

Consciousness is a biological mechanism that evolved

Simon Robledo-Cardona*

Master student of Neurosciences, University of Groningen, The Netherlands

Introduction

Consciousness is one of the last surviving mysteries, along with the end of the universe, dark matter, and quantum gravity. A mystery is a phenomenon that people do not know how to think about [1]. The correct way in which to think about consciousness is hardly debated among philosophers and scientists. A consensus is far from being found, but important insights have been laid, like anchors that keep the thinkers from going stray when they sail in the familiar yet obscure winds of consciousness. Two main anchors guide philosophers' and scientists' thoughts. These were constructed across centuries but had two crucial modern representatives: David Chalmers and Daniel Dennett.

Chalmers argues that there are easy problems of consciousness and one complex problem. The easy problems include how humans can discriminate sensory stimuli and react to them, how does the brain integrate information, how subjects can read and verbalize, etc. [2]. This type of question is related to the mechanisms of the cognitive system, but Chalmers argues that the answers to the easy problems are futile in order to understand the complicated problem: the problem of experience, of "what is like," often referred to as "qualia," or the representation of experiences. This position is best described by property dualism, which holds that the properties of consciousness are fundamental, alongside the fundamental properties identified by physics.

On the other hand, Dennett argues that there is no such thing as a complex problem like Chalmers conceives. That qualia do not exist, and they are a mere illusion of humans. We are prone to think, Dennett states, that there are qualia, that there is both a medium and a content of our experiences, the same way the pixels in television are the medium of a movie and the content is the story the movie tells. Dennett points out that citing correspondence with Richard Powers [3] is only content in reality. Vision is not television. We only experience the vision, and there are not double transductions: there is no tiny human, or homunculus, intertwined within the web of neurons that watches the movie of our life.

Dennett then reformulates the tricky question of consciousness: "When some content reaches consciousness, then what happens?" [3]. This question seems only to be problematic by its current accessibility. Technological advancements are not yet capable of answering how consciousness arises and develops. On the other hand, the complicated problem of consciousness stated by Chalmers seems to be inaccessible and fundamental, to a degree in which is compared to fundamental concepts of physics, like electromagnetism [2]. In a sense, Chalmers' approach returns to Descartes's dualism of body and soul, the mind-body problem. Consciousness becomes then something mysterious, fundamentally dark, and separate from the body, from matter.

I am a biologist, a scientist undergoing a research master's program in neuroscience. For this reason, I believe the anchor that I

choose when thinking about consciousness is the one laid by Dennett. In an interview published in 2020 by the Closer to Truth library, he summarizes his view: "Consciousness is not a mysterious property or phenomenon that sunders the universe in twain. It is a complicated variety of different things". If I may add, consciousness is a complicated variety of biological things. Continuing with the interview: "... and the model that we use, which is our consciousness... when we apply that to other creatures, and robots and the like, we get in much trouble because some of the features of our consciousness are just not the features of the consciousness of other creatures".

Thesis

Let us give Dennett's anchor a more precise name: biological materialism. Biological materialism is a type of monism or a commitment to an underlying unity in nature. This view is committed to the idea that mental phenomena and subjective experiences manifest from basic activities described by biology, chemistry, and physics [4]. Anchored by Dennett, by Godfrey-Smith (author of *Other Minds*), and by their intellectual predecessors, Darwin, Huxley, and Aristotle, I construct this essay in an evolutionary, materialistic framework. I argue that consciousness is a biological phenomenon that arose through an evolutionary process, with natural selection pressure. To sustain this thesis, A. it is first necessary to fit consciousness in a biological materialism perspective, and B. argues that consciousness is a trait that evolved. This essay is divided into two former points. The biggest counterarguments of my thesis are: first, for part A., that consciousness and body are separate entities, the former being a fundamental property of the universe as argued by Chalmers; second, for part B., the tasks assigned to consciousness can be performed without assigning a conscious state to the animal.

Approach

From a biological materialism perspective, you are conscious of something it feels to be like you [4] Since this "something" is biological, then to study it, is helpful to apply the four questions raised by Niko Tinbergen more than 50 years ago in his classic paper "On aims and methods of ethology" [5,6]:

- How does the trait work (causation)?
- How did it develop (ontogeny)?
- How did it evolve (evolution)?
- What purpose does the trait serve (survival value)?

*Correspondence to: Simon Robledo-Cardona, Master student of Neurosciences, University of Groningen, The Netherlands, E-mail: ncardona@ces.edu.co

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The four questions correspond to the four major problems in biology. I argue that consciousness, being a biological phenomenon, has the same major problems as well. One can further divide these four questions into two groups that correspond to the essay's two main sections (A. and B). The first group contains the first and the second question, which both study consciousness at the individual level [6]. How does consciousness work (1.) and how does it develop (2.) address Dennett's complex problem "When some content reaches consciousness, then what happens?" [3]. A problem hampered by the unresolved mind-body problem, which dates back to Buda and Plato: are body and mind one thing or two separate entities? The first part of this essay (A.) deals with the philosophical debate involving the mind-body problem to fit consciousness into a biological materialism view. How consciousness works and how it develops is not clear yet, and the particular advances on the mechanistic explanation of consciousness are beyond the scope of this text. For our purposes, it is enough to justify that consciousness could be explained with biology.

The second part of the essay (B.) addresses the argument that consciousness is a trait that evolved. It relates to the third and the fourth question, the purpose of consciousness and how it arose in the evolutionary tree. This section will be debated whether consciousness has a purpose (and thus was selected for). How the definition of consciousness could be biased and thus expanded to successfully include other animals far away in the evolutionary tree branches: consciousness equals "is something it feels like" [4]. The examples of an antelope (not considered particularly intelligent) and an octopus (considered very intelligent) will be analysed to suggest that "it feels like something" to be them and that this trait for selected.

A. Fitting consciousness in a biological materialistic framework

How consciousness works and how it develops (Tinbergen's first and second questions as listed here) are questions regarding consciousness mechanisms [6], laying in the heart of the debate between Chalmers vs. Dennett. Does consciousness arise from elements that can be explained with biology, chemistry, and physics in support of a monist view (Dennett's side)? or is it a fundamental property of the universe, supporting a dualist view (Chalmers' side)? I have stated my position in this essay's introduction that I lean towards Dennett's arguments. I will further develop my position with an example.

During an expedition in 1857, a mud sample from the Atlantic seafloor was taken. Years later, in 1868, this sample was analysed by the British biologist Thomas Huxley, an essential scientific persona known as "Darwin's Bulldog" for his advocacy of Darwin's theory of evolution. Only some protozoan cells were found, but when Huxley put the sample in a jar of alcohol to preserve it, he noticed a slime-like substance appearing to have veins. He thought to have found a new organic substance that lay in the intersection of life and inorganic matter. Huxley named this substance *Bathybius haeckelii* in honour of his colleague, the German biologist Ernst Haeckel, who had previously proposed the existence of a universal protoplasm from which all life originated. With the discovery of *Bathybius*, Haeckel's theory was confirmed, and the missing link between life and the inorganic matter was found.

It was not until 1872, when the Challenger expedition began, that the proposed universality of *Bathybius* was, ironically, challenged. The expedition took hundreds of samples from the seabed, but there were no signs of the protoplasm-like substance. A young chemist on the

expedition named Jhon Buchanan analysed one sample that resembled a *Bathybius*, and found that this slimy substance was not more than a seawater's chemical reaction preservative alcohol. Huxley immediately corrected his mistake, but Haeckel only did so several years later. The duality of life and the inorganic matter was overturned. There is no such thing as a fundamental substance that gives rise to life. A specific organization of lifeless matter forms life. Monism, materialism, had triumphed.

The *Bathybius* example is practical when addressing consciousness because we can think of conscious experience as an unresolved monistic problem. Chalmers would then be the equivalent of Haeckel. The proponent of something fundamental, separate from matter; a slimy mysterious substance that gives rise to conscious experience, qualia. On the other hand, Dennett would become Buchanan, the chemist. However, he does not have access to the equivalent of a simple chemical reaction that would solve the mind-body problem. The technology is not there. Dennett only possesses his intellect and access to the latest scientific research, enough so far to make robust arguments for the monistic nature of consciousness.

An argument against materialism, in general, is that not everything can be explained and reduced to the laws of physics, which materialism in a traditional philosophical sense claims [7]. It is then crucial to part from pure physical materialism if the intention is to frame consciousness in biological materialism perspective. Before, I have defined biological materialism as the idea that everything can be explained from biology, chemistry, and physics. However, not everything in biology can be explained by chemistry or physics. A complex whole, a biological mechanism, consists of parts plus an organization that makes the sum of such parts more than their simple aggregate [8]. Biology aims to explain such organization, which can lay in different levels that physics cannot reach. The mere constituents of a man, or a plant, or an octopus are not the same as men, plants, or octopuses.

Let us borrow the cruel but practical example used by Jaworski in his 2016 paper "Why materialism is false, and why it has nothing to do with the mind." Let us put a man inside a strong bag; then the bag is squashed with hundreds of tons of force. Before the squashing, Jaworski argues, the bag contained a man, now it has none. However, since it is a muscular bag and nothing leaked, the physical constituents that composed the unfortunate man that gave his life for philosophy are all the same. What changed than is the organization of these components. This organization is explained by biology, not physics. For a traditional materialist, a man is a physical object [9], but for a biological materialist, a man is a sum of physical objects that is more than an aggregate of parts since these parts are organized. The same would apply to consciousness: a biological mechanism that consists of both parts (neurons) and organization (wiring).

A dualist could argue that this "organization" is entirely distinct from the body, and thus, something fundamental in nature, as electromagnetism might be. However, the organization of consciousness is part of consciousness itself. Physical parts (neurons) and their organization (wiring) form a unique entity, a unique biological mechanism that, by definition, can be explained with biology. Chalmers argues that no matter how respectful biology advances, consciousness is a challenging problem that would be unreachable through a mechanistic explanation. However, within a biological materialistic framework, what Chalmers refers to as the hard problem of consciousness can be explained by knowing its components and their organization, no matter how hard that task may be.

Chalmers is right when he states that the current biological explanations fail to address consciousness in its entirety, so the advances regarding Tinbergen's first two questions, how consciousness works and how it develops, are not discussed here. For our purposes, it is enough to argue that these questions can be answered from a biological materialism point of view, that parting from the traditional materialistic view, considers consciousness as a biological mechanism consisting of materials and organization. This whole is then explainable, the same as the functioning of a cell, with biology.

B. Consciousness is a trait that evolved

The manifestations of consciousness are genuinely scarce. When the universe is observed as a whole, the material that indisputably has consciousness, human beings, constitute a fleeting fraction. Is it a coincidence that the only irrefutable proof of consciousness lies within the biological entities that we are? The same as consciousness, life is scarce in the universe, at least in our current knowledge. The fact that both life and consciousness coincide within the same beings I regard as proof of consciousness's biological nature. If consciousness is a biological phenomenon, the famous title of the essay by Theodosius Dobzhansky, "Nothing in biology makes sense except in the light of evolution," argues for its evolutionary condition. However, to study the evolution of consciousness, it is essential to acknowledge that behaviour, and not the inner life of animals, affects the animal's fitness (the ability of an individual to pass its genes successfully to the next generation). Behaviour is the external property that is selected by natural selection. Thus, consciousness is relevant to evolution only if it modulates behaviour, serving a function with adaptive value [10].

For consciousness to have a function and thus evolve, it must serve a goal or be the goal itself. Like a beak, that is a tool that serves the stork to catch a fish, or as the goal itself, to catch the fish [6]. Several functions of consciousness as a tool have been proposed, including enabling flexible cognitive behaviours [10]. Nevertheless, a problem that arises with this notion is that flexible cognitive behaviours could, in theory, be achieved without possessing an inner life. A stork could catch a fish, flee from a crocodile, and then provide the fish to its chicks without the need to be conscious, like an automaton. However, if an unconscious process causes the behaviour, how can feel like fear cause behaviour [11]? A solution to this problem is to unify feeling and consciousness; that is, a feeling is a conscious experience. In this case, feelings (and consciousness) become the goal itself, something that enhances the individual's fitness [6]. Consciousness would be the act of catching a fish, and neurons are the beak that supports this goal.

Gutfreund raises a problem that remains in his 2018 paper: an antelope that escapes from a lion needs to run away quickly and efficiently, but why, from an evolutionary perspective, does the antelope have to experience the terrible feeling of fear? It is a puzzle, Gutfreund states, that evolutionary theory has no answers. I am afraid I have to disagree with Gutfreund. A solution that I find for this problem arises when examining an extended time in an antelope's life instead of a single escape attempt. The fear instilled in the brain serves as a helpful trigger that increases the animal's alertness and the number of times it escapes successfully. Fear would then be an efficient alarm deep ingrained within the brain that sounds every time something indicates a threat. I rephrase the question posed by Gutfreund, if fear is an efficient way of keeping the animal alive, why shouldn't it have evolved? Evolution selects for things that work, and fear seems to work for us as well as for antelopes. Several studies have found that fear neural circuits are conserved in mammals, including humans [12]. If we experience fear and the antelopes have the same neural circuits associated with fear,

then why shouldn't antelopes experience fear?

Despite some evidence of conserved circuits regarding fear, it is possible to argue that different tools, not necessarily related to consciousness, can get the consciousness job done, the same as both a beak and a tooth can dig into flesh. Thus, fitting consciousness into an evolutionary perspective involves the difficult task of studying other close or distant animal relatives and assessing whether the jobs that they perform have something to do with a conscious experience. The beak and the tooth, the brain of an insect, and the brain of a human. How does one study a beak's properties by just looking at a tooth, only knowing that this mysterious beak also digs into flesh? As Dennett mentions in his interview, the model that we use to study consciousness is our human consciousness, and the features of our consciousness are not necessarily those the consciousness of other creatures have. Therefore, when we try to apply human consciousness features to other creatures, we run into much trouble.

A good example that depicts this problem is that of octopuses. Octopuses and cephalopods in general (the group of animals that also contains cuttlefish and squid) have the largest nervous systems of all invertebrates. The behaviour of octopuses, in particular, is very sophisticated, to the point that regulators in the European Union have granted them an honorary "vertebrate seat" that provides them with further protection as research subjects. Several scuba divers have had the impression that octopuses stare back in curiosity [4]. Another more active account of octopus's intelligence is brought by Gutfreund, recalling when he was a Ph.D. student working in a lab dedicated to studying octopus' biology [13]. He remembers how tanks had to be sealed off with special care to prevent octopuses from escaping. The sealing mechanism they employed had sticks for opening the tank lid that could only be pulled from the outside. However, to their surprise, one day, they found an octopus roaming the lab floor.

The only way this octopus could have escaped is by sticking one or several arms through a tiny gap into the outside of the tank, encountering the sealing stick, and then pulling it. Some may argue, must surely be evidence that this octopus must have thought about the problem and found a solution to achieve freedom. That octopuses have a sophisticated, conscious mind which allows them to perform complex cognitive tasks. Gutfreund, on the other hand, argues for the opposite. He clarifies that each octopus arm has its brain and that when an arm encounters a novel object, a reflex kick in which the arm then grabs the object and pulls in every direction. He proceeds to argue that the escape attempt might have been a consequence of pure chance. The octopus' arms, constantly (and automatically) scanning the environment, eventually encountered a tiny gap through which they could slide, then they found the stick, which pulled in every direction until they removed the seal successfully. In this case, there is no need for a mind, for a centralized consciousness as we know it, to pull the escape feat. Any attempt to assign consciousness to an octopus, Gutfreund argues, is a sign of anthropomorphism, or the tendency to attribute human features to animals, a sign of subjective human psychology.

A solution to this problem lies in the very definition of consciousness. Since the model of consciousness is based on our own experience, I agree with Gutfreund that we expect and search evidence for the type of centralized biological mechanism we are familiar. The term consciousness can be misleading since it often suggests something quite sophisticated [4]. However, if we opt for a laxer definition, it is possible to bypass the bias that comes from our expectations. The new definition is best summarized by the phrase "something it is like," which includes any experience. There is something that feels like being

an octopus, even if this feeling has no connection to the escape feats these animals' arms are capable of. There is something it feels like to be an antelope escaping from a lion, or to be a human also escaping from a lion (have you escaped from a lion before? That would be a frightening conscious experience). If this feeling is a tool or a goal that externalizes in behaviour over time, consciousness is a biological mechanism composed of parts and organization that has evolved during millions of years.

Conclusion

In the first part of this essay, I argued that consciousness is a mechanism that fits in a biological materialistic framework because it is composed of parts (neurons) and their organization (wiring). This view parts from the traditional materialistic framework that everything can be reduced to physics because physics can only account for the materials of consciousness but not its organization. Thus, consciousness can be explained through biology, which includes the organizational levels. In the second part, I argued that given this monist framework of consciousness, it is a trait that evolved and was selected. It is necessary to have a function to evolve, and several functions of consciousness have been proposed. An important counterargument to this notion is that the functions of consciousness could be performed by an automaton, meaning that consciousness does not influence behaviour. Feelings, however, influence behaviour and can be defined as a type of conscious experience that is evolutionarily relevant. Fear, for instance, is helping to improve the rate of successful escape attempts from predators. A problem that remains is that human attributes are often assigned to other animals' consciousness, and an animal performing a complex task is taken as evidence for a centralized human-like consciousness. This problem is bypassed by removing the human bias from the definition of consciousness, reducing it to "is something it feels like to be." If the arguments listed here hold, consciousness is a biological mechanism that evolved, not only in humans but in many other animals, taking

multiple forms, a notion that erodes the forever-lasting perception of human uniqueness. Generating the same kind of erosion that Darwin unleashed when he proved that humans do not come from Adam and Eve, our consciousness is one example of the extent conscious experiences animals possess.

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