fact that species have been recognized and defined differently in biological literature.

Scientific realism demands a single unique way of understanding things. Contrary to this, biology has multiple ways of understanding species. Species pluralism ultimately takes us to anti-realism (Ereshefsky 1998, 111), but monism and realism perceive species as a real kind in nature (Henry 2011, 214). Here comes the relevance of Nelson Goodman's idea of irrealism; he says that irrealism means, "... not speaking regarding multiple possible alternatives to a single actual world but of multiple actual worlds" (1978, 2). As his words indicate, different biologists and even philosophers look at species differently and understand separately so propose different definitions. The difference in concepts rests on the difference in the understanding of ontology. The ontological difference in these accounts claims that they are different. Pluralism [of species] provides not only alternative definitions but also maintain conceptual diversity. It becomes transparent that biology carries an irrealist position concerning species.

## 4.5 The *Real* and the Realism

Biologists and philosophers, who engage with the species problem, are categorized as monists and pluralists based on their approach to species problem. Monists are those who are concerned about the unique causal structure of species and speciation. They think about and seek one single underlying structure which delimits different taxa. The argument for a unique species concept seems to be rooted in fear of having a conceptual nihilism in biology. Monist arguments tend to go in the following direction. There should be one species concept in biology as already many species concepts exist in literature; biologists must decide which one among them biology should adopt; if no one is correct, we can be optimistic that future developments in biology will have a correct species concept.

Pluralists, on the other hand, argue for the legitimacy of multiple species concepts. Pluralists (Kitcher (1984a; b), Dupre (1993), Stanford (1995), Ereshefsky (1998), Mishler & Brandon (1987), Mishler & Donoghue (1982)) note that it is impossible to dream for a single species concept which meets and satisfies all the biological interests. Consider the most celebrated example of the Biological Species Concept (BSC) (Mayr, 1996) that defines species as groups of interbreeding populations which are reproductively isolated from other such groups. Here, the 'reproductive isolation' is the determinant which cannot be used to delimit asexual species taxa. Paleontology as an established area of biology also cannot use BSC because fossil records will not give any idea about whether two species in the past were reproductively isolated. Different biologists have different interests which may end up with various investigations in biology. In Mayr's opinion, functional biology and evolutionary biology deal with different kinds of investi-

gations; the former seeks 'proximate' causation of a phenomenon while the latter is concerned about the 'ultimate causation (1961). Kitcher (1984a, 1984b) notes this point and emphasizes the necessity of different investigative practices corresponding to the interests of biologists.

The biological explanations should converge to have a unique understanding of the term 'species'; conceptual plurality instead results in the divergence of explanations. These altogether questions the reality of the underlying phenomena; in this case, the species. Pluralists argue that legitimate concepts of species are made concerning the true features of species. The interbreeding, phylogeny, common ancestry, etc. are all true features of any species. Concepts based on these features can be true and valid. Instead of one, we get different ontological bases of species through these concepts. From pluralism, our realist concerns should be rearranged to have a clear understanding of biological phenomena. The realist claims should stem from the realization of 'multiple' ontological structures that objectively exist in nature rather than a 'single' ontological structure.

Realist concerns are more interesting on the pluralist side than in monism. Almost all monists are realists in the species problem in that their reality concerns are made by the nature of existence of species in nature. For example, Mayr (1996) says that species are concrete as well as extra-mental entities in nature. Pluralists are further grouped into realists and antirealists depending upon the reality concerns. Notable realists from the pluralist side are Kitcher (1984a, 1984b) and Dupre (1993). Both share a common thread of arguments for pluralism; but unlike Dupre, Kitcher's realism stems out from his belief on the ideal end of biology. Kitcher (1984a, 1984b) thinks that biology, as Stanford (1995) notes, may reach at an ideal end which provides an objective understanding of all our

experiences. A species concept is considered legitimate only when it reaches at the ideal end or somewhere near to it. Kitcher opines that all the available legitimate species concepts are converging to this ultimate end. Dupre (1993) observes that the different pluralist possibilities he defended in his account of species do not hinder the possibility of realism. Some people defend pluralism in the same way as we just discussed and they also defend antirealism.

The notable pluralist antirealists are Stanford (1995) and Ereshefsky (1998). Stanford's pluralism goes hand in hand with that of Kitcher, but at the same time, he argues that Kitcher's pluralism points toward antirealism and not realism. His criticism of Kitcher has a base on the inappropriateness of the thought about the ideal end and the converging nature of concepts. This is not possible because we do not have an ideal set of species concepts which would provide an objective understanding of species in nature. So we are not at the ideal end. Another important point is that biological interests are evolving and we have different species concepts based on different interests. Interests may vary through time, but the objective physical condition would remain the same. If concepts are made based on our interests, then they are relative to the subjective state of biologists. Hence, it is antirealism. Ereshefsky also argues for antirealism in more or less the same way as Stanford. As antirealism is a collective response to realism, the base of the reality-claims remains the same. A brief examination of the reality-claims in species problem may light up or put on hold skepticism about the varied nature of biology.

In the philosophy of science, realism refers to the claim that the world described by science is real and the descriptions of phenomena, observable and unobservable, are true (Chakravartty, 2007, 2017). Consider two examples of

reality-claims from species problem: Mayr (1996) and Kitcher (1984a, 1984b). The former made the reality-claim which is allied with his consideration that species are concrete entities. The condition of existence of species is taken for granted here. Keeping in mind his claim that species are 'extra-mental,' two possibilities open with the phrase 'extra-mental'- either it means 'outside the mind,' or it means 'trans-subjective.' If the first is the case, then Mayr's claim can be interpreted as species as concrete entities existing outside the mind. That means species exist even if no mind exists. Species, in short, exist objectively. To understand this issue, we can take the objectivity claim concerning electrons into account. Electrons are not observable, but we can make out their objectivity with the help of electron detectors. The apparent claim of objectivity through mind-independence in scientific realism then is substituted with the detectable nature along with the observable nature of the entity. Detection of electrons requires human assistance along with instrument. If species are concrete entities in nature, the concreteness Mayr talked about cannot be the same as the concreteness of an electron. The objectivity of species, thus, differs from the kind of objectivity an electron possesses. But understanding species necessitate human intervention. Take the case of extra mental means 'trans-subjective'. This does not mean a complete avoidance of mind and mental abilities. It is an up-gradation from the subjective realm. Species, in this sense, is not an entity of subjective imagination. As such, species are unobservable and undetectable entities consisting of concrete instances. Hence, it exceeds the limit of subjectivity. Thus the second sense of the term extra-mental becomes more appropriate in the context of species. Kitcher's account is an unconventional combination of pluralism and realism. The objectivity in his realism comes at the ideal end where he argues we will have an ideal set of species concepts. It implies that we will be given ontological pluralism at the end. The present biological literature shows that we do not attain such an

ideal end so that we must concentrate on the multiple legitimate species concepts available in biology. How does this pluralism become realism if objectivity is an unavoidable element as realists claim? In Kitcher's account, the convergence of concepts to the ultimate end to form the ideal *set* is the available answer.

Kitcher's realism can be defended by referring to the objective nature of features in an organism based on which biologists derived different concepts of species. So, species concepts are real concerning the concrete existence of features. It assures the ontological pluralism concerning properties. Properties cannot exist independently. As thought and extension are inseparable from mind and matter respectively, we cannot think of features of species without, presupposing the entity called 'species.' If Kitcher were right in his argument, we would have an ideal set of species concept. The outcome of this would be the ontological pluralism of features (of species) and not of species. Realism here is not made concerning the entity in question but with the features of that entity. It becomes clear that understanding the existence of species acknowledges the importance of subjectivity. Observation and detection are the tools which realists in science commonly used to support their reality-claims. In our context, these tools do not lead us to make proper reality-claims of species. A radical inclusion of subjectivity (regarding cognitive abilities) is highly necessitated to grasp the claims about the conditions of species in nature. Consider the claim that species are groups of organisms having such and such properties. The nature of the group here is homogeneous which renders the particular group as species. The above claim presupposes observation of homogeneity among particular organisms as well as their features. The observational integration, the borderline between concreteness and abstractness, is the stage where subjectivity starts its real play. We pass from observation and reach an abductive stage where we get an inference to the best

explanation of the observed natural phenomena (species). Along with observation and detection, a realist may consider the possibility of 'inferability' as a condition for reality-claims. The inability here does not mean our ability for simple inference, but it refers to our ability to infer conclusions from complicated situations. Inferring fire by perceiving smoke is a simple kind of inference; inferring the orbit of a planet is a complicated one through observation of that planet around the sun. In the first case both the antecedent and the consequent are observable, but in the latter, the consequent is not at all perceivable. The imperceptible nature of entities not only opens a room for inference but also makes the inferential claims liberal. People may infer differently about the ontology of entities which exhibit imperceptible nature. This diversity brushes up our feeling of intractability.

## 4.6 The intractability of species

The discussion so far made the point clear that we use the term 'species' in biological explanations/discussions though we are conscious about the intractable nature of the ontology of species. We know what we are referring to when we use the term 'species,' but the confusion arises when we are asked what we mean by 'species.' There is no clarity from the philosophical side whether species are kinds, or individuals, or sets. Likewise, no clear definition is given by biologists regarding species. If given five black balls and four white balls one can make two sets of white and black balls, then one can even think of species as sets. Given the evolutionary argument for the changing nature of species, there is no exaggeration to think species as individuals changing over time. One cannot even completely reject the multiple species concepts completely; all are useful

in different theoretical contexts. We can say that 'Species' are natural groups of organisms but to understand the existence of species one should use extra perceptual means. Our ability to infer, indeed, plays an important role. If a unique ontological structure exists and which science aims at, then we lack the reality of species in every way. Presuming that there is no such unique structure enables us to stick to the best available knowledge which is useful in a pragmatic sense. In the case of species, all of us share a common thread which binds our understanding of species. The context determines the usefulness of our species concept. Different contexts require suitable species concepts different from the one we look at. So we feel there is something more to add on to each of these concepts to maximize their utility.

There were cases in the history of science, and in philosophy, where theories were defended with weak epistemic arguments. The weakness refers to the unspecified ontological dependence of factors which are the backbone of those arguments. Such a case is the evolutionary argument for the mutability of species in biology. The evolutionists with paleontological data not only defend the plasticity of species, by offering the tree of life that depicts the evolutionary lineages but also criticize the essentialism of creation-views by exposing the non-fixity of traditional natural kinds. We are left with two options, on the one hand, the blurred species boundary defends the evolutionary views, but on the other, it obstructs the attempts for a general definition of species in biology. The several attempts to delimit species in biology result in the formation of different definitions/concepts of species, and at the same time assume all definitions are equally relevant concerning different areas of biological investigation.

There are multiple ontological assertions in the biological literature concern-

ing different definitions or concepts of species. If the realist supposition is kept aside as discussed above, then we get a philosophical base for pondering about the scientific dilemma of definitional diversity. It is the 'underdetermination' argument which exposes the situation where one finds the existence of multiple opinions (of an entity or a process) based on the same data. The underdetermination argument is often used by rivals of realism to counter its monistic ontological claims. Biologists and philosophers hold a different understanding of the ontology of species. It is a tough task finding out the 'actual' ontology among the 'real' ontological claims explicit in the available species accounts. This has a close correspondence to the monists' argument discussed in the previous section. To say that a particular view of species is a scientifically realistic claim, we need a deterministic explanation of the ontology. That means, species must be perceived uniquely, but that is not the situation in biology or philosophy of biology. Ontological issues of species are 'exceedingly refractory to solution' because, as Mayr puts it, "Opposing viewpoints continue to be firm, neither side being able to produce the kind, of arguments that would be able to convert their opponents" (1987, 145-146). The pluralism here is inadequate to accommodate scientific realism; rather, it has a close affinity to metaphysical realism which demands objectivity through mind-independence. This, of course, discards the argument for the possibility of 'realist pluralism.' What we attempt to demonstrate here is how aptly the pluralist concepts put forward the metaphysical realism.

It is clear now that pluralism is an outcome of the vindication of multiple ontological attitudes towards species in biology. By referring to Darwin, one may doubt the credibility of thinking ontology of species because for him it is a theoretical term arbitrarily given to the group resembling organisms. This is provoking to determine the ontology itself. Ontology as an older philosophical enterprise

is understood as the theory of being. Or, that which investigate what entities are out there in nature and the way of their existence. Ontological assertions are deductive while speaking about the existence of species and their nature entails induction as a requisite condition. In biology, species are understood in two ways - species taxa and species category. Species taxa are a specific group of populations such as Homo sapiens or Canis Familiaris while species category is rank in Linnaean taxonomy. The former is concrete, and the latter is abstract. Generally, people identify the problem with the second because it is conceptual. So we keep it aside for a while. Consider a given species taxa includes organisms with close correspondence. It seems science first takes an inductive leap to generalize the 'way of existence' of a given kind and then talk about the ontology of its particular entities deductively. Both physical and biological sciences agree on this. Physical science uses induction by observing the consistent nature of entities to generalize the kind nature. Unlike this, biological generalizations (of species) are the product of inductive leap taken from the observation of arbitrary and inconsistent nature of organisms. As evolution is a natural characteristic of biological entities one cannot claim the regularity of the nature of entities; especially, organisms in the borderline cases between two species. It offers a double feast for those who argue against the use of induction in scientific investigations. For homogenizing varieties under given taxa, biologists use nonempirical methods such as intuition and imagination. Species as a category does not have an empirical relation. It is not perceivable but conceivable through psychical means. The monists and pluralist consider the species as the real kind in nature (Henry 2011), i.e., possesses ontology. If they make ontological claims for species, then they would be considering species as taxa and not a category. But the issue whether it is ontological or epistemological rests with species category and not much with species taxa. The arguments of both monism and pluralism reflect that they are concerned with

'category' not 'taxa.' If species is a real kind in nature, then it is evident that ontology can be applied to abstract things too in biology (or in the philosophy of biology).

The link between pluralism and realism in species problem remains important. Pluralism clearly states that there are multiple legitimate definitions of species in biology. The relation between epistemology (definition) and ontology (the way things exist) has been established already. Hence, it is appropriate to say that different definitions are the product of different ontological determinations. Different understanding the ontology of species would obstruct us to have an objective determination about it. Pluralism asserts the subjective aspects which in fact lead to the rejection of objectivity from knowledge. This ultimately hinders, while questioning, the scientific status of biology. What pluralism explicitly and monism implicitly show that the actual ontology of species is not yet determined, i.e., it is independent of the available species accounts. This independent existence is the weapon of traditional metaphysical realism. Unlike the mystic nature of metaphysics in the traditional philosophy, the nature of metaphysics associated with biology is speculative. The ontology of species possesses an independent (objective) nature, apart from what the pluralist accounts say, admits the metaphysical parlance. Metaphysical aspect of realism must understand in two ways; one necessitates the independent existence of both entity and its ontology while the other demands the independence only of ontology. It is clear from the discussion that the species is knowable, but its ontology is out of the ken. The ontology of species retains a realist position. Hence, ontological realism concerning biology seems to be a stage, in the epistemology of science, before determinism; or a halfway stop of realism or a position in the scientific progress towards the revelation of the actual. To understand this, one needs to get rid of the specters of meta-

physical absolutism which never reveals the actual and scientific relativism that demands what it says is the real. A middle path, if not a third way, is a necessary condition to see ontological realism as an epistemological and not a metaphysical conundrum.

# Chapter 5

# *Gaia* Hypothesis and Anthropocene

From the previous chapters, it can be said clearly that inquiry concerning the reality of life, organism, and species is not limited within the purview of biology. Philosophical and extra-biological views play substantial roles in shaping our understanding of the 'real' concerning such entities. Historically speaking, there is a lack of successful homogeneous attempt, either philosophical or biological, that explains the reality of biological entities with certainty. This concern is not because there are no successful theories of biological phenomena at all. In other words, the success is relative to the paradigm of the investigation, and in fact, paradigms change over time. Kuhn (1996) has a remarkable opinion that science progresses through such paradigm shifts. If we broaden the scope of this argument, we may specify that even philosophical understanding of biology has developed through corresponding paradigm changes in thinking. Following Kuhn,

we notice that there is a radical paradigm shift with Darwin's (1859) theory of evolution in the history of biology. Pre-Darwinian biology is creationist and teleological while evolutionary biology is naturalistic and non-teleological. There are paradigm shifts in the philosophical ponderings on biology from ancient times to the present. We had vitalistic, mechanistic, organismic, molecular and synthetic paradigms in biology. Philosophers of biology appear to be devoted to the discussions of the biological roots of morality and ethics, apart from the ontological issues. Keeping this in mind, we also try to bring some extra-biological discussions of life, organism, and species in this chapter. At first, we look upon the issues related to life and organism through Gaia hypothesis, and secondly, we discuss the ontology of species (taxa), regarding the difference between human and the rest of nature, through a discussion of Anthropocene.

## 5.1 Biological phenomena through Gaia Hypothesis

The Gaia hypothesis is an unintended outcome of the 'Viking Program,' of the USA, with an explicit goal to detect life on Mars. The hypothesis put forth by James Lovelock, who was part of this Mars mission, suggests the Earth along with life functions as a self-regulating system to perpetuate the conditions suitable for life on Earth. The professional scientific community has been most skeptical about the hypothesis since its outset. Maynard-Smith considered it as 'an evil religion'; Gould thought that is a 'metaphor than mechanism'; and for Ehrlich and May, Lovelock was 'radical and dangerous' and a 'holy fool' respectively (Ruse 2013, 32-33; Bond 2013). However, the hypothesis got a strong support from an

American biologist Lynn Margulis (1999, 1993, 1971) with her advanced ideas on endosymbiosis (also see, margulis & Bermudes 1988; Lovelock 1991). Numerous facts and corresponding examples have been given by the advocates of *Gaia* to espouse the essence of the argument that 'the total ensemble of living organisms which constitute biosphere can act as a single entity' (Ruse 2013, 19). However, we must not confuse 'gaia' with biosphere which is the " three-dimensional geographic region where living organisms exist" while 'gaia' is the "superorganism composed of all life tightly couples with the air, the oceans, and the surface rocks" (Lovelock 2000, xii). The notable point is that all life-forms including humans are part and partners of a 'vast being' which has the "power to maintain our planet as a fit and comfortable habitat for life" (Lovelock 2000, 1). The questions concerning the existence of organism and life have been reconstituted in this new scenario.

### 5.1.1 The ontology of life from the Gaia point of view

Lovelock noticed that very little had been written about the nature of life though there is abundant data accumulated on every aspect of living species. He analogically explained this fact with an example that

> At best, the literature read like a collection of expert reports, as if a group of scientists from another world had taken a television receiver home with them and had reported on it. The chemist said it was made of woods, glass, and metal. The physicist said it radiated heat and light. The engineer said the supporting wheels were too small and in the wrong place for it to run smoothly on a flat surface. But nobody said what it was (Lovelock 2000, 3).

It seems that life is unexplained in the literature. Even though Schrodinger (1992) strived to answer the question 'what is life,' he too ended up with a conclusion which does not address the question. Life, for him, is "one of those processes which are found whenever there is an abundant flow of energy" (Lovelock 2000, 4). Not only scientists like Schrodinger but also a chemist of the recent time possesses such an opinion (see Pross 2012). The question is - has our understanding of the nature of life changed with Gaia? The immediate answer is Gaia has made a remarkable shift from 'thinking about life' to 'how to think about life.' This point reveals that life has another function other than biological understanding. However, this does not correctly account for the above question because it, in fact, seeks an ontological answer. To discuss the ontology of life in Gaia, we need to analyze some notable points in Lovelock's hypothesis.

Lovelock like the proponents of abiogenesis seems to believe in the chemical origin of life on Earth by chance (2000, 13). It would be a barren attempt to find answers to the questions 'what is life' and 'how did life originate' in the works of the proponents of Gaia. Lovelock himself has proposed to assume that life might have originated in a sequence of chance events on Earth. In fact, in the Gaia hypothesis, life seems to be a 'given' entity. The reason suggests is that its proponents are "not primarily concerned with the origin of life but with the relationship between the evolving biosphere and the early planetary environment on the Earth" (Lovelock 2000, 14). In his account, Lovelock attempts to connect the origin of life to the origin of the universe through a supernova event. (Similar point of view can be seen in Rai 2000). Though the hypothesis is silent on the reality of life, it legitimizes the existence of life as a real phenomenon/entity in nature. The hypothesis has two broad claims about life: first, the existence of life is conditional to the Earth's physicality and second, life along with the inorganic

surroundings work towards perpetuating its existence on Earth. These claims, though implicit they are, have larger philosophical implications.

What are the elements dragging philosophical attention to the above claims? To answer this, we must look at Lovelock's concept of Gaia again. For him, *gaia*

> ...is a complex entity involving the Earth's biosphere, atmosphere, oceans, and soil; the totality constituting a feedback or cybernetic system which seeks an optimal physical and chemical environment for life on this planet. The term 'homeostasis may conveniently describe the maintenance of relatively constant conditions by active control (Lovelock 2000, 10).

This above definition seems to clarify life's ontological dependence on Earth; at the same time it also implicitly gives an important remark that Gaia has existence only if life exists on Earth. As we noted already, there is a lack of justification in this hypothesis on the origin of life. From this proposition, we have drawn the argument that life for Gaia hypothesis is 'given.' This given-ness seems to be the first element in which philosophers possess some interest. When looking at the status of life with matters related to its origin in Darwinism and Gaia hypothesis, one would interestingly realize that both are heading in the same direction, *i.e.,* the 'given-ness of life.' Evolution theory purports to reveal the natural causality behind the origin of species while Gaia hypothesis tries to establish this causality of the perpetuation of life on Earth. The truth of their underlying argument is subject to the belief in the existence of life.

The Gaia hypothesis, unlike Darwinism, is closer to the ontology of life. It

asserts that the outcome of the synergetic functions of Gaia is the persistence of life on Earth. The conditioning of the inorganic environment, however, is manipulated by life itself. That means Gaia works as a feedback mechanism which alters the physical conditions on Earth suitable for the life's existence. Every action begins with life and finally ends with life. Life seems to be self-sustaining phenomenon/entity by altering the lifeless environment. "Evidence shows the Earth's crust, oceans, and air to be either directly the product of living things or else massively modified by their presence. The evolution of the rocks and the air and the rest of the biota are not to be separated" (Lovelock 1988, 33). The physical nature draws its shape by an immanent play of life. This point has some correlation to Spinoza's God-nature relation (*pantheism*) where God immanently acts in nature and manifest themselves through their symbiotic existence. Gaia as a 'planetary-sized' entity works like an organism. The causality is internal, and the actions come from within. In the third chapter, we had an elaborate discussion over the idea of function 'from-within' nature of the organism and the play of immanence. We cross check the principle of immanence here with Gaia's life. We have mentioned above that life has an indefinite ontology in the Gaia hypothesis. It is indefinable like God in Spinoza's *pantheism*. Immanence is a state where two entities work symbiotically for their benefit; among these two, one possesses concrete existence, and the other possesses abstract existence; the latter would be ontologically indeterminate. In the Gaia hypothesis, life seems to be an indeterminate entity because it does not say what life is. The physical condition, the co-worker of symbiosis, is the concrete entity which is altered by and for life.

### 5.1.2 *Superorganism* – Ontological issues

The other aspect in Gaia hypothesis, on which philosophers have a special interest, is the concept of Superorganism. What is a superorganism? For Lovelock, "these are bounded systems made up partly from living organisms and partly from the nonliving structural material. A bee's nest is a superorganism, and like the superorganism, [g]aia, has the capacity to regulate its temperature" (Ages 1988, 15; emphasis added). What he intended to show with this analogy between Gaia-superorganism and bee nest-superorganism is the property of homeostasis, *i.e.,* simply the regulation of the internal conditions to have a stable state of existence. Apart from this similarity, they vary ontologically. To understand this, a clear understanding of the concept of a superorganism is required. The word 'superorganism' itself was introduced in 1920 by William Morton Wheeler, but the conceptual crux one may find in Plato's philosophy. Plato in the *Timaeus* had opined that 'kosmos' (the world/universe) is a living thing which includes all the species of living as is parts (Zeyl and Sattler 2017). It is a perfect animal with perfect parts; so that it exists in itself and also self-sufficient (McDonough n.d.). The world is a "living creature truly endowed with soul and intelligence by the providence of God" (Plato, Tim.). Plato's world-animal seems to be parallel to the modern superorganism concept. We call this world-animal superorganism. The fundamental difference between Plato's and Lovelock's superorganisms is their ontological dependence. Plato's superorganism is a created entity while Lovelock's appears as a self-emerged entity. The origin of Gaia (superorganism), following evolutionary argument, seems to be an accidental event. Apart from this distinction, these two has some similarities; both of them possess living beings (biological organisms) as parts. Concerning the homeostasis property, both

evolutionary and Gaian superorganisms relate to each other. The latter varies from the former regarding the heterogeneity of parts. Evolutionary superorganism consists of homogeneous living beings while superorganism of Gaia contains heterogeneous entities as parts. Based on the similarities and differences, we must consider now the conditions of being superorganism.

How do we call an entity a superorganism? What are the implicit conditions of categorizing an entity as superorganism? Plato did not use the word superorganism in his philosophy; rather, he considered the world as a living being. The concept of world animal might have emerged in Plato's mind only after the experience of living beings. He equated the concept of a living being to the world. In the evolutionary biology, the concept of a superorganism has been tied to the idea of group selection. When Darwin had introduced evolution theory in the Origin, the level of selection was individual which hold some useful variations. Later, with the identification of characteristics of social insects to humans the understanding of the level of selection has shifted from the individual to the group. The selection at the individual level indicates that the beneficiary of such selection if the relative individual or organism, while the beneficiary of a group selection is the group. Concerning these two kinds of selections, both individual and group are beneficiaries; they are parallel. A hive consists of innumerable bees gets benefits from selection in the same manner how an organism benefits from the selection. The bees in a hive act like parts of an organism; their works have an ideal end, *i.e.,* the persistence of existence of the hive. The term superorganism signifies 'extra-organism' in evolutionary biology. That means there should be two or more organisms from the same species which exist symbiotically to behave like a single entity. If the hive is a superorganism, then it must contain only bees of the same species. The organisms in a superorganism must be part of a homo-

geneous species. The *Gaia* as a superorganism contains all species of organisms and inorganic elements. It is clear from the definition mentioned above. It becomes clear that there is an ontological gap between the superorganism concepts in evolutionary biology and Gaia hypothesis.

The existence of superorganism in the evolutionary scenario is dependent on the existence of homogeneous organisms. Rather, heterogeneous organisms along with inorganic elements are the base of superorganic existence in Gaia. The existence of individual species became secondary. Believing that organisms are the origin and the end of their activities becomes paradoxical here. The organismic activities, which are said to contribute to their existence, ultimately contribute to the existence of superorganisms which itself is an organism with features a biological organism usually possesses. If we consider superorganism as a huge/giant organism, then it is possible to retain the belief that an organism is the origin and end of its existence. Looking at *Gaia*'s superorganism through the evolutionary point of view, one may even find difficulty in the applicability of the evolutionary arguments. Selection, whether it is in the level of organism or gene or group, happens internally, but such selection does not benefit the superorganism directly. Gaia's superorganism requires organismic existence which retains life on Earth. The existence of particular species such as *Homo sapiens* is an issue relative to the evolutionary biology. Evolution theory works on these matters. *Gaia* does not care whether an individual or a species exists or is extinct. The only thing it cares for is the persistence of life on Earth through life. Another point the discussion so far made clear is that the superorganisms in evolutionary biology are also part and partners of Gaia's superorganism. There happen internal selections in Gaia's superorganism according to the changes in the inorganic environment of Earth. It happens so because this superorganism constantly regulates the conditions (for

life's existence) through a 'feedback mechanism' (Onori & Visconti 2012). The constant regulation (homeostasis) sometimes results in the internal selection. Another anti-evolutionary feature of Gaia's superorganism is that it does not make copies of itself. There is no replication. Otherwise, there would be many Earth-like sibling planets in our galaxy. Lovelock might have reached at the concept of superorganism by keeping the model of the usual biological organism in mind. With the absence of many organismic features, a superorganism concept would be vague because in Lovelock's view the 'Gaia' implicitly modeled an organism in nature. The superorganism in Gaia presents itself as an indeterminate entity. The proponents of the Gaia hypothesis do not explain the characteristic features of their concept of superorganism. There must be two reasons for their silence. First, they think that superorganism is not ontologically different from the organism. That means it varies only in size not in essence. Second, a superorganism is beyond our understanding. It possesses an objective existence from us though we are also part and parcel of it. The second reason has minimal probability because the proponents of the Gaia hypothesis were established scientists one of which was part of an extraterrestrial investigation of life. Even though we are part of the fraction of this universe, we conduct interplanetary investigations to reveal the reality of the physical universe. Hence, it would not be right to think that Lovelock had proposed the concept of superorganism out of ignorance about its ontology. The chances are high for the first reason, *i.e.,* not only Lovelock but also Margulis thought that superorganism is essentially similar to the organism. Will the issue be solved if we consider 'Gaia' as an 'organism'? The answer is 'no' because as we have seen in the third chapter, an organismic activity comes from within. There would be no direct external influence for organismic self-activities. In Gaia hypothesis, the Earth together with its biota/biosphere works as a feedback mechanism. There is an internal-external interaction within the parts of

'Gaia.' Also, the whole universe is related to the functions of 'Gaia.' So far it is clear that there is an ontological disparity between the organism and the superorganism in Gaia hypothesis. The ontological indeterminism concerning organisms and their activities are all together part of the ontological indeterminism concerning superorganism. This indeterminism is a result of the inaccessible ontology of life. In the case of an organism, we are unaware of the parts of our body which are the carriers of life; we believe that the whole organism carries life which is indeterminate. In the case of the Gaia hypothesis, the superorganism has definite carriers of life within it. The innumerable species (organisms) are the carriers of life. If there is no organism on Earth, there will not be such a superorganism. In both the cases, however, life exhibits an indeterminate ontological nature.

## 5.2 Anthropocene: Call for an Ontological Unity in Nature

As anthropocene explains the influence of behavior and activities of humans over the environment here, we attempt to trace the possible philosophical roots which might have had influenced and generated the drives in humans to subjugate the nature. It creates a dialectical situation while debating the 'dominance' [of human] either as an immanent predisposition inherent or as a nurture-product imposed upon *Homo sapiens* by the history of thought which is highly anthropocentric. Besides the *logocentric* understanding of the teleological power-relations of the world of objects, the orthodox religious/philosophical thought processes often encourage the human supremacy in nature. What is natural here is treated as environmental. The universality of hegemonic human comportment demands the need for a

comprehensive understanding of the human 'being-ness' other than the superficial evolutionary understanding of it as one among the many species, *i.e.,* belief in the no-ontological divide. The worry about the drastic environmental changes caused by a human is eventually rooted in the future of existence (of humans?). Hence, it is a way of thinking in which both antecedence and consequence have pointed to a single entity, *i.e.,* human. It seems that the anthropogenic way of thought does not argue for a constant nature/environment so that, the 'swift change' is a matter of concern here. The reason of this rapidity in environmental change, from Anthropocene, is a human activity which is an expression of being-difference from the rest of nature. Although Gaia hypothesis offers a superorganic understanding of self-regulative nature, a substantial philosophical understanding of it enriches the discussion of Anthropocene in a better way. We thus endeavor to explore the philosophical underpinnings of the anthropic element as well as it analyses necessity of the Anthropocene worry. A substantial understanding of the nature of *Homo sapiens*; whether it is teleologically bound or independent-in-itself, is needed for this analysis. This section of the chapter attempts to conceive a naturalistic ethic that values the wider conception of nature – which doesn't see the 'distinctness' of the human element. It means that humans are part of a larger nature that refrains us from proclaiming loudly – "humans and the rest of nature." Through this discussion, we emphasize that ontological difference exists within the species 'taxa'. This idea clarifies the difference we discussed in the fourth chapter about the difference between species taxa and species category. An appendage outcome of the chapter would be the unity and diversity of organisms in nature.

### 5.2.1 Human attitude to 'nature': immanent or imposed?

The uncertainty of the commencement of Anthropocene tugs our interest to the industrial revolution which, some consider, could be the possible point of departure of an accelerated massive extinction of natural resources. The reason behind this consideration may be its resemblance with the Paleocene; a geological epoch that starts with the immense devastation of the environment. There ensued a great paradigmatic divergence in the growth of the world economy during industrial revolution; thereby it resulted in the gigantic consumption of natural resources. This sudden variance of the economic growth has a significant impact upon the policy-making process of nations which has reflected in the human way of living. Though the industrial revolution is the collective movement in the world history, one of the reasons behind it is an understanding that humans can conquer the nature. Of course, the roots of this understanding might have scattered in the vast history of thought, *, i.e.,* in philosophy. Out of the outnumbered possibilities, here we explicate some philosophical views which have, far-reaching impact upon the human world since the outset itself, nurtured the human impetus to master the world.

Let us begin with the sophistic understanding of human being since the history of western thought; the first anthropocentric approach demonstrated in the views of Protagoras who became popular later as the father of humanism. His proclamation of "man is the measure of all things, of the things that are that they are, and of the things that are not that they are not" (Guthrie 1971, 170) seems to have a potency to make far-reaching ethical implications. This statement itself exposes the existence of anthropocentric views of the world long before the An-

thropocene outlook. Protagoras considers human as the measuring tool so that he discards all the outside (of the human realm) interventions. Humans seem to be the ethical authority/centrality of nature in the sophist thinking, and hence, every activity including human action is percieved from anthropo-ethical sense. In the modern period, Rene Descartes treats human as a combination of thinking and extended substances (Wee 2006, 613) while animals and the rest of nature as consciousness-less automatons (Cottingham 1978, 551-552) without feelings. In Buddhism, the human has been treated as a desire-centric being (Alt 1980 in Webster 2005, 22). Apart from these philosophic views, there are religious views which have influenced the dominant thinking of humanity. Some of them believe that human beings are free-willed creations of God and the human freedom in nature, they believe, as a gift of God (Theories of Human Nature. Web). All those above philosophical/religious views exhibit anthropocentrism and underscore the supremacy of human nature. The totemic understanding, *i.e.,* the human kinship with the rest of nature seems to be absent in these explanations. These thought histories observe anthropo-monarchic attitude. The underlying supposition is that the ancient thoughts externally impose the conquering tendency of humans in the modern period. If the Industrial Revolution is considered to be the departure point of Anthropocene, then one can argue that it is a cultivated tendency of human thought. The question that arises here is, what about the hunter-gatherer behavior of primitive human beings? In that primitive period also humans used nature as a means to satiate hunger, a basic need (if not egoistic, to satisfy our other needs). It means we suppose no thinking species were existing before *Homo sapiens*. In other words, if there were a rational species, then there might not exist a hunter-gatherer period. The assumption infers that this particular behavior/attitude of human beings, nature, is immanently bound with the ontology of the *Homo sapiens*. It is immanent and not imposed.

To understand the human 'nature' (being-ness), a brief clarification of the naturalistic evolutionary ideas of Darwinism and Sociobiology is necessarily needed. To support the preceding argument, Charles Darwin, in the 19th century introduced the idea of evolution using natural selection. As he also thinks about a 'common descent' (Darwin 2009, 91) in evolution, the human 'being-ness' must have evolved from the early forms of life. Instead of proposing a creationist argument, which always needs metaphysical support (transcendental other than immanent), he argues that contemporary species to have emerged from their ancestral ones. Accordingly, both humans and the rest of nature have been considered as the different branches of an evolution-tree. Thus, some Darwinians conclusively treat human as part of the rest of nature, *i.e.,* there is no ontological divide in nature. Edward O. Wilson further supports the Darwinian view with an argument for the natural origin of behavior in his well-known theory Sociobiology. For a Sociobiologist, the behaviors especially social behaviors like altruism is a product of natural selection (Wilson 1998, 3-14) and the cause of these behaviors, of course, is implanted in the genetic endowment. Hence, whatever (social) behavioral features an animal has is an outcome of organic evolution, *i.e.,* social behaviors are real biological adaptations. The progressive changes in the biological features might have proportionally influenced the social changes. Now consider an industrial revolution, which is an outcome of the collective practice of social policies and hence, the causes of this may have coalesced with the human behavior. Therefore, from the point of evolutionary naturalism, the hegemonic tendency of humanity over the environment must be a natural outcome and not a nurture-product. Instead of standing on one side and blaming the other, in this Anthropocene epoch, Franz de Waal (2006, 99) suggests that it is the time to get rid of this nature-nurture dichotomy and understand human nature more intimately, to think about the possibilities in environmental protection.

Now Biology dominates in our endeavors to fathom science, very-well reflected in the philosophy of science. Takacs and Ruse (2013, 5) argue that the philosophy of biology dominates in the philosophy of science. The biological science has predominantly considered evolutionary biology. Evolutionary Darwinism, amongst other evolutionary views, seems to be the more acceptable in the realm of 'descriptive' emergentism. From Darwinism, the existing features of a species/organism are the consequent product of the checks-and-balances of the processes of natural selection. Natural selection, for Darwinians, is a mechanistic process based on chance/accidental principles and hence it evades the teleological subject. In Darwinian terms, it is the preservation of more favorable variations and the extinction of injurious ones (Darwin 2009, 63). Taking this natural selection into consideration, another possibility that arises here is that the anthropocentric attitude to nature may be a new behavioral variation, among the human population, in which natural selection has to work. Both these possibilities reveal that the Anthropocene worry seems to be questionable because biological evolution in this sense is responsible for humans' destruction of nature. If Darwinism is true, one cannot say that humans are responsible for environmental change because humans work with their existing traits which are the outcome of natural selection. A detailed explanation, about how evolutionary views set into the Anthropocene vision, follows in the successive sections.

### 5.2.2 Anthropocene worry and the realization of human attitude

Climatologists or environmentalists complain that the human intervention with nature brings more drastic changes which had never happened before in the Earth's history. If the environment changes severely, then it may cause the extinction of several species including human. This concern is all about the worry of Anthropocene and to analyze this; it needs to look upon the evolutionary history of life. Once there existed dinosaurs on Earth, but now we have only fossil facts about them so that species extinction is not a new problem in the history of Earth and life. It is the fact that after several species extinctions and environmental changes the Earth and life on it still exist. It seems nature has its immanent inner principle according to which it changes itself so that the worry is not about to protect the nature as such. Then, who will be benefitting once the environment gets back its pre-Anthropocene status through human efforts? As it is impossible for humans to recover the extinct species, it would be beneficial for the existing species. If nature has been enriched with non-human organisms, then ultimately the profit goes to the humanity because of its population explosion. The population outburst demands more natural resources than the present availability. The cause-effect relationship in Anthropocene thinking, indeed, moves circularly. The antecedent cause and the consequent effect are pointing towards a single species, *i.e., Homo sapiens*. It is not incorrect to say that the Anthropocene worry is mostly about the future of human existence along with the sustainable preservation of natural resources. Hence, the solution for this Anthropocene worry should come from the human difference itself.

This novel environmental outlook redirects our attention specifically to ontology to understand the 'being-ness' of both nature and human. What it means by ontology is the internality of the 'being-ness.' Before going into the detailed explanation it is necessary to consider the questions Vittorio Possenti (2002, 40) interrogates in his paper Nature, Life, and Teleology that "what is natural and what not? Is the concept of nature morally relevant? Are some things unnatural and contrary to nature?" Nature appears to be an ever-changing entity, *i.e.,* the static element in nature is 'change.' According to Possenti, nature is the inner principle of movement (42-45) so that natural changes are the changes that come from within. This new understanding of nature demands to scrutinize our superficial understanding of it as the totality of objects including us. Taking Possenti's view into consideration, one can argue as an inward principle; nature works itself differently in a different object. This operational variability of nature can be the reason for the 'being-difference' of species. Each species differs from others in a certain manner. For example, among the bipedal species, *Homo sapiens* differ from their ancestors. The overall characteristics of an organism or species together with its nature, one can collectively entitle as the 'being.' The being-ness of human beings differs from other species in its way, and this difference reflects on their characteristics.

Let us have a brief idea about how Gaia hypothesis comes into the picture of environmental change. The Gaia hypothesis, the contribution of James Lovelock, says that life together with other environmental elements works to regulate the homeostasis (Lovelock & Margulis 1974) and then condition the Earth's atmosphere suitable for the sustenance of life (Wilkinson 1999, 533). The Earth, therefore, works as a feedback mechanism to regulate the temperature and other environmental conditions. Here, with the help of *Gaia*, the chapter tries to ex-

amine whether the Anthropocene worry is anthropocentric only or not. In the preceding section, the highlighting point is the non-necessity of negating the ontological divide. These differences are mostly biological, though a human is a social animal. Even though those features like consciousness and rational intelligence frame the sociality of human beings, these are the outcome of biological evolution, *i.e.,* adapted characteristics of *Homo sapiens.*

Gaia hypothesis seems to be influenced by the evolutionary mechanism of natural selection to justify the feedback mechanism of the earth's environment. There eventually arises a doubt, especially scholars habituated with evolutionism and Gaia that if nature works independently, why should one worry about the changes in the environment? It is a fact not only to the evolutionary naturalists but also to the general public that nature has some working regularities. For instance, take the experience of the regularities of the season in each year. Evolutionary natural selection and self-regulating feedback mechanisms of earth etc. are some of the brute facts or the brute forces of nature. Nature is not a constant entity, but there is a constancy of the regularity in nature. The sustainability of species, including human, depends upon the constant regulation of natural events. The unintended natural happenings support to argue that nature might have an inherent tendency to maintain the equilibrium through checks and balances of its events, though there is a crisis in nature. Nature has its own pace for each process and this intrinsic pace maintains the balance of natural regularities. What then interrupts the nature? The above question, through an Anthropocene perspective, is pointing towards the human activity and the pace of its direction. It feels odd to understand the truth that *Homo sapiens* are the key species; which disturbs the natural equilibrium in an accelerated manner even though humans are part of nature. Human development through agriculture, mining, construction, industri-

alization, urbanization, etc. collectively constitutes the recent geological era, *i.e.,* Anthropocene in which the physical, chemical and biological features of the environment are rapidly changing. The scale and intensity of the human interactions with the environment/nature vary from the ancient to the present as an effect of the proliferation of population. This problem can locate in the different stages of human effects on planetary processes as paleoanthropocene where agriculture exploits nature; industrialization – pollute the environment through the industries, and there is a high depletion of natural resources; and post-world war II- which is also known as great acceleration period of Anthropocene (Gillings & Paulsen 2014). The changes happen not only in the outer environment but also in the inner environment of organisms, *i.e.,* microbiome of species including human. The changes in the bacterial diversity and composition in human from hunter-gatherer to the present significantly shows the corresponding change in the living modes in different stages of Anthropocene (Gillings & Paulsen 2014). The argument shows that the changes happened in almost all directions in nature.

Unlike other animals in nature, "the amazingly successful animal species", *i.e.,* human (Tickel 2011, 927) exploits the nature of an intra-species status competition and assures its status as not only geological force but also evolutionary force, and that is why Gillings and Paulsen ( 2014) argues that there would be intense natural selection due to human-induced changes. There is a struggle, both in the intro and inter-species level, not only for physical existence but also for egoistic existence in the human world. Physical existence is a part of nature while egoistic existence is a part of a culture which is a social-product. Human is, but not, the only social animal. Human sociality, in fact, differs from the rest of social animals because human social sense binds with its egoistic essence while the rest of nature binds with their physical existence. The ego, the driving force that

accelerates the intentional natural changes in a radical mode, of humanity is the root of the exploitative behavior. The stages mentioned above of Anthropocene represent the transition of human ego from its primitive to a modified form. It has to add the social ego, in the case of human, along with Freud's three levels of ego. One can, if not accurately, associate the self-ego with intra-species level and the social-ego with inter-species level. It seems that the intra-species ego is more exploitative than the inter-species one. Humans may compete with the rest of the species to achieve or satisfy the fundamental things for physical existence while they have to compete with the fellow ones to achieve the social solidity for egoistic existence. For instance, the capitalists' accumulation of wealth, not in a needy but a greedy manner, is an intra-species egoistic activity and for that, they exploit the natural resources. It is well known that no other animal except humans that accumulate wealth(resources) other than their fundamental needs. Therefore, the Anthropocene argument, that human activity that centers on hazardous changes in the environment is right.

History gives a more clear idea about how humans exploit the nature so that it needs further clarification on what history articulate. History explains everything about human beings so that it cannot be both the history of life and that of the earth systems. History, therefore, talks about the story of either human dominance over nature or human subjugation of nature. The recorded human actions become the history while the natural events always remain as mysteries. The anthropocentric version of history is the blend of natural appetite and social customs, *i.e.,* mixture of nature and nurture. Though climatic "uncertainties cannot ever be completely tamed by the existing human knowledge and that its exact tipping points are inherently unknowable" (Chakrabarty 2014, 6), history shows that the finitude of humanity seems to be troubling the indefinable infinity

of nature. Without referring to human history, the story of climate change cannot be explained. This point does not mean that human history is different from the natural history, but because of the anthropogenic tendency and the inscrutable appearance of nature, as Viconian-Hobbesian view, humanity omits the nature and thinks only about the human history. The line of demarcation between nature and human vanishes once we humans start thinking on a species level. Even the natural/environmental thinkers, indeed, contemplate that there is an irreconcilable difference between nature and human and Dipesh Chakrabarty's (2009, 206) opinion that, "climate scientists posit that the human being has become something much larger than the simple biological agent that he or she always has been," justify it. The persons who take the initiative and efforts to solve the environmental problems should be ready to discard all the problematic stereotypes, the obstacles of the preservation of nature, first. Nature has its immanent principles, and by those natural codes, each phenomenon in the world are supposed to happen. For example, only the combination of two hydrogen atoms and one oxygen atom make water or the particular combination of three oxygen atoms only make ozone. Humans disturb the natural phenomena which are the outcome of those natural laws. There would be check and balance in the natural environment, or there may have climatic tipping points (Chakrabarty 2014, 7), *i.e.,* the line of equilibrium beyond that it could be disastrous, on which natural feedback mechanism works to regulate the stability of the environment. Nature may react customarily to the human-induced environmental changes, but it could be unpredictable. Since it is an ever existing entity, the real habits of nature seem to be anonymous to humans, and so we cannot predict nature's reaction would be either harmful to the existing species. It is sure that the speed of the diminution of natural resources is faster than the natural speed of their formation. Therefore, human actions disturb the pace of nature, not the principles. Anthropic fastening

of the use of resources does not cope with regularities of natural phenomena, and that is why, for instance, the repairing of ozone take more time than it's depletion. There are changes in the environment, and the regularity of these changes helps nature to maintain the stability or the homeostasis. Gaia hypothesis is right in its view that there is a natural process of homeostasis at a particular pace to maintain the equilibrium. In this sense, nature works independently, but the accelerated human activities do disturb the naturally paced regularities of nature which would result in natural hazards or environmental catastrophes. The carelessness and the avoidance of the human-induced injury in nature may lead to the eradication of both, the rest of nature and human species from the face of Earth. Anthropocene outlook reminds humanity the need for a rapid wake up from the obliviousness and makes a substantial move to protect our future along with the rest of nature. Therefore, the Anthropocene worry about the catastrophic environmental change is a necessary one which at least alarms the unsafe future.

### 5.2.3 No Ontological Divide in Nature

It is inconceivable for humanity, in future, to get into an 'economic dark age policy' in which all the developmental programs are put to a standstill, a system in which no further industries and urban areas promoted, and where the rate of production decrease permanently. But there would always be policies to control lifestyle to protect nature. We cannot expect a global policy like that since it creates a dialectical situation in world politics because developed countries or the industrialized nations have done more harm to nature than the developing or third world countries. There are nations with poor technological development trying to raise their conditions from the lower level. However, an economic Dark Age

policy, even it is only for five years, is impossible to implement not only globally but also at domestic level because of the economic hierarchies. Nevertheless, it is essential to move a step ahead in environmental protection on a global level. As it needs to become a worldwide movement, the nature of the policy should be politically oriented. It is necessary to adopt a new policy on the planetary level which would be acceptable for all kind of nations and humans. It needs to analyze the different styles of living to realize the cost and benefit based on which the world should design an ideal policy. Not only industrialization and capitalism but also the different human living styles also affect the environment to a predominantly larger extent. The human activity needs to be regulated, and it must be from the ethical point of view. The living style of the high technological or industrial nations is far different from that of third world countries. Even if the contribution of hazardous activities varies from nation to nation, the world population as such has to suffer equally. Development policies either in a nation or across the globe create economic inequalities, but the climate crisis extends to all population equally. The climate crisis is then, from John Bellamy Foster, Brett Clark and Richard York (qt. in Chakrabarty 2014, 10), the product of social rift; the dominion of human by human. So it is not only a political issue but also an ethical one so that there is a need for a planetary level natural ethic for the protection of nature and it has originated from the human mind itself.

Alan Weisman puts forward a thought-provoking question in his work The World without Us that "suppose that the worst has happened. Human extinction is a fait accompli. . . . Picture a world from which we all suddenly vanished. . . . Might we have left some faint, enduring mark on the universe? . . . Is it possible that, instead of heaving a huge biological sigh of relief, the world without us would miss us?" (in Chakrabarty 2009, 197). It is certain that those ecological thinkers

who are blaming human beings for the massive change in the environment cannot or will not think about the elimination of *Homo sapiens* from the planet of life. They worry about nature including ourselves and try to find a key to resolve the human-induced environmental issues. Their synergetic approaches show that there is a need to comprehend human 'being-ness,' with its highly adaptive qualities, as part of the rest of nature. The Anthropocene, then, implicitly argue for an 'ontological no-divide' state of nature. The Anthropocene ontological no-divide argument is slightly different from that of evolutionary thinkers. Charles Darwin ([1859] 2009) through his theory of natural selection argues for common ancestry in evolution, and this entails that there is no ontological divide in life-world. E. O Wilson (1998/1975) through Sociobiology argues that the altruistic behavior of man evolved from the earlier species. Franz de Waal (1997, 2010) and Nicholas Wade (2007) also argue that the moral behavior of human beings has evolved from the primate species. All these views are referring to physicality to point out the ontological no-divide argument. It is right that humans have many crucial aspects to share with the rest of the living world, but humans differ in their way that is why we are now worried about the human interventions with nature. The evolutionary approaches to understand human as one among the many species of the Earth play a very crucial but different role in making the argument that there is no ontological divide in nature. This biological enlightening, perhaps, lead to finding a solution for Anthropocene worry. Before going into a conclusive statement about the Anthropocene worry, it requires an understanding of 'how it has assessed the position of human species in nature' (de Waal 2006, 163). Humans stereotypically consider their species as 'social' rather than natural, and this is the foundation of human devastation behavior which destructs nature. The interrelatedness of species comes secondary in human thinking. To recover the primacy of species interconnectedness, it has to change the statement 'we are

social' as 'we are natural.' Realization of the continuity of the lineage in the tree of evolution only makes human to understand the necessity of a mutualistic existence of human with other species in an Anthropocene era. Because of the incapability to anticipate the harmfulness and the resulting pain, what humans did in nature until now was harmful to the environment. The pain and pleasure, hence, should be discussed in a nature-centric perspective and not to be limited in anthropocentrism.

# Chapter 6

# Ontological Realism – A Novel Idea

Let us now consider the two terms used widely in biology – life and species. These terms are representing two underlying entities or phenomena which are fundamentals to any successful biological theory. It is often argued, in inter and intra-biological discussions, that they are abstract entities. A philosopher may find uneasiness to accept such claims because we cannot assign the designation 'abstract' to them in a unique way. Firstly, there is a lack of a general principle of abstraction and secondly, the difference in the condition of existence. Remember the points we have already noted in the earlier chapters; there is no universal definition for life and species, and we do not have a general consent over 'how do they exist in nature.' The conditions of existence of these entities are intractable to our understanding. The point we try to establish here is that there are theoretically important entities, which science establishes, whose 'condition of existence'

is beyond the scope of scientific epistemology.

Also, there are some other entities which seem to be scientifically irrelevant of whose 'condition of existence' is also beyond our understanding. The difference between scientifically relevant and scientifically irrelevant entities is that the former possess some empirical inclination (directly or indirectly) while the latter does not. Entities like an electron, life, species, etc. become scientifically important because they are the fundamental pillars of some successful scientific theories. Entities like God and Soul are the subjects of theology, not science, because they do not have any empirical inclination either directly or indirectly. Concerning the condition of existence, these two groups of entities possess 'independence' differently. Consider the example of the condition of existence of life. We grasp the existence of life through our experience of living beings (organisms) which are concrete entities in nature. Life is what all living beings commonly share. It is an empirically necessary factor without which the ontological categorization of 'living' and 'non-living' would be impossible. In fact, the science legitimizes such a categorization otherwise there will not be subjects like, for example, physics and biology. An organism cease to exist (dead) means the union between inert matter and life breaks. Life exhibits some empirically predictable or demonstrable nature though we do not make any definite claims concerning its condition of existence. It does not exist like an organism or any such concrete thing. The absence of concrete nature is the root of the argument that it is abstract. The indeterminate nature of its condition of existence shapes the abstractness here.

How does the abstractness of life differ from the abstractness of God? To answer this question, we must specify the causative role of life, and God plays in our epistemology. In the science of biology, life seems to be an empirical necessity.

The definitive answer to the question 'what differentiates living things from non-living things' would probably be 'life' in biology. For a naturalistic framework, life serves as the base of organic/inorganic distinction. The creationists and theologians conventionally consider God as an absolute causal necessity. It is absolute in the supernatural realm. It is a *causa sui* subject from which the whole world had originated. This belief is derived purely by subjective means. A cause without a cause is against the rationality of science. We do not have empirical reasons to assert the self-caused existence of God. There is no causal connection between God and the condition of its existence. It cannot be an effect without a cause. A causeless entity is beyond the boundary of causation, but life, unlike God, falls under causation. Though natural science is ignorant about the causality behind the origin of life, it expresses an optimistic attitude towards its natural origin. God is abstract in the sense that it does not possess concrete existence. The abstractness of God is a product only of imagination without empirical experience; the abstractness of life is a product of imagination with empirical experience. The former is a 'from without' cause while the latter is a 'from within' cause of the subject of experience. There is an explicit ontological difference between a property with and without an empirical base. Abstractness being a property differently manifests in life and God.

[1.] Condition of existence and its independence: Having said all that, it is time we focus on the 'independent' nature of the condition of existence. Firstly, it is necessary to explain what is meant by the condition of existence in our discussion. It is an aggregate answer to the following questions; 'what causes the existence of a particular entity' and 'how does it exist in nature.' Consider the condition of existence of electron, for example. To understand the condition of its existence we need to address the question above. The causality behind the origin

of the electron is unknown to us; we treat the electron as 'given' in nature like the given-ness of the gravity. It is 'independent' of our cognitive schema. We are also unaware of the nature of its existence because it has an 'observation–independent' nature. The condition of the existence of electron thus possesses independence from our understanding. The condition of existence, as we noted in the first chapter, can be an aspect of ontology. Inquiry concerning the condition of existence of entities falls under ontological inquiry. Reminding the point once again that there are successful scientific theories, like evolution theory, which are ontologically committed to entities whose condition of existence is independent of our understanding. This understanding of the independence of ontology (of some entities) pushes us strongly towards some aspects of the metaphysical realist claim. That is, entities exist independently of our conception/understanding of them. We do not rely completely on metaphysical realism but require only the aspect of 'mind-independence' from it. The 'independence' is the foundation of reality claim in metaphysical realism. Based on this we argue that some scientifically important entities possess intractable nature concerning their ontology. They are real in the scientific realist sense; while their ontology is real in the metaphysical realist sense. Combining these two aspects, we come to propose a new conception of ontological realism. It is substantial to understand the unavoidability of such unobservables in certain scientific theories and explanations.

Our conventional dichotomies of observable/unobservable and concrete/abstract may fail to establish the truth of the reality claims we make about the objects that furnish the world. Some interpreters of science (anti-realists) believe that science cannot make any claims concerning that which is unobservable. The inherent supposition with such an argument is that science would be successful in its endeavor to make true claims about the observables. For the skeptics of un-

observables, entities like jellyfish and sugar cubes, etc. are real because they are immediately accessible to our senses. As we have already discussed, our reality claims of entities based on observation sometimes fail. The bent of a stick that is partly immersed in water and the mirage on the road etc. are the examples of perceptual errors. The reality claims based on such observations (perception) would probably be wrong as they do not represent the reality out there in the world. Also, sometimes we make reality claims without the direct perception of entities. For example, the perception of dense smoke on a mountain may lead us to claim that there is fire on the mountain. Once we proved that our claim about the fire on the mountain is true, then the claim represents reality. We reached at the true description of the world without direct observation of the underlying reality. It is the observation by inference. We often claim that 'all men are mortal'; we reach this conclusion by inductive reasoning without a factual observation of all human beings in the world. It also appears to be a true description of the world. Believing that science cannot truly describe unobservables is inappropriate because such an argument rests on two dogmas; the reductionist conception of observation (by sense perception) and the consideration that human sense organs are ultimately reliable. We have noted in an earlier section that a) observation has a broader understanding than sense-perception, and b) our sense organs are designed by the process of evolution to make us fit for the environment. We can prove that X-rays exist though they are not subject to our observation (perception). We make use of X-rays for medical imaging on a daily basis, and it is a successful process in medical diagnosis. Not only X-rays but also ultra-sonic sound, atoms, molecules, etc. are not directly observable (perceivable) because our sense-organs have certain capacity-limit. The following example may clarify this. The human ear has a specific range of hearing; it can hear sounds between 20Hz to 20kHz. Bats and dolphins can hear sounds range up to 100kHz while other organisms

like some whales can hear the sound as low as 7Hz. Like hearing, there is a visible spectrum for human vision. There are organisms which can see outside the human visual range. The bat, for example, can see the ultraviolet light. All these together bring us to the conclusion that perception, based on human sense organs, is relative and reveals only some aspects of reality. We can detect the presence of these unobservable entities in nature by instruments. Believing that only inbuilt sense organs, the products of evolution, are legitimate and reliable crates a natural/artificial divide among the capacities that help us to understand the world. Instead of creating such a divide, we must realize that the artificial aids help us to extend our observation (perception). Apart from the dichotomy of observables/unobservables, there are entities which are detectable.

There is a problem with the division of entities as abstract and concrete. The problem comes when we try to categorize a particular object as abstract. It is because there is no general theory of abstraction. Abstract entities manifest differently in nature. 'Colour' is an abstract concept and we realize it by experiencing particular colors which are also abstractions in a relatively different sense. The concept of 'color' and the 'color red' has a different existence. The former is an abstraction of abstract entities so that it has an ultimate abstract nature. It exists in the ideal realm of our experience. While the 'color red' has a mixed nature; its existence necessitates both empirical and ideal aspects of the experience. Our experience of 'red' logically presupposes the existence of a particular concrete thing say apple. It does not have an independent existence. It is our subjective realm of understanding that made us possible to understand such kind of mediated existence. Not only color but entities like space, time, etc. also exhibit the same kind of distinction. On the one hand we have made abstractions with empirical instances, but on the other hand, we have made abstraction

of abstractions (absolute abstraction). In biology, species is the best example of absolute abstraction. Species here means 'species category,' not 'species taxa.' In this sense, abstraction has a connection with grouping. Consider a group of different entities (differ in both shape and size) which are colored homogenously. Suppose that we say that those are green colored objects. How do we reach such a conclusion? It is not size or shape but the common property – that is, being green colored- which leads us towards such a conclusion. Abstraction in such case is an abstraction from perceived commonality. Another example which asserts an entirely different kind of abstraction is that of life. Suppose that from a given group of entities we categorize some are living and some are non-living. The common factor which leads us to group the living beings (organisms) is the condition of being alive. We may call it 'living' which is the totality of organismic functions. Vaucanson's duck also performs some functions of organisms, and the robot Sophia also behaves perfectly like a woman. But it is not possible to argue that they are organisms in the real sense. Based on the functional analogy we cannot truly categorize something as living. We further investigate to expose the underlying cause behind the unity of organisms. More often we infer that there must be an underlying homogeneous cause that differentiates organisms uniquely from the non-living things. The most reliable claim we find in the literature is that the cause is 'life.' However, we are unable to establish the concrete existence of life, and this impossibility is the drive element behind the argument that life is an abstract entity. Here the abstraction does not directly come from the perceived commonality. Apart from all these, people outside the science (mostly in theology) talk about the existence of God who is not a concrete entity. Also, God does not exist as 'one-over-many' or 'one-in-many' so that we cannot rightly proclaim that it is an abstract entity. God is neither concrete nor abstract. It is a mystic metaphysical entity of which we cannot make any factual claim. It is possible to

talk about entities which possess absolute independence from our experience, but we cannot demonstrate the truth of the proposition of such entities. It becomes clear now that relying on conventional dichotomies will be inappropriate to understand the ontology of the world. Instead of being *dual*, the reality has multiple aspects. By insisting the observable/unobservable division, anti-realism tries to eliminate those entities which exist outside the range of human sensibility. In fact, it is not that easy to eliminate such entities because theories and models in science well support them. The successful scientific theories have practical implications, and we make use of them to understand the reality objectively. The elimination of entities which are said to be unobservable will create an epistemological gap in our established scientific theories. And this will probably reflect in our scientific practice. We cannot justify the medical imaging used for diagnosis of pathological problems if X-rays do not exist. Though the ontology of such entities possesses intractable nature, we cannot avoid them entirely from the ontology of the world.

[2.] Ontological realism: The notable point is that we have to find an abode for the epistemological condition caused by our inability (regarding cognition) to make determinate claims over the intractable ontology of some entities in nature. It seems a novice understanding of 'ontological realism' may help us in this endeavor. In literature, ontological realism has been introduced as a position which aims to answer the meta-ontological question concerning the objective nature of answers to the basic question of ontology. It seems it has an inherent relation to meta-ontology (Chalmers 2009, Jenkins 2010). Ontological realism, in general, seeks to address the second order questions of ontology by justifying the answers to the first order ontological questions. Here realism has a close alliance with objectivity by mind-independence. Based on the discussion about the intractability of the ontology of entities like life and species, we can clearly state that the

ontology of such entities possesses mind-independent nature. It is 'out there,' but we are unable to conquer it by our available cognitive schemas. Suppose that we attempt to claim the mind-independent nature of the ontology of those entities. We end with a statement that the entities with intractable ontology exhibit 'ontologically real' nature. Here the ontological realism represents the epistemological incompetence to have determinate existential claims concerning some scientifically relevant entities.

In biology, entities like life and species explicitly while organism implicitly express a (realistic) kind of independence, from us, concerning their conditions of existence. We have made the point clear that 'condition of existence' interlaced with ontology. So that the ontological question 'what there is/what exists' can be modified regarding the condition of existence. That is, we may ask 'what there is as the conditions of existence' of a particular entity. This question specifically aims to seek the causal factors of things that exist in nature. We can change the mode and tempo of our inquiry through a simple alteration of the question. Instead of 'what there is' we may use 'what is'; the question becomes appeared as 'what is the condition of existence' of a particular entity. It is, in fact, a metaphysical question which seeks to reveal the nature of reality. Among the two kinds of inquiry, we choose the ontological one to establish a novel understanding of ontological realism. We are now aware that not only the above said biological entities but also some other non-biological (physical) entities such as electrons display a unique kind of independence about some aspects of their ontology.

We do not consider 'ontologically independent,' as used in our discussion, as an antonym of ontological dependence. Ontological dependence is explained simply as a relation (or family of relations) between entities. It is used to show that

an entity depends upon one or more entities for its existence or identity. Generally, 'ontological independence' of objects signifies the independence, regarding identity and essence, from other entities. For example, the nature of species does not ontologically depend on the relative nature of its constituents (organisms). What we mean by 'ontologically independent' is that some entities which are natural, having empirical and theoretical importance in science, whose ontology (condition of existence) is independent of our understanding or has an intractable nature.

We can further reframe the phrase 'ontologically independent' as 'ontologically real' where the term 'real' indicates objectivity through independence. The ontology of the entities mentioned above is intractable, but that does not prove its nonexistence. Of course, we have relative conceptions of the ontology of such entities. This conceptual relativism does not help us to have a unique definition or explanation of such entities. It is a fact that we do not have a general/universally-agreeable definition of, for example, life, organism, and species. The reason for this is that we could not find the actual condition of their existence in nature, though we have a plethora of functional definitions/explanations. Apart from our relative understanding, their ontology has an objective or independent nature. It seems that our conceptions of the condition of existence are relative or functional; otherwise, we might have come up with a general definition of intractable natural entities. If our understandings of their ontological aspect are relative, the actual ontology 'out there' will be real. Hence, it is not inappropriate to use the term 'ontological realism' to signify the scientific-stage where one is incapable of determining the ontology of intractable natural entities. More often science confronts such situation where scientists are unable to either define an entity or determine the condition of the existence of an entity which is theoretically important. The use of terms like electrons, life, species, quarks, etc. in successful scientific theories

acknowledges the scientific presupposition of the reality of such entities. Scientists use these terms in successful scientific theories because they believe that they are part of the ontology of the world. Scientists do so because they have optimism toward the scientific progress; that is, one-day science will reveal the real condition of existence of that which is now intractable.

Although science has gained a rapid anti-metaphysical momentum after positivism, scientific theories cannot completely get rid of the specters of metaphysics. Philosophers of science demonstrate the validity of scientific theories in opposing ways regarding the commitment to entities which have intractable ontological nature. There were different paradigms in science where different scientific disciplines abandoned the traditional metaphysics. For physical sciences, it was the mechanistic paradigm; for biology, it was the evolutionary paradigm. It is right that scientific disciplines could avoid the kind of metaphysics which had a mystic nature at some point in time. However, they cannot eliminate the aspects of metaphysics from their purview of explanation. The metaphysical aspect which is in play with science is rooted in the intractable ontology of entities postulated by scientific theories. The entities we discussed in the last chapters; life, organism, and species, are biologically important and are used widely in biological theories/explanations. Biology is ontologically committed to the existence of these entities. However, the fascinating point is that there is no universally accepted definition of these entities in and out of biology. It is so because there is no determinate account of the ontology of these entities in biology. How does a successful biological theory, say evolution theory, provide a true description of reality with an indeterminate understanding of the ontology of entities about which the theory talks? If life, organism, and species do not exist, then there is no meaning for evolution theory. Evolution theory is a scientific theory in the sense that it

explains in purely naturalistic terms how a new species originate in nature, from the existing one. Also, the theory establishes a necessary causal connection between the antecedent and consequent events without necessitating assistance from metaphysics. In its endeavor to explain the origin of species, the evolution theory is quite successful. Most successful scientific theories are trying to justify observation conveniently. Kinetic theory of gases, in physical science, states that any volume of gas contains a large number of small entities, which are not subject to our observation, in motion. Based on this theory we can justify the observable behaviors of gases. The theory does not aim to give a determinate account of the underlying entities (molecules).

Evolution theory in biology is also doing a similar kind of job as does the kinetic theory of gases in physical science; justifying observation. If anti-realism is right in its claim that the unobservables are 'convenient fictions,' then the term molecule in the kinetic theory of gas or species and organism in evolution theory turns out to be fictional. Suppose we see someone heats a balloon containing a particular volume of gas under constant pressure, we can predict that the balloon will explode due to the expansion of molecules. In the same way, one can state that evolution theory gives a naturalistic justification to paleontological data. Some people believed that we could not make predictions based on evolution theory. It is partly right and partly wrong. It is right that we cannot predict what would be the next species that will evolve from *Homo sapiens*. It is wrong because we can have predictions about the process, that is, by observing the heritable variations among organisms in a particular species we can say that there will be an evolution of new species in future. Regarding process, we can have predictions based on the evolution theory. Of course, this kind of predictions is, in a sense, simplistic compared with the predictability of successful physical theories. The process-

based prediction concerning evolution theory is interlaced with the capability of evolution theory to explain past events. We can justify or can make a prediction, of our observation. It is possible because the underlying entities exist in nature. The terms like life, species, organism, electron, etc. might be 'fictional' but what they refer to in nature is real. With common consent, we can substitute the term species, for example, with another term in biology but the substitute also refers to the same underlying entity or reality.

It becomes clear that in successful scientific theories, the use of the terms which represent intractable entities presuppose a) the scientific belief on the existence of such entities in nature and b) the optimism that science will describe the ontology of such entities truly in future. This tentative indeterminism about the ontology of entities is the cause of contemporary metaphysics in science. This epistemic situation of science, we called as ontological realism. Ontological realism, hence, can be explained as a stage/situation in epistemology that signifies the tentative indeterminism concerning the ontology of entities postulated by successful scientific theories; it is a half-way stop of realism; or, a position in the scientific progress towards the revelation of the actual.

[3.] Some concluding remarks: At this point, we revert to the claims of each chapter to illustrate how they have contributed towards the main objective of the thesis. That is, with a new conception of ontological realism we can rightly demonstrate the metaphysics of science, through biology, via justifying the success of scientific theories which postulates unobservable entities. The stand-alone chapters substantially contribute to the holistic argument of the thesis though they have independent claims in specific concerning the ontology of entities they describe. The first chapter (the prologue to ontological realism) explained the

conventional types of reality claims generating the discussion of metaphysics in science, especially, in biology. Through a historical account, it has claimed that the way philosophers connect ontology with realism is not the only way that we can conceptualize ontological realism. Indeed, it is partial by limiting its possibility only in the realm of metaphysics. Ontological realism in that sense aims to express something exists out there in nature. We then have made an argument that it is possible to connect ontology with realism in a different way; connecting the 'condition of existence' with the 'mind-independent' aspect of realism. The new concept has a broader scope as we can drag it into the realm of science to address the tentative indeterminism of scientific theories. At large, it reflects the nature of the metaphysics of science in general. These altogether have created a theoretical niche to examine the ontological issues in biology concerning life, organism, and species. The focal point of the second chapter was the ontology of life, and we explained it through evolutionary biology. The chapter holistically made the point clear that evolution theory has some inherent metaphysical issues. So that argument concerning complete determinism, of evolution theory, would be misleadingly false. The metaphysics in evolutionary biology first comes with the indeterminate account of the ontology of life. Apart from the considerable explanatory success of the process of evolution, Darwin's theory fails to account for some highly life dependent features like mind and consciousness. This indeterminism is a product of the combination of unobservable nature of such life-dependent features and the Darwinian reticence on the ontology of life. The aforementioned organismic features are ontologically dependent on life. Interestingly, not only Darwin but also later Darwinians have not addressed the fundamental questions of life; 'what is it' and 'how did it originate.' It seems, for Darwin, life is a real entity with an indeterminate existence. It is appropriate to believe that he considered life is a given entity in nature. This 'given' nature of life further paved the

way to the issues related to the 'category' of life. We then argue for the necessity of breaking the belief on the conventional dichotomy (physical/metaphysical) of existence. The lack of a general definition or explanation of above states questions of life altogether pinpoints the independent nature of its ontology.

The success and possibility of Darwin's theory are rooted in the belief that life truly exists in nature because evolution (biological sense) is meaningful only in the context of life. Like the number theory in mathematics, evolution theory possesses an inherent supposition that life exists. Evolution theory then has an indirect ontological commitment towards the existence of life. Evolution theory, a successful theory in biology, discreetly postulates life as a true entity in nature. However, in all the possible ways, the ontology of life exhibits mind-independent nature. Concerning the ontology of life, the conventional ontological realists may try to address the question whether it is right to ask the question 'does life exist in nature.' They may even consider life as a composite property of the properties of the living beings. Whatever the case it might be, they assert that life exists in nature. By doing so, they try to address the meta-ontological question 'whether there is an objective answer to the question does life exist.' The ontological realist's assertion signifies that life exists 'out there.' They connect ontology (existence) with realism (objectivity) in a usual way, and as a whole, the ontological realism becomes a rigid metaphysical thesis. Unlike the conventional concept, the proposed conception of ontological realism opens up new possibilities by connecting the condition of life's existence (ontology) with its mind-independent nature (realism). By this unconventional linking of ontology with realism, it addresses the metaphysics of biology. We made the point clear that one among the metaphysical issues in the evolution theory is the intractable ontology of life. That is we do not know how does life exist in nature but that does not indicate its nonexistence.

The success of evolution theory proves its existence, but the theory is incapable of explaining its condition of existence. The theory possesses tentative indeterminism concerning the ontology of life. It is the locus of metaphysics in biology, and the new concept of ontological realism addresses this tentative indeterminism by stating that the condition of existence of life possesses mind-independent nature.

In the third chapter, we looked at the ontological issues related to the life-ascribed matter, *i.e.,* organism. We discussed the ontology of an organism regarding organismic activities. The 'from within' nature of organismic activities not only necessitates the possibility of an inner principle of life but also indicates the possibility of immanence in biology. From an elaborate discussion of the ontological difference between organism and 'mechanism,' the chapter concluded that organismic activities have an origin in the organisms themselves. Organismic activities come outwards; so that, there must be a condition/state where an inner principle (life) instigates organismic activities. This condition/state is analogical to Spinoza's *pantheism* where Spinoza argued that God immanently acts in nature. These altogether lead us to the claim that immanence is a condition in nature where two entities (of which one is concrete, and the other has an indefinite existence) act for the manifestation of both. Organisms exist in nature differently, but the unique aspect of their existence is their performance of self-centric activities. Although we address organismic activities with immanence, we are unable to determine the condition of existence of the organism. Some aspect of organismic existence seems to exclude from our description. We are sure about the fact that organismic causality has an intrinsic nature, but we are not able to account for the ontological dependence of organismic activities. In this sense, the condition of existence of organism (regarding activity) is beyond our imagination.

The chapter discussed the ontology of species argues that the debates between realism and anti-realism as well as that of monism and pluralism have their roots in the intractable ontology of species. The species problem is to be stated either as the disagreement between biologists on the definition of species or philosophers' disagreement between the ontology of species. The plethora of species concepts is functional. That means they are relative to the specific field of inquiry. Pluralism in the species problem turns toward relativism. This relativism stipulates the fact that the ontology of the underlying entity represented by the term 'species' is independent of our understanding. The lack of a determinate account of ontology and the absence of a universal definition of species vindicate the argument that the species possesses an intractable ontology. There is more reason to believe that the species realists are true in their claim concerning the existence of species. Monists' reductive strategy does not end up with determinism; pluralist belief in the truthfulness of multiple species concepts logically portrays relativism. All these together compel us to think about a unique underlying entity whose condition of existence possesses independence from our cognitive schemas. It is the kind of independence to which metaphysical realism is heading. This chapter has made an appendage claim that there are two types of ontological practices in biology concerning of which the philosophical one is appropriate for the inquiry concerning the ontology of species.

The fifth chapter was an amalgam of the ontological issues related to life, organism, and species. The chapter has underlined the independent claims of earlier chapters through Gaia hypothesis and Anthropocene. Gaia hypothesis had proposed a different understanding of life and organism by claiming that 'earth itself is an organism.' This claim has noticeable impacts on our understanding of the ontology of life. The hypothesis indirectly argues that life is conditional to

earth. However, it also fails to address the fundamental questions of life. That means, life's ontology is mind-independent; it is a parallel claim to that of the first chapter. The remarkable point of the Gaia hypothesis is that earth is an organism; it is a superorganism, in fact. The chapter notes that the proponents of Gaia fail to account for the ontological condition of superorganic existence. They model earth as an organism by copying the ontology of organism which itself is mind-independent. Hence, they cannot determine the ontology of organism (superorganism). Anthropocene looks at the varied nature of *Homo sapiens* who, it argues, are a potential threat to the environment. Through an elaborate discussion of the possible roots of this human difference, the chapter made a remarkable point that human behavior is an outcome of evolution. The impossibility of finding out the cause of this noticeable human difference portrays the fact that we have an indeterminate account of the ontology of human beings (a particular species taxon). It becomes clear that not only species category but also some aspects of the species taxa are also, possess intractable nature.

The mind-independent or intractable ontology of life, organism, and species accentuates the truth that the metaphysics in biology has a unique nature. Biology postulates these entities through its theories and explanations. Among them life and species are unobservable entities; the organism is an observable entity, but some of its aspects are unobservable. All these are composite are composite biological entities whose existence depend on the existence of their constituents/bearers. Instead of proposing ontological realism by simply asserting that they exist out there, we put forth a novel understanding of ontological realism by combining the condition of existence with mind-independence. This latter one has both metaphysical and epistemological aspects. On the one hand, it addresses the tentative indeterminism of scientific theories on the ontology of postulated entities; on the

other hand, it necessitates the true existence of those entities. By and large, the metaphysics comes with the indeterminism concerning the entities successful scientific theories describe. The pragmatic aspects of such theories along with the successful models which support them reasonably necessitate the existence of underlying entities which are the reference of terms, for example, life, organism, species, electron, etc. It requires accounting for this scientific indeterminism of the ontology of entities in a way without damaging the truth of the theory. Our proposed conception of ontological realism is hence doing the same so that it reflects the metaphysics of science. Not only philosophers but also biologists (scientists) can use this ontological realism to address the indeterminism due to our cognitive incapacity.

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