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A Panpsychist Interpretation of Evolutionary Theory

Evrim Teorisinin Panpsişist Bir Yorumu

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A Panpsychist Interpretation of Evolutionary Theory

Abstract

If there is a questionable element in the theory of evolution, it is likely the randomness of mutations, which is seen as the primary source of evolutionary change. The idea that errors in DNA sequences are the source of species change does not seem acceptable to many scientists and philosophers. According to them, adaptive evolution, which suggests that some mutations occur purposefully, is possible. Both views seem scientifically supportable. However, science typically excludes purposes, especially due to their implications of the supernatural. So, the philosophical problem here concerns which metaphysical framework would better explain a natural world in which purposes are at work, assuming that adaptive evolution is real.

In this article, I propose panpsychism as a candidate for such an explanation. Although panpsychism is a well-known metaphysical view, it has rarely been associated with evolution. Panpsychism simply states that all actual natural entities possess some form of mentality that is intrinsic to matter. Mentality must be present at the most fundamental level of existence to manifest in any higher-level form. This idea of panpsychism that mentality develops gradually is already compatible with the traditional view of evolution that species change slowly and incrementally by small steps. Nevertheless the adaptive evolution hypothesis demands more. The idea that organisms can alter their own DNA in response to environmental conditions implies that this process occurs voluntarily in a controlled manner. However, adaptation does not always occur voluntarily, and such an understanding becomes difficult to accept as it attributes higher-level cognitive functions, such as choosing, will, and decision-making, to cells and molecules. Thus, a more naturalistic approach is needed.

Panpsychism can take many forms such as dualistic panpsychism or idealistic panpsychism. I suggest dual-aspect panpsychism as a wholly naturalistic version of this concept. Accordingly, mentality and physicality are two aspects of the same thing or stuff. Just as there is no mental causation from the mental to the physical, there is no physical causation from the physical to the mental. There are processes or events that manifest as physical happenings when observed from the outside and as mental happenings when experienced from the inside. Along with an interpretation of dual-aspect panpsychism that is compatible with physicalism, when we accept that the most plausible way to extend mentality to all actual entities is to think of it as intentionality, it may become even more easier to situate adaptive evolution within a naturalistic framework. Non-random mutations do not occur as mental acts of choice but arise from the organism's behavior being about or directed towards selective environmental conditions for the purpose of ensuring survival.

The article consists of two main parts. The first part seeks to establish the possibility that some mutations may not be random on a scientific-philosophical basis. The second part aims to show the compatibility of this possibility with dual-aspect panpsychism. As a result, it is hoped that an acceptable interpretation of evolutionary theory, combined with a naturalistic interpretation of panpsychism, will result in a fruitful synthesis that explains the seemingly purposeful actions of cells and organisms.

Keywords: Metaphysics, Panpsychism, Dual-Aspect Panpsychism, Evolution, Adaptive Evolution, Directed Evolution.

Evrim Teorisinin Panpsişist Bir Yorumu

Öz

Evrim teorisiyle ilgili şüphe uyandırıcı bir unsurdan söz edilecekse, muhtemelen bu, evrimin yakıtı olarak görülebilecek mutasyonların rastgeleliği olurdu. DNA dizilimlerindeki hataların tür değişiminin kaynağı olduğu fikri, birçok bilim insanı ve filozof için kabul edilebilir görünmüyor. Onlara göre, bazı mutasyonların amaçlı gerçekleştiğini bildiren adaptif evrim olanaklıdır. Her iki görüş de bilimsel olarak desteklenebilir görünmektedir. Ancak bilim, doğaüstü güçleri ima ettiğinden ötürü genellikle amaçları dışlar. Doğal olayları açıklayıcı bir kavram olarak teleoloji, bilimsel jargonda kendine yer bulamaz. Dolayısıyla, adaptif evrimin gerçek olduğunu varsaydığımızda, burada söz konusu olan felsefi problem, hangi metafiziksel çerçevenin amaçların yürürlükte olduğu bir doğal dünyayı daha iyi açıklayacağı hakkındadır. Zira adaptif evrim gerçekse, felsefi spekülasyona kapı aralanmış olacaktır.

Bu makalede, aday olarak panpsişizmi öneriyorum. Panpsişizm iyi bilinen bir metafizik görüş olsa da, evrimle nadiren ilişkilendirilmiştir. Panpsişizm, basitçe söylenecek olursa, tüm aktüel doğal varlıkların, maddeye içkin olan bir tür zihinselliğe sahip olduklarını ifade eder. Panpsişizme göre, zihinselliğin herhangi bir üst-düzey formda (hayvan veya insan zihni gibi) ortaya çıkması için, varlığın en temel düzeyinde dahi zihinsellik yer almalıdır. Panpsişizmin bu zihinselliğin kademeli olarak geliştiği fikri, türlerin yavaş ve küçük adımlarla değiştiği şeklindeki geleneksel evrim görüşü ile halihazırda uyumludur. Ancak adaptif evrim hipotezi daha fazlasını talep etmektedir. Organizmanın çevresel koşullara yanıt olarak kendi DNA'sını değiştirebileceği fikri, bu sürecin kontrol altında, isteğe bağlı olarak gerçekleştiğini ima etmektedir. Ancak adaptasyon her zaman isteğe bağlı olarak gerçekleşmediği gibi, böylesi bir anlayış, seçme, irade etme, karar verme gibi üst-düzey bilişsel işlevleri veya

edimleri hücrelere ve moleküllere atfettiğinden kabul edilmesi güç bir hal almaktadır. Bu nedenle söz konusu güçlüğün aşılmasını gerektirmeyen daha natüralist bir yaklaşıma ihtiyaç vardır.

Panpsişizm, düalist panpsişizm veya idealist panpsişizm gibi çeşitli biçimlerde olabilir. Bu çalışmada bu kavramın tamamen natüralist bir versiyonu olarak çift-yön panpsişizmi öneriyorum. Buna göre, zihinsellik ve fiziksellik aynı şeyin veya maddenin iki yönü veya veçhesidir. Bu görüşte, zihinselden fiziksele zihinsel nedensellik olmadığı gibi, fizikselden zihinsele fiziksel nedensellik de yoktur. Dışarıdan gözlemlendiğinde fiziksel, içeriden deneyimlendiğinde zihinsel olarak ortaya çıkan süreçler veya olaylar vardır. Fizikalizmle uyumlu çift-yön panpsişizmin bir yorumuyla birlikte, zihinselliğin tüm aktüel varlıklara genişletilmesinin en makul yolunun onu yönelimsellik olarak düşünmekten geçtiğini kabul ettiğimizde, adaptif evrimi natüralist bir çerçeveye yerleştirmek daha da kolay olabilir. Rastgele olmayan mutasyonlar, zihinsel birer edim olarak bir seçim şeklinde gerçekleşmemekte, organizmanın hayatta kalımını sağlamak adına davranışının seçici çevresel koşullar hakkında veya onlara yönelik olması sonucu ortaya çıkmaktadır.

Makale iki ana bölümden oluşmaktadır. İlk bölüm, bazı mutasyonların rastgele olmayabileceği olasılığını bilimsel-felsefi bir temelde ortaya koymayı amaçlamaktadır. Mutasyonların rastgele olduğunu gösteren deneyler olduğu gibi aksi yönde bulgular da vardır. Felsefi açıdan bu bulguların illa doğada bir teleoloji olduğu şeklinde yorumlanmak zorunda olmadığını bildiren alternatif görüşlerin varlığı ileri sürülecektir. İkinci bölüm ise, mutasyonların rastgele olmayabileceği olasılığın çift-yön panpsişizm ile uyumluluğunu göstermeyi hedeflemektedir. Çift-yön panpsişizm bir yandan doğaüstü kaynaklı her türlü amaç düşüncesini dışlarken öte yandan amaçlılığı maddeye etki edebilen bir zihinsel güce bağlayan felsefi teorilerden farklı bir çizgiye oturabilmekte, böylece fiziksel ve doğalcı bir anlayışla bağdaşabilmektedir. Sonuç itibarıyla, evrim teorisinin kabul edilebilir bir yorumuyla, panpsişizmin natüralist bir yorumunun, hücre ve organizmaların amaçlı görünen eylemlerini açıklayan verimli bir birliktelikle sonuçlanması umulmaktadır.

Anahtar Kelimeler: Metafizik, Panpsişizm, Çift-Yön Panpsişizm, Evrim, Adaptif Evrim, Yönlendirilmiş Evrim.

Introduction: What is Wrong with Evolutionary Theory and What Does Panpsychism Have to Do with It

Evolutionary theory is a highly successful theory. It is a successful theory not only in terms of its explanatory power but also in terms of its practical applications, especially in medicine and agriculture (Mindell, 2006; Poiani, 2012)[1]. It is also a very ambitious and dangerous idea. It is ambitious in the sense that it purports to explain the origin of species—all species, from the simplest organisms (and indeed molecules) to the most complex living things. It is a dangerous idea because it suggests that, "evolution is, in the end, just an algorithmic process" (Dennett, 1995, 266). This implies that there is no transcendent being or God behind the splendor of life, but mechanical, self-perpetuating, material happenings devoid of any inherent meaning or purpose.

Later on, some theists contested this idea by introducing God into the evolutionary scheme (theistic evolution), but for most people, the primary and crucial mechanism of evolution, which is natural selection, renders such an interpretation untenable. It is nature that preserves "favourable variations" (Darwin, 1869, 92) or modifications which are advantageous to the organism in its struggle for survival. There does not seem to be an external agent needed for natural selection to do its job. For this reason most theists who are committed to the doctrine of creation based on scriptures choose to reject Darwinian account of the descent of life altogether (Moreland et al., 2017). Another interpretation would be to equate nature with God and to say that so-called mechanisms of evolution, like other laws of nature, actually describe the behaviour of God. While it is a simpler view than the classical theist one (where there are two separate entities, God and nature) it is not entirely clear what we gain from this kind of pantheistic personification of nature.

[1] There is a journal dedicated to practical applications of evolutionary theory by the name of "Evolutionary Applications". See here https://onlinelibrary.wiley.com/journal/17524571.

If the theory of evolution is so successful, why is there a need for alternative interpretations? Although the apparent answer is that the theory, when approached from a naturalistic standpoint, doesn't allow for God's intervention in nature or involvement in natural processes, another motivating factor for entertaining the idea of divine intervention may be that the theory is not found satisfactory enough. Even if we take into account the vast geological timescale of the Earth, we must admit that it is quite challenging to grasp the idea that all living organisms ultimately descend from a single common ancestor. Recognizing that the beaks of Galapagos finches varied according to the principles of evolutionary adaptation is one thing; saying that these birds ultimately descended from theropod dinosaurs is another. In other words, almost no one rejects microevolution or finds it difficult to accept, but the idea of macroevolution meets resistance.

Whether it is microevolution or macroevolution, the transformation of species largely depends on the presence of mutations (alterations in the DNA sequence), which serve as raw materials upon which natural selection operates. However, "mutation" is not usually defined as a neutral term as suggested in the parentheses above. "Mutations" they say, "are simply errors in DNA replication" (Coyne, 2009, 128). As a result, all the complexity and functionality we see in nature is essentially nothing but an accident. How could it be otherwise, since the traditional view of evolution excludes purposes or goals from nature? Although it is not a surprising result, it is most likely this aspect of the theory of evolution that will drive a person to seek an alternative interpretation, regardless of their belief.

Other than the concept of divine intervention, is there an account that does not make mutations completely random? What does science say about this? In their article published in the journal Nature, Cairns et al. (1988), based on some experiments, suggested that "cells may have mechanisms for choosing which mutations will occur." Later, this notion became known as directed or adaptive mutation, describing any process through which advantageous mutations emerge in response to selective conditions (Roth et al. 2006, 479; Foster, 1998). Accordingly, organisms can, to some extent, influence the occurrence of mutations in their genomes in a way that enhances their adaptation to certain (stress-induced for example) environmental conditions.

The adaptive mutation hypothesis is highly controversial (Savic, 2009; Brisson, 2003; Lenski – Mittler, 1993), but the possibility that the hypothesis is correct or that the traditional view is flawed is sufficient for us to engage in philosophical speculation. In fact, the concept of divine intervention is one of these speculations, but there are other ways to explain the phenomena. In this regard, I will argue that panpsychism can be used to explain possible non-random mutations, and, therefore, a panpsychist interpretation of the theory of evolution can be given. According to this interpretation, if cells "choose" mutations in line with certain environmental conditions, it implies that they possess abilities that we might call "mental".

Panpsychism is generally understood as the view that "mentality is a fundamental feature of the world which exists ubiquitously throughout the world" (Seager, 2020, xi). Although it is a proper definition, it does not tell us how the term "mentality" should be understood. In order to show what kind of panpsychism can be integrated with the theory of evolution, it is necessary to clarify the term in question. But first, let us examine how receptive the theory of evolution is to alternative interpretations regarding mutations.

1. The Possibility of Non-randomness of Mutations

Mutations are not the sole mechanism of evolution. Other well-known mechanisms are, genetic drift, gene flow (migration), non-random mating, and, of course, natural selection (Whitlock, 2014, 305). It is Darwin's great insight that in their struggle for survival, organisms preserve "variations, however slight, and from whatever cause proceeding, if they be any degree profitable to the individuals of a species" (Darwin, 1869, 72). Moreover, even if he didn't know by what processes it occured, he nevertheless concluded that these variations or traits "will generally be inherited by the offspring."

After the birth of genetics and the discovery of DNA, we now understand these processes quite well, hence the "modern synthesis". We've come to know that for evolution to operate, certain alterations must take place in the genetic material of individuals. Evolutionary mechanisms such as natural selection and genetic drift—changes in gene frequencies due to chance events—act only if there is variation in the genetic material, and the existence of these variations ultimately depends on the existence of mutations.[2] Even if a genetic variant is introduced to a population through migration or gene flow, it must have originated as a mutation. In this respect, mutations are essential to evolution. Without mutations evolution simply could not occur. Mutations provide the necessary material for populations to adapt to changing environments, and, over time, lead to the emergence of new species with the filtering act of natural selection. But how do mutations arise?

Mutations can arise due to internal or external factors. The most common internal factors leading to mutations are errors that occur during the process of DNA replication. These errors include the substitution, insertion, or deletion of nucleotides, which are the building blocks of DNA and RNA (Zimmer–Emlen, 2016). Extrinsic factors contributing to mutations typically involve the exposure of cells to radiation, harmful chemicals, or viruses. These factors can directly damage DNA or disrupt the replication process. Mutations can be beneficial, neutral or deleterious (Mayr, 2001, 107). Only beneficial mutations are favored by natural selection. Since neutral mutations have no effect on the phenotype (observable properties or traits of an organism), they are immune to selection. On the other hand, deleterious mutations are eliminated over time by natural selection because of their negative effects on the fitness of the organism. It should be added that mutations must occur in reproductive cells (sperm or egg cells) to have an effect on the genetic makeup of the next generation and thus have evolutionary significance. Mutations in somatic cells (body cells other than sperm and egg cells), which are non-reproductive, typically do not get passed on to offspring.

So, why are mutations considered random or chance events? First of all, DNA replication is a highly accurate process, and mutations are anomalies that occur occasionally as mistakes. Secondly, it is impossible to know or predict which gene will undergo mutation in a specific cell of an individual. Lastly, and most importantly, the occurrence of mutations does not depend on whether they are beneficial or harmful (Ayala, 2007, 77).

[2] I say "ultimately", for although "all new genes are produced by mutation, most of the phenotypic variation in natural populations that is available for selection is the product of recombination" (Mayr, 2001, 108). Recombination refers to the process by which genetic material is exchanged between two similar or identical molecules of DNA. This process can occur during the formation of reproductive cells or during certain stages of the cell cycle. During sexual reproduction, for example, the chromosomes from the mother and father undergo recombination, leading to offspring with a unique combination of genetic material. This process contributes to the variability within a population and is a key factor in evolution through natural selection.

There is a well-known experiment illustrating this final reason (Futuyma – Kirkpatrick, 2017, 95). This experiment, called replica plating, was conducted by Joshua and Esther Lederberg in 1952 using E. coli bacteria. While most E. coli bacteria are vulnerable to a virus named T1, there are occasional mutations that render the bacteria resistant to this virus. The Lederbergs started with a single cell of E. coli that wasn't resistant to the virus and cultivated it into numerous colonies on a petri plate (master plate). They used a disk covered in velvet, gently pressing it onto the master plate to pick up cells from each colony. Then, they pressed the velvet onto several sterilized replica plates, transferring the cells. The clever design ensured that the positions of colonies on the master and replica plates were the same, facilitating the observation of how the resistant trait spread among colonies.

The subsequent phase of the experiment involved subjecting all the plates to a culture of the T1 virus. As anticipated, most of the bacteria were killed by the virus, except those with the resistance mutation. If the resistance mutation had occurred randomly, independent of the presence of the T1 virus, some bacteria should have possessed it before the virus was introduced. In such a scenario, the same colonies would have survived across all replicas since they would all share the resistance mutation. However, if the mutation only occurred after exposure to the virus, it wouldn't have been present before the virus was added. Ultimately, the bacteria developing the mutation should differ in each replica because the mutations would have taken place after the transfer.

The Lederbergs observed that each petri dish appeared quite similar, indicating that the resistance mutation occurred before the transfer and, therefore, before exposure to the virus. This indicated that beneficial mutations occurred randomly, not because they were beneficial.

This experiment, along with another famous one (Luria – Delbrück, 1943) that achieved similar results, was accepted by scientists as proof that mutations are entirely random. However, another study conducted by Cairns et al., thirty six years after the replica plating experiment, told a different story. For Cairns et al. "these classical experiments could not have detected (and certainly did not exclude) the existence of a non-random, possibly product oriented form of mutation" (Cairns et al., 1988, 142). What these experiments prove is that some bacterial mutations occur randomly. To claim that all mutations are random, it would be necessary to give bacteria enough time and see what they would do.

So instead of using a bacteriophage that kills the bacteria instantly, Cairns and his colleagues considered placing the bacteria in an environment that was not conducive to growth. They created an environment where lactose was the only available food source for the E. coli bacteria. However, some cells carried a mutation that allowed them to utilize lactose more efficiently. The researchers hypothesized that if cells could actively select beneficial mutations, the frequency of these mutations would increase in the population over time. The results showed an increase in the frequency of beneficial mutations related to lactose utilization, while rates of other mutations which offered no selective advantage did not exhibit the same increase.

Cairns et al. interpreted these findings as evidence that the bacteria somehow "chose" specific mutations in response to the environmental challenge. The organisms not only appeared to know when they needed to mutate but also which gene to mutate. This experiment led to the proposal of the idea of directed or adaptive mutation, suggesting that cells might have mechanisms to actively choose mutations that confer a selective advantage in specific environments.

"Choose" might be the wrong word, but it seems likely that more than random events are at play here. Other studies have also supported the results achieved by Cairns et al. (Wright, 2000; Rosenberg et al., 2012; Monroe et al., 2022). While these studies do not conclusively settle the discussion, they successfully raise questions about the authority of the orthodox view. The concern with adaptive mutations is that they appear to suggest a form of Lamarckism. Lamarckism, named after the French biologist Jean-Baptiste Lamarck (1744-1829), is now considered a discredited theory proposing that acquired traits during an individual's lifetime can be passed on to the next generation. The association between Lamarckism and the theory of adaptive mutation lies not in their agreement on the process of genetic inheritance but in Lamarckism's acknowledgment of the guiding influence of the environment on adaptation.

Therefore, the adaptive mutation hypothesis is not strictly a form of Lamarckism, but as Paul Davies has noted, it carries a "Lamarckian flavour" (Davies, 2019, 126). Davies concludes from experiments on adaptive mutation that the cell's ability to implement beneficial mutations is not a spontaneous act on behalf of the cell but rather something that emerged during its past evolutionary history. In other words, "nature selects not just the fittest organisms but the fittest survival strategies too". If we adhere to this explanation, we must accept that the cell's "choosing" is nothing more than the application of evolutionarily inherited strategies—the information it uses to cope with the survival challenges of life.

But how do these strategies emerge in the first place? Do they also happen randomly? While Davies doesn't provide an answer, he highlights that cells' ability to actively manipulate their own genome (for example, correcting the errors that occur during DNA replication) may require a reconsideration of the orthodox view.

It seems, then, that the jury is still out on the scientific question, despite the fact that most scientists support the traditional view. Can we make sense of the adaptive mutation hypothesis on other grounds? Theodosius Dobzhansky, the famous evolutionary biologist who helped pave the way for the modern synthesis with his work in genetics, touches upon one way of doing this with the following words:

> The most serious objection is that since mutations occur by "chance" and are undirected, and since selection is a "blind" force, it is difficult to see how mutation and selection can add up to the formation of such complex and beautifully balanced organs as, for example, the human eye. This, say critics of the theory, is like believing that a monkey-pounding a type writer might accidentally type out Dante's Divine Comedy (Dobzhansky, 1950, 40).

The primary contention of this objection, generally voiced by theists, is that the complexity observed in living creatures is highly unlikely to be the result of random processes. Could there be some truth to this? There are certainly some points that need to be taken into account.

First of all, most mutations are not beneficial (Futuyma–Kirkpatrick, 2017, 575; Ayala, 2007, 77). They are either neutral or harmful. Secondly, no matter how beneficial they are to the individual organism, mutations occurring outside germ cells are not evolutionarily significant in the traditional Darwinian view.[3] Thirdly, it will require more than a single mutation for the emergence

[3] The situation differs when it comes to epigenetics, which falls outside the traditional Darwinian view. The essence of the epigenetic theory lies in the idea that substantial environmental changes throughout an individual's life can lead to heritable

of a new bodily structure, let alone a new species. When we add these (and possibly some other) points together, it seems doubtful to attribute the complexity of life to the existence of random mutations.

This approach, which we can call the low probability argument, is frequently employed by proponents of intelligent design, who are most commonly theists.[4] One aspect of the low probability argument revolves around the mathematical improbability of a functional body structure emerging by chance. Consider proteins—the fundamental building blocks of body structures—that play crucial roles in diverse cellular functions and indispensable for the overall regulation of the body. Proteins are composed of amino acids, of which there are 20 different types. Many proteins with various functions can be produced by using these 20 types of amino acids. However, the specific sequence of amino acids in a protein is crucial for its three-dimensional structure, and, consequently, its function.

As an example, let's take a relatively small protein consisting of 100 amino acids. With a simple mathematical calculation, if we consider that the probability of one amino acid being in the right place is 1/20, the probability of 100 amino acids in the correct sequence will be 1/20^100. Given that the number of atoms in the observable universe is around 10^80, we can say that this figure is astronomically low. And this is for just one protein. Life as we know it requires many more proteins—often longer than 100 residues—and other essential molecules to sustain itself. If we take all factors into account, the figure becomes even more staggering.[5] Looking at the numbers alone, it seems implausible to explain the complexity of life solely by chance events like random mutations. So, what are we missing here?

For evolutionary biologists, the missing factor is the power of natural selection combined with the vastness of geological time. They emphasize that the process of natural selection, acting on variations provided by mutations, can gradually lead to the development and refinement of complex structures over long periods. Richard Dawkins, one of the most prominent evolutionary biologists, effectively communicates this idea in his book *Climbing Mount Improbable*. He uses the metaphor of climbing a mountain to illustrate how complex structures in living organisms could evolve gradually over time through a series of small, advantageous steps. Dawkins acknowledges that, if left entirely to chance, the formation of even a short protein or enzyme is almost mathematically impossible: "You don't need to be a mathematician or physicist to calculate that an eye or a hemoglobin molecule would take from here to infinity to self-assemble by sheer higgledy-piggledy luck" (Dawkins, 1996, 77). He emphasizes, however, that Darwinism is not a theory based on random chance. Instead, it is a theory of random mutation combined with non-random cumulative natural selection. Thus, evolutionary theory addresses the low probability problem "by breaking the improbability up into small, manageable parts, smearing out the luck needed, going round the back of Mount Improbable and crawling up the gentle slopes, inch by million-year inch" (Dawkins, 1996, 77).

modifications in that organism, which can be passed down to succeeding generations (Ward, 2018). More specifically, "epigenetics can be defined as the set of modifications to our genetic material that change the ways genes are switched on or off, but which don't alter the genes themselves" (Carey, 2012, 7). It's important to note that the field of epigenetics is still an active area of research, and scientists continue to explore its role in evolution and inheritance.

[4] See for example, Dembski, 2002; Behe, 2007; Taslaman, 2007; Meyer, 2013; Axe, 2016.

[5] Davies calculates that "the odds against producing just the proteins by pure chance are something like 10^40000 to one" (Davies, 2003). Biologist and complex system researcher Stuart A. Kauffman writes: "It would take at least 10 to the 67th times the current lifetime of the universe for the universe to manage to make all possible proteins of length 200 at least once" (Kauffman, 2000, 144).

Focusing on the improbability of the first organic molecule forming by chance is pointless, as Darwinian evolution concerns itself with how life evolved, rather than how it initially emerged. In other words, evolutionary processes take place at the organismic level, involving changes in populations of organisms over generations. Nonetheless, some scientists have sought to bridge chemistry and biology, proposing that evolution is also applicable at the molecular level. For instance, distinguished chemist Addy Pross states that "the central biological paradigm, Darwinism, is just the biological manifestation of a broad physicochemical description of natural forces" (Pross, 2012, xiii). From this perspective, once a replicating molecule—such as DNA, RNA, or even a simple protein, depending on one's preferred theory of life's origin—arose by a chance event, natural selection would gradually shape the remaining elements of life.

However, there is still a long way to go from the first molecule to the first cell and from single-celled organisms to complex life forms. This journey requires numerous beneficial mutations, some of which likely need to arise concurrently. Even if we take into account the power of natural selection and the vastness of time, is it probable to traverse this long road with random mutations? Evolutionary biologist Lynn Margulis (1938-2011) addressed this issue in 2002:

> Although random mutations influenced the course of evolution, their influence was mainly by loss, alteration, and refinement. One mutation confers resistance to malaria but also makes happy blood cells into the deficient oxygen carriers of sickle cell anemics. Another mutation transforms a gorgeous newborn into a cystic fibrosis patient or a victim of early onset diabetes. One mutation causes a flighty red-eyed fruit fly to fail to take wing. Never, however, did that one mutation make a wing, a fruit, a woody stem, or a claw appear. Mutations, in summary, tend to induce sickness, death, or deficiencies. No evidence in the vast literature of heredity change shows unambiguous evidence that random mutation itself, even with geographical isolation of populations, leads to specification.

There is ample evidence that speciation has occurred, ranging from anatomy and molecular biology to biogeography and the fossil record. However, similarly compelling evidence for the complete randomness of mutations is lacking[6]. Since Margulis wrote these lines, there has been a growing chorus of voices expressing dissatisfaction with various aspects of Darwinism, alongside the acceptance that mutations are entirely random. The common point of these objections appears to be the endorsement, in one way or another, of the concept of organism-centered evolution, wherein the organism plays a more active role in the evolutionary process (Walsh, 2015).

One prominent approach advocating for a reevaluation of Darwinism is known as the extended evolutionary synthesis (EES). EES challenges the modern synthesis, which its proponents perceive as limited by gradualism, externalism, and gene centrism. It proposes an expansion or revision of the Darwinian framework to incorporate new mechanisms and factors, such as non-genetic inheritance (for example, epigenetic modifications or cultural transmission), phenotypic plasticity, and niche construction (Pigliucci–Muller, 2010).

Although EES suggests enriching the evolutionary theory to better account for the complexity of biological systems and the diverse ways in which organisms evolve, it does not discard the

[6] Another much more direct way to put it is this: "The power of natural selection is beyond dispute, but this power has limits. Natural selection can preserve innovations, but it cannot create them. And calling the change that creates them random is just another way of admitting our ignorance about it" (Wagner, 2014).

fundamental principles of natural selection and genetic inheritance, including randomness of mutations. On the other hand, the so-called third way of evolution (TWE) does not endorse the concept of mutations occurring entirely randomly. According to James Shapiro, one of the leading representatives of this view, "the capacity of living organisms to alter their own heredity is undeniable. Our current ideas about evolution have to incorporate this basic fact of life" (Shapiro, 2011, 2). He argues that cells possess mechanisms to actively restructure their genomes, coining the term "natural genetic engineering" to describe this modifying capacity (Shapiro, 2011, 43). For him, molecular agents—the operators of natural genetic engineering—are like human engineers when they create new products or enhance existing functions for greater efficiency or responsiveness (Shapiro, 2011, 129). Just as an engineer, when needing to adjust a system, doesn't randomly tinker with its components or start from scratch, cells utilize existing evolutionary innovations as the foundation for creating new genomic architectures.

If it seems like mental traits are being ascribed to cells, you are not mistaken. Shapiro asserts that "living cells and organisms are cognitive (sentient) entities that act and interact purposefully to ensure survival, growth, and proliferation. They possess corresponding sensory, communication, information-processing, and decision-making capabilities" (Shapiro, 2011, 143). This is a direct rejection of the modern synthesis's mechanistic view of organisms.

Physiologist and biologist Denis Noble, another prominent advocate of TWE, also contends that the modern synthesis fails to fully recognize and integrate new scientific findings and developments. He suggests the replacement rather than the extension of neo-Darwinism because "the existence of robust mechanisms of trans-generational inheritance independent of DNA sequences runs strongly counter to the spirit of the Modern Synthesis" (Noble, 2015, 7). According to Noble, the view of living systems as machines stems from the belief that information flows unidirectionally, moving from genes to proteins and subsequently to organismic functions. He calls this idea the Central Dogma, which states that "the genotype maps to the phenotype in a one-way causative fashion", and he further adds, "making us prisoners of our genes" (Noble–Noble, 2023). Yet, the fate of organisms is not up to the whims of genes. The main actor is the organism itself. Self-regulating organisms, much like arranging musical notes in different ways to create compositions, utilize their genetic heritage to produce a variety of potential outcomes. Additionally, when confronted with environmental stress beyond their heritage's capabilities to cope, they can modify their genes, showcasing their ability to change their genetic heritage. It is actually this ability to evolve actively that enables macroevolutionary transformations to occur.

For these scientists, despite the rapid increase in empirical data that clearly reveals incompatibilities with the modern synthesis, mainstream evolutionists maintain their attitude that there has been no change in the basic assumptions (Shapiro–Noble, 2021). The likely reason behind this attitude is the fear that revising -or worse, rejecting- the modern synthesis could open the door to interpretations that seek to explain biological processes by invoking supernatural agents, such as creationism or intelligent design. However, TWE explicitly rejects both creationism (and intelligent design, which can be considered a variant of it) as well as the modern synthesis. This is precisely why they refer to their movement as "the third way":

> The vast majority of people believe that there are only two alternative ways to explain the origins of biological diversity. One way is Creationism that depends upon intervention by a divine Creator. That is clearly unscientific because it brings an arbitrary supernatural force into the evolution process. The commonly accepted alternative is Neo-Darwinism, which is clearly naturalistic science but ignores much contemporary molecular evidence and invokes a set of unsupported assumptions about the accidental nature of hereditary variation.[7]

The TWE appears to aim at reintroducing purposes and goals into the living world without reverting to old methods and outdated concepts. For example, they use the term teleonomy to express the idea that "living systems exhibit/demonstrate an evolved, means–ends purposiveness" (Corning et al., 2023). This differs from the infamous term teleology in that teleonomy denotes an internal purposiveness within living beings, whereas teleology implies an overarching plan at work in the biological world (Okasha, 2023, 237). Evolution is blind in the sense that there are no externally imposed long-term goals or ends for organisms. However, this does not mean that organisms lack goal-directed behavior or short-term goals that they fulfill (Noble–Noble, 2017).

Of course, for TWE, goal-directed behavior is not limited to activities connected with "migration, food-getting, courtship, ontogeny, and all phases of reproduction" (Mayr, 1988, 45). It also encompasses organisms' capacity to alter their genetic material in response to changes in the environment. Accordingly, goal-directed behavior occurs not only at the organismic level but also at the cellular level. Indeed, it is primarily the purposeful actions of cells that are responsible for the emergence of an increasingly complex living world through evolution (Baluška et al., 2023).

These are controversial issues, and a paradigm shift in evolutionary biology is not expected any time soon. While it may not be possible to say that many scientists have embraced the ideas of TWE (Svensson, 2023, 176), those who have are nonetheless engaged in legitimate scientific research, much like mainstream scientists. I am not a scientist, so I cannot be in a position to decide between the traditional view and its alternatives. In this chapter, my sole aim was to demonstrate how the adaptive or directed mutation hypothesis finds acceptance within the scientific community. This acceptance is driven by factors such as the lack of strong evidence supporting complete randomness and the presence of evidence suggesting the possibility of non-random mutations.

From now on, I am going to argue, after some clarifications, that this scientifically supported idea aligns well with panpsychism from a metaphysical point of view.

2. How to Understand Panpsychism?

Panpsychism seems to have gained popularity in recent years. Aside from its relative advantages in addressing the problem of consciousness, one of the key reasons for its appeal is that it allows for discussions of purpose and meaning without invoking a supernatural entity. A supernatural entity like God can undoubtedly provide purpose and meaning to life, but this would come at the cost of needing to justify the existence of such a being. Since the meaning of life -if there is any- is already inherently mysterious, attempting to solve it with another mystery like God is unlikely to be a successful endeavor. Consequently, naturalistic explanations, especially as

[7] The Third Way of Evolution, "Home" (Retrieved November, 16 2023).

naturalism increasingly becomes a default position -at least in academic circles- tend to be more favored.

Panpsychism is not naturalistic due to its assertion that mentality exists ubiquitously throughout the world. For the idea that mentality is everywhere in the universe is not sufficiently clear and can be thought of in both immanent and transcendental terms. For example, the fact that a transcendent God sees, knows, or encloses everything with his/her mind can be thought of as being present or existing everywhere in the universe. What makes panpsychism naturalistic is its view of mentality as intrinsic to matter. The mind doesn't reşide in matter, rather, it is found within matter. In other words, matter in itself, by its very nature, is mental or has qualities that can be characterized as mental.

Here, panpsychists not only assume that matter have an intrinsic nature, but also argue that this nature is mental in character. So, why should matter have an intrinsic nature beyond its structural or relational features which are described by our mathematical models?[8] Because if it weren't so, we would have difficulty explaining the actual existence of matter. As the renowned physicist Stephen Hawking put it: "The usual approach of science of constructing a mathematical model cannot answer the questions of why there should be a universe for the model to describe" (Hawking, 1988, 174). Furthermore, science remains entirely silent on the intrinsic nature of matter. Bertrand Russell (1872-1970) made this observation in his *The Analysis of Matter*: "Physics, in itself, is exceedingly abstract, and reveals only certain mathematical characteristics of the material with which it deals. It does not tell us anything as to the intrinsic character of this material" (Russell, 2023, 9).

The assertion that matter have an intrinsic nature presupposes the distinction between appearance and reality, a concept found in philosophers like Plato, Descartes and Kant. According to Kant, for example, our perception or experience of the world is shaped by our mental faculties, such as space, time, and the categories of understanding. While we can perceive objects through our senses, our perception is filtered through these mental structures. As a result, we perceive objects only as they appear to us. However, Kant believed that beyond our perception of objects lies their true nature, which he referred to as "things-in-themselves." The concept of things-in-themselves represents the idea that there is a reality independent of our perceptions, but that this reality is inaccessible to human knowledge: "...things as objects of our senses existing outside us are given, but we know nothing of what they may be in themselves, knowing only their appearances, i.e., the representations which they cause in us by affecting our senses" (Kant, 1977, 30).

There is a real physical world out there (i.e., subjective idealism is false), but we can never know its true nature using our cognitive apparatus, as that apparatus can only provide us with an image of the world. Nevertheless, Kant sees it as possible that the intrinsic nature of matter is mental in character. When talking about the mind-body problem, he raises this possibility:

[8] In philosophy of science this question raised by the structural realists who argue that our scientific theories do not describe the real nature of physical things -what they are in themselves- but rather their structure, "the relations that are captured in the theory's equations" (Bokulich–Bokulich, 2011: xi). To give an example, for a structural realist, what matters is not the reality of electrons -whether they exist or not- but the reality of relations between electronic phenomena that are described by Maxwell's equations and preserved throughout various physical theories. There are two kinds of structural realism: Epistemological structural realism (ESR) and metaphysical structural realism (MSR) (Ladyman, 1988). While ESR remains agnostic about the intrinsic nature of matter, MSR declares that all that exists is structure and that matter has no other intrinsic nature. ESR is no threat to panpsychism but MSR is. Since it is beyond the scope of this study, I do not intend to provide a detailed criticism of the MSR here, but only include the most serious objection raised against it, especially by panpsychists.

> ...if one considers that two kinds of objects [mind and body] are different not inwardly but only insofar as one of them appears outwardly to the other, hence that what grounds the appearance of matter as thing in itself might perhaps not be so different in kind, then this difficulty vanishes... (Kant, 1998, 456).

Russell makes a similar remark:

> As regards the world in general, both physical and mental, everything that we know of its intrinsic character is derived from the mental side, and almost everything that we know of its causal laws is derived from the physical side. But from the standpoint of philosophy the distinction between physical and mental is superficial and unreal (Russell, 2023, 372).

If matter have an intrinsic nature, there is a real possibility that it is mental in character. This is because the only evidence we have for the intrinsic nature of matter is our own mental states. The fact that our brains can generate these states could be seen as an indication that matter, in general, may have such a capability.

Let us assume, then, that matter have an intrinsic nature that can be characterized in mental terms. This is where the different interpretations of panpsychism come into play. All forms of panpsychism take mentality as fundamental, but they differ on how this mentality should be understood.

A widely held view among panpsychists posits that the mind is one of the fundamental properties of matter, alongside mass, charge, and spin (Skrbina, 2009, xii). In this case, the mind is either a physical property or a mental property.[9] If we think of physical properties as attributes or characteristics of physical objects or systems that can be observed or measured, then mentality cannot be considered a physical property for the simple reason that minds are neither observable nor measurable. However, this does not preclude minds from being physical. They can be physical, just as quantum fields are physical. While we cannot directly observe or measure quantum fields in the same way we can observe and measure macroscopic objects, their effects can be observed indirectly through experimental techniques in particle physics. Similarly, while we cannot directly observe minds, we can observe their effects through our subjective experiences -thoughts, emotions and feelings. Thus, there can be physical minds in the universe without them being physical properties that can be attributed to anything.

The idea that seems more convenient or natural to adopt here is to think of mentality as mental properties of physical entities. Mental properties are typically understood to denote non-physical properties. In the philosophy of mind, the view that mental properties are distinct from physical properties but dependent on the same physical substrate is called property dualism (Mandik, 2010, 37). Electrons have mental properties alongside their physical properties, just as our brains have mental properties alongside their physical properties. Therefore, regarding the mind as a fundamental mental property entails extending property dualism, with all its problems, down to the quantum level. One glaring issue with property dualism is that, while it acknowledges the dependence of mental properties on the physical substrate, it fails to provide a satisfactory explanation of how the mental can autonomously influence the world apart from

[9] Actually, a third option is possible: the mind could belong to a category of properties distinct from both physical and mental properties. However, given our conventional understanding of mental properties as non-physical, it remains unclear how to classify this third type. Moreover, the usefulness of such a classification is dubious, as it introduces additional entities.

the physical. The relationship of dependence from the physical to the mental suggests physicalism rather than dualism.

Another way to think about mentality is to conceive of it as a substance rather than a property. Again, the mind is either a fundamental material substance or a mental substance. The view that considers the mind as a mental substance, like the soul, is known as substance dualism. A panpsychist version of substance dualism would hold that what is found within matter is a soul-like substance. Historically, substance dualism has been predominantly advocated by thinkers with religious sensitivities. Consequently, the entity responsible for placing the soul-like substance into matter was often conceived as God. While we do not know the mechanism by which God might have placed the soul into matter, we do know that once matter and soul were separated as distinct substances, reuniting them -as our experiences suggest- has proven to be quite challenging. Hence, the enduring mind-body problem.

How about the mind as a fundamental material substance? Such a metaphysical view is possible and is advocated in contemporary philosophy, particularly by Galen Strawson. Strawson asserts that "mind is the stuff of reality, the ('categorical') stuff being of reality" (Strawson, 2020, 317-18)[10]. By "stuff" he means "whatever it is that gives the structural-relational features of reality their concrete existence" (Strawson, 2020, 318). If we express physical stuff in the language of modern physics as energy, then, according to Strawson, energy is also equivalent to experientiality, which refers to what we understand as mentality. So, for Strawson "the ultimate, intrinsic, categorical nature of physical stuff is experience, experientiality" (Strawson, 2020, 319). He terms this perspective as "physicalist pure panpsychism". It is "pure" because it does not merely propose that experientiality is one of the fundamental features of reality, but rather that experientiality or mentality is all there is to reality. If I understand Strawson correctly, physicalist pure panpsychism can be seen as a kind of idealism in that it reduces reality to mentality or accepts the ontological priority of the mental. Thus, quite surprisingly, conceiving of the mind as a fundamental material substance leads us to idealism.

The problem with this view is explaining how a fundamental mental reality enables physical existence. There are things in the world for which we have no reason to believe they have experiences or mentality. While we might say that the atoms making up a chair are experiential, we are less inclined to accept that the chair itself is. Yet, chairs exist (very likely) as non-experiential things. The only way to render non-experiential things experiential seems to be by embracing subjective idealism, which posits that everything exists as a perception, image, or thought.[11]

We have seen that when we consider mentality formally, we can think of it both as a property and as a substance. This leads to different types of panpsychism -panpsychist dualism, panpsychist physicalism, and panpsychist idealism- as philosophical standpoints. We should also consider mentality in terms of its content: What is this mentality about? For Strawson and many

[10] Although Strawso's view can be traced back to his well-known articles *Real Materialism and Relistic Monism: Why Physicalism Entails Panpsychism* (2008), it has recently been expressed more forcefully.

[11] Although Strawson tries to distance himself from a Berkeleyan-style subjective idealism in his article, he seems to unintentionally flirt with that view: "...if the universe is space-time, and if space-time is stuff, and if it is experiential stuff, and if it is also, in a fundamental sense, a unity, and if the existence of an experience entails an experiencer, in some fundamental and ineliminable sense, as I believe it does, then -so it seems- we must not only suppose that the universe is itself a subject, but must also (unless considerations about the nature of time show this to be a mistake) suppose that it is experiencing all the disparate and often mutually incompatible thoughts and feelings of all sentient beings" (Strawson, 2020, 334). Given this statement, it would not be unreasonable to argue that everything that exists, not only sentient beings with their thoughts and feelings, but also insentient ones such as chairs, are experiences of the mind of the universal subject.

others, it is about experience. Experiencing an event or moment implies that the encounter or interaction with the object of experience generates a certain inner state or feeling within the subject. To use philosopher Thomas Nagel's famous phrase, if an entity experiences the world, there must be something it is like to be that entity (Nagel, 1974, 436).

The concept of experience is closely related to the concept of consciousness. An entity experiences the world only when it is conscious of that world. Another idea associated with mentality is cognition. Cognition is somewhat an umbrella concept that encompasses mental activities such as perception, reasoning, memory, attention, language, problem-solving, and decision-making—essentially, all the processes that enable individuals to perceive, understand, and interact with their surroundings. Sentience is another related concept, usually understood as the ability of an organism to sense and respond to stimuli from the external environment. It is sometimes associated with consciousness and subjective experience, referring specifically to the capacity to experience sensations or feelings. Lastly, mentality can be linked with the concept of intentionality. Mental states always seem to be about or directed towards something, and this aboutness or directedness is expressed by the concept of intentionality. Intentionality is loosely connected to the word "intention," as intentions are just one type of intentional state.

Therefore, when a panpsychist claims that mentality is inherently present in matter, they may mean that material entities such as particles and atoms, experience, are conscious, possess cognitive capacities, are sentient, or have intentionality.

3. Panpsychism and Evolution

Evolution is a natural phenomenon. This means that if we want to relate any metaphysical theory to evolution, it is important for that theory to be situated within a naturalistic framework to ensure the plausibility of the relationship. Certainly, ideas that we currently consider inexplicable by natural means can be naturalized over time as possible gaps in our knowledge or understanding are filled. The world could indeed turn out to be comprised of two distinct realms—physical and mental (dualism)—or it could be entirely a product of the mind (idealism). However, based on our current knowledge and common sense, the world appears to be entirely a physical place governed by physical laws.

As we have seen, panpsychists do not view the mind as something outside or beyond matter. All forms of panpsychism operate from the same basic assumption: the idea that the mind is intrinsic to matter. However, they reach different conclusions in their efforts to establish the connection between mind and matter. Even when we say "the connection between mind and matter", we are using a dualistic language, yet dualism -being the view that creates the mind-body problem in the first place- has not been successful in comprehending the nature of things. Therefore, a monistic version of panpsychism might offer a more promising approach.

Strawson's physicalist pure panpsychism is one of those monistic approaches, but since it reduces reality entirely to mentality, it leans toward the idealist side of monism, thereby straying from naturalism. It seems that what we require is a metaphysical view that neither reduces the physical to the mental nor the mental to the physical, while also avoiding dualism. Is there such a nuanced view?

There is such a view, found in thinkers like Arthur Schopenhauer (1788-1860), Gustav Fechner (1801-1887) and William James (1842-1910). We may call this "dual-aspect panpsychism". This view draws its theoretical basis from dual-aspect monism, which can be traced back to Baruch

Spinoza (1632-1677). According to Spinoza, thought and extension are two attributes of the same substance (Nature/God). In other words, "the order and connection of ideas is the same as the order and connection of things" (Spinoza, 2002, 247). This implies that for every physical entity, there is an associated mental aspect, and vice versa. Just as the mind is an idea for the body, the body is an object for the mind: "The object of the idea constituting the human mind is the body" (Spinoza, 2002, 251).

Spinoza also speaks about the inner nature of things and introduces a metaphysical principle: "Each thing, insofar as it is in itself, endeavors to persist in its own being." He calls this tendency toward self-preservation "conatus". According to Spinoza, the conatus, or the drive of each thing to preserve its existence, is nothing other than the actual essence of the thing itself (Spinoza, 2002, 283).

Schopenhauer, drawing inspiration from Spinoza, posits another metaphysical principle to describe Kant's thing-in-itself: "...this thing in itself, this substratum of all phenomena, and therefore of the whole of nature, is nothing but what we know directly and intimately and find within ourselves as the will" (Kant, 1889, 216). For him, will is the noumenon of things -what is behind the representations- and it is this will that gives them the power to exist and act (Schopenhauer, 1889, 217). Schopenhauer is quite clear that all entities, organic or inorganic, by virtue of their existence, have this will[12], and the body as will is not separate from the body as representation —hence dual-aspect panpsychism of Arthur Schopenhauer (1969, 100):

> The act of will and the action of the body are not two different states objectively known, connected by the bond of causality; they do not stand in the relation of cause and effect, but are one and the same thing, though given in two entirely different ways, first quite directly, and then in perception for the understanding. The action of the body is nothing but the act of will objectified, i.e., translated into perception.

Gustav Fechner (1801-1887) is also in agreement with Schopenhauer when he says: "What will appear to you as your mind from the internal standpoint, where you yourself are this mind, will, on the other hand, appear from the outside point of view as the material basis of this mind" (Schopenhauer, 1860, as cited in Clarke, 2004, 70). According to Fechner, what we call the mind is the inwardly experienced side of things, whereas matter is the outwardly observed side. Reality is perceived as physical from an external perspective and as mental from an internal one. Fechner's view is panpsychist because he expands this psychophysical conception of reality beyond living organisms to include the non-living world (Heidelberger, 2004, 173).

James, who admitted late in his career that he came to a "general view of the world almost identical to Fechner's" (James, 1920, 309-10), put forward ideas that openly reveal his affinity to panpsychism in his writings (Lamberth, 1997). James's view was a dual-aspect kind of panpsychism because he believed that mind and matter are two aspects of the same fundamental stuff:

[12] "...accordingly, not only the voluntary actions of animals, but the organic mechanism, nay even the shape and quality of their living body, the vegetation of plants and finally, even in inorganic Nature, crystallization, and in general every primary force which manifests itself in physical and chemical phenomena, not excepting Gravity, —that all this, I say, in itself, i.e. independently of phenomena (which only means independently of our brain and its representations), is absolutely identical with the will we find within us and know as intimately as we can know anything" (Schopenhauer, 1889, 217).

> There is no thought-stuff different from thing-stuff, I said; but the same identical piece of 'pure experience' (which was the name I gave to the materia prima of everything) can stand alternately for a 'fact of consciousness' or for a physical reality, according as it is taken in one context or in another (James, 1922, 137-138).

Reality is experiential through and through. For James, we should reach the same conclusion when we approach from an evolutionary perspective: "If evolution is to work smoothly, consciousness in some shape must have been present at the very origin of things" (James, 1981, 152). If physicality is there at the beginning so should mentality. Since the process of evolution does not create physical bodies from scratch, it should not create mentality from scratch either. Physical complexity should develop mutually with mental complexity.

Although the orthodox view holds that evolution had no purpose in creating increasingly complex minds, what we observe in natural history is the emergence of complex minds in tandem with the increasing complexity of brains. Viewed this way, dual-aspect panpsychism integrates well with an evolutionary framework. The notion that both physical and mental aspects evolve together aligns with the observed emergence of sophisticated minds as brains become more intricate. Moreover, the idea that the mind has existed in some form since the beginning of biological history seems more comprehensible than the notion that it emerged at a specific point. If the evolutionary process introduced mentality at a certain moment, we face a challenging question: What made that moment special? Exactly what advantage did mentality confer on organic matter in terms of survival and reproductive success, such that it was favored by natural selection? In other words, what specific tasks were biological organisms unable to perform before the emergence of mentality, but became capable of doing with its development, thus enhancing their survival and reproductive success? It is difficult to say.

Besides that, the idea that a phenomenon like the mind could be created from scratch with a certain configuration of matter seems implausible. No matter how you arrange matter (no pun intended), shouldn't you eventually just get more matter? This is to be expected, because awareness, sensations, thoughts, emotions, and feelings are nothing like atoms, molecules, minerals, soil, and stone. Unless we assume that matter have mind-like qualities in itself, it seems to remain a complete mystery how the former can emerge from the composition or interaction of the latter.

Of course, when we make this assumption, we will encounter further problems, such as explaining how smaller mental units (like the mind of atoms) can give rise to larger mental units (such as the mind of molecules). However, these problems don't pose the same kind of tough conceptual difficulties that the materialist perspective encounters. While panpsychism can answer the question of why mentality with its various lower and higher powers exists in the world at all, the materialist view, which completely divorces matter from mental characteristics, has no better answer than claiming "it is a brute fact." This is the real difference between the two camps.

Although materialism and panpsychism are opposing metaphysical views, a physicalist version of dual-aspect panpsychism is possible. Indeed, it may even be the most viable option. The term "materialism" is often used interchangeably with "physicalism". However, given the historical usage of the term materialism in philosophy,[13] it may be useful to make a distinction between it

[13] For instance, George Berkeley (1685-1753) defines "matter" as "an inert, senseless substance, in which extension, figure, and motion do actually subsist" (Berkeley, 1878, 198). Accordingly, materialism was not confined to the thesis that "everything is material"; it also involved a judgment about the nature of matter.

and physicalism, as the two do not carry identical connotations. Physicalism asserts that everything is physical, while materialism goes further, claiming that the physical is inherently devoid of mentality. By making this distinction, physicalistic dual-aspect panpsychism appears as a coherent metaphysical position. If the fundamental stuff of reality is physical, then mentality exists as the other aspect of this stuff. Thus, mentality is not a property but is just as substantive as the physical. Since there is only one substance, there can't be a causal interaction between the mental and physical, as they are two aspects of the same underlying reality.

If this is the case, how can the occurrence of non-random mutations, and hence adaptive evolution, be understood within physicalistic dual-aspect panpsychism? How do we explain the seemingly purposeful actions of cells and organisms, such as modifying or manipulating DNA sequences, without invoking the concept of mental causation?

On a conceptual level, the behaviors of cells and other lesser organisms are not fundamentally different from those of higher animals, including humans. We are purposeful beings, but there is no evidence that our purposeful actions are created by the top-down influence of our mind on our bodies. On the contrary, scientific evidence has been presented to demonstrate that such an effect does not exist (Libet, 1993; Haynes, 2011). It seems that it is the brain that makes the decisions and carries out the actions. This is not a surprising fact for physicalistic dual-aspect panpsychism because, in this view, purposeful actions can be explained with reference to the mental aspect of the physical system, i.e., the brain, without denying its deterministic role.

Certainly, having a brain is not a prerequisite for possessing a mental aspect. In panpsychism, mentality isn't exclusive to entities with brains or central nervous systems. Microorganisms like bacteria, cells, protein molecules, and even atoms and subatomic particles can perform actions that are meaningful and exhibit a sense of purpose. The purposeful behavior of a developed animal is not of the same complexity as that of simpler beings, but the difference is one of degree, not of kind.

So, if we consider mentality in terms of its content, which one among them can be seen as the common mental denominator shared by all spontaneously interacting entities?[14] The least demanding, most inclusive candidate seems to be intentionality. As mentioned earlier, intentionality refers to the idea that mental states are always about or directed towards something. According to Franz Brentano, who introduced the term into contemporary philosophical discourse, intentionality is the "mark of the mental". In a famous paragraph, he explains the term as follows:

> Every mental phenomenon is characterized by what the Scholastics of the Middle Ages called the intentional (or mental) inexistence of an object, and what we might call, though not wholly unambiguously, reference to a content, direction toward an object (which is not to be understood here as meaning a thing), or immanent objectivity. Every mental phenomenon includes something as object within itself, although they do not all do so in the same way. In presentation something is presented, in judgement something is affirmed or denied, in love loved, in hate hated, in desire desired and so on (Brentano, 1995, 68).

[14] Here, I'm using the expression "spontaneously interacting entities" to simply distinguish objects that seemingly do not have mentality, such as a table or a rock, from those that do. According to dual-aspect panpsychism, a table does not have mentality because its only physical activity is nothing other than the individual and collective activities of the atoms that constitute it.

The term "intentional inexistence" might be misleading, as it does not imply the possible or actual non-existence of objects of thought. Instead, it simply denotes what is later stated in the paragraph: "Every mental phenomenon includes something as an object within itself." As Tim Crane puts it, intentional inexistence literally means "existence in the mental act itself" (Crane, 2006, 26). The object of thought or perception resides within the mental act itself, not necessarily in the external world. In Brentano the divide between the mental and physical is preserved: "This intentional inexistence is characteristic exclusively of mental phenomena. No physical phenomenon exhibits anything like it" (Brentano, 1995, 68). In dual-aspect panpsychism, however, there is no such divide. Thus, physical phenomena can exhibit intentionality due to their inner mental aspect. The actions of physical phenomena are always directed towards something —whether objects with extension, like bodies, or objects without extension, like thoughts and purposes.

For example, while the intentional action of a cell may be about the DNA material (a macromolecule, which is an extended object), it may also be about the ensuring of survival and proliferation (a purpose, which is a non-extended object). The concept of intentionality allows us to consider the purposeful behavior of entities without necessarily attributing complex cognitive capacities, such as thinking, deciding or choosing, to them. These capacities are present to varying degrees in humans and other animals, but are likely absent in simpler organisms and cells. However, fundamentally, they all exhibit intentionality in the same way.

Even atoms, though their actions cannot be about survival and proliferation like cells, may be directed towards other atoms and the idea of being part of a larger whole —that is, to create. In the context of evolutionary theory, the occurrence of mutations should not be viewed as teleological events dependent on the will or volition of cells or organisms, nor should they be seen as entirely undirected processes. Actions can be directed without conscious will or deliberate planning; in other words, they can be teleonomical. Adaptive evolution takes place not because organisms decide and will it into being, but because they are mentally concerned - albeit unconsciously on the organismic level- with changing conditions.

When information about the outside world is shared with the body's cells and molecules, the body may act on this information, and sometimes this action results in adaptation. This is a wholly natural process, but it is important to recognize that the driving factor here is the tendency toward self-preservation (Spinoza's conatus) or the power to exist and act (Schopenhauer's will). These tendencies stem from the mental aspect or intrinsic nature of beings. As long as we try to understand the physical through a materialist lens, there seems to be no explanation for the unconscious desire of beings to persist or their propensity to act and create. Dual-aspect panpsychism suggests discarding that lens while leaving everything else unchanged.

Conclusion

A panpsychist interpretation of evolutionary theory necessitates an interpretation of both evolution and panpsychism. The interpretation of evolution hinges on the contingency of the randomness of mutations. Scientific data on the subject seem to support both conclusions: that mutations are entirely random and that they are at least partially non-random. If mutations are not entirely random, meaning that directed mutations are a reality, it can be argued that some adaptations, which externally appear purposeful, may indeed be so. This leads to a philosophical issue regarding how to understand the purposefulness in question. Panpsychism can be

considered a candidate for explaining purposefulness in nature. There is nothing supernatural about panpsychism, as its sole hypothesis is that matter have an intrinsic mental character that science has yet to access. However, to provide a fully naturalistic account of panpsychism, we must think of it in physicalistic terms. This is where the need for an interpretation of panpsychism arises, as neither dualistic nor idealistic versions of panpsychism fully align with naturalism.

Dual-aspect panpsychism is a type of monism that views the physical and mental as two facets of the same substance. This means there is no causation between the mental and the physical. Material entities act by themselves and interact with other material entities due to their mental aspect, but what we observe is their physical aspect. The actions of entities are intentional; they are always directed toward something. When they act on their own, it may be about a desire or a purpose; when they interact with others (objects or individuals), it may be about the other's body or presence. The intentional actions of cells and molecules make adaptive evolution possible. Adaptive evolution is purposeful not in the sense that adaptation is an end goal for the organism that it consciously calculate to achieve, but in the sense that it is a directed response to changing conditions, signaling to the organism that something needs to be done.

In conclusion, panpsychism in its various forms align well with the idea of gradualism central to evolutionary theory. Just as the physical evolution of living organisms unfolds gradually over geological time, their mental development follows a similar gradual process. What distinguishes dual-aspect panpsychism is its compatibility with physicalism, enabling it to incorporate purposeful behavior within a naturalistic framework —without invoking separate mental powers or forces.

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