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THE PHYSICALITY OF QUALITIES AND CONSCIOUSNESS: CONCEPTS WITHIN THE THEORY OF CONSCIOUSNESS

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ABSTRACT

The recent transplantation of specific genes into experimental animals has enabled the animals to have consciousness of qualities they previously lacked. The genes code for proteins are referred to as "consciousness molecules" and "qualitative proteins." These are regarded as having the ontologies of qualities. Thus, the qualities are considered to be physical entities, as well as the central elements of consciousness, which are integrated into the cognitive structures of the brain. The constitution of consciousness by a physical entity is elucidated.

INTRODUCTION

Attempts to explain consciousness and the concepts surrounding it have historically been fraught with unscientific theories and efforts to naturalize the concepts are felt even today as counterintuitive. Yet, empirical research has finally begun to provide evidence which penetrates through the obfuscating layer of egocentric and anthropomorphic impressions which enclose the entire area of knowledge. In previous writings (Brooks, 2006-2007, pp. 127, 133; 2009-2010, p. 172) I have postulated that certain proteins constitute the central elements of consciousness. The present article adds a pivotal step to my own theory as well as to the many other theories of consciousness. I believe the step is indispensible to a valid understanding of consciousness. It is now well supported by relatively

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recent experiments involving genetic engineering, which research I recognize as having inadvertently provided empirical evidence that overall consciousness is physical. The research strongly supports the concept that physical elements (neurons, molecules, particularly proteins), are responsible for consciousness as was originally postulated in Brooks (2006-2007, pp. 132-136; 2009-2010) and was called the Ontology Theory in Brooks (2011-2012).

PRESUPPOSITIONS AND DEFINITIONS

There is almost complete agreement among theorists of consciousness that consciousness is diffusely located within the nervous system. I consider such elements to be widespread discrete core components of consciousness. For the putative core elements, I shall be using the terms "physical elements," "consciousness molecules," and "qualitative proteins," or the simpler and more concrete terms "molecules" and "proteins." Specifically, concrete terms lend themselves to easier comprehension than generalities and are more likely to avoid misunderstanding. Johnson-Laird (1988) is also concerned with core elements of consciousness which he called "bare awareness," while other theorists have named elements of consciousness as "bridge locus neurons" (Teller & Pugh Jr., 1983) and "consciousness neurons" (Crick, 1994). I regard "mind," which is generally viewed as "above the physical" or "psychological," to be a concept of the complex physical functioning of one's brain. By "environment" is meant any area outside the location of the "mind," including one's body as well as areas outside one's body.

EMPIRICAL EVIDENCE

Within the past 10 years, considerable laboratory evidence has been obtained which strongly supports the concept of the physicality of consciousness. Mice are normally dichromatic, having vision only for the colors of red and green. By transplanting a human gene for the color blue into mice, both Onishi et al. (2005, pp. 1145-1156) and Jacobs et al. (2007, pp. 1723-1725) have independently enabled the mice to be trichromatic. (I wish to be clear that genes function by coding for the production of proteins. The proteins then produce carbohydrates, fats, and other molecules.) The research has demonstrated that the mouse brains were able to integrate the new information in making color discriminations. The research therefore constitutes a serendipitous but highly significant breakthrough in understanding a mechanism of consciousness. The color information is a form of consciousness which is newly present within the mice.

In a more recent transgenic experiment, Carey et al. (2010, pp. 66-71) provided for the novel consciousness of a specific scent in a mosquito. This was accomplished by transplanting into the mosquito a gene for an odor receptor molecule which the mosquito lacked due to a mutation. The gene which coded for the scent

was obtained from a fruit fly. In other transgenic experiments, Park et al. (2008, pp. 0156-0170) allowed a mouse-like animal called a mole-rat, which genetically lacked the capacity for feeling certain types of pain, to be aware of the quality. Also, Roska (2010, p. 11) led a group which accomplished a genetic transfer into mice, which were blind from a genetic disease, to recover their vision in yellow color. The gene was obtained from a light sensitive bacterium. In research indirectly involving the transfer of genes, human embryonic stem cells have been used to restore the hearing of deaf gerbils (Rivolta, 2012).

As described by Carlson and Carey (2011, pp. 76-79), in the article cited above by Carey et al. (2010), fruit flies were found to have 60 genes for olfactory receptors which allow for the perception of a much larger number of different odorants. Odorants are molecules which bind to receptor molecules located on the surfaces of nerve cells in the olfactory system. Carey et al. (2010) explain in greater detail:

> A single neuron has thousands of receptors, but they are identical, each type binds only a small subset of odor molecules. Different neurons have different types of receptors that bind to other subsets. . . . [One of the researchers] found that individual receptors responded to a limited subset of odorants and that individual odorants activate subsets of receptors. Similar results have been observed in the mammalian olfactory system. Thus, animals, from fruit flies to humans, detect scents in the same way: *different odors activate different combinations of receptors*. [Emphasis added.] This strategy helps to explain how animals, including mosquitoes, can discriminate among the vast number of smells found in nature without having to possess a receptor dedicated to every single variety. . . . When receptors bind to odor molecules, an electrical signal travels down the nerve cell . . . to the insect's brain, indicating that the odor is present. (pp. 66-71)

The mechanism in which an odorant combines with a receptor molecule, in both mice and in humans, is in large part similar to that by which the body develops immunity to pathogens. Evidently it was relatively simple in the course of evolution for the body to use the same or a similar mechanism for both the attainment of immunity and for consciousness. In the immunity mechanisms, an antigen protein combines with an antibody protein (Vander, Sherman, & Luciano, 1975, pp. 488-489), while in the mechanism providing for the consciousness of odors described above, stimulant proteins combine with receptor proteins. In both cases, a part of a three dimensional chemical stimulant structure fits into the complimentary arrangement of a receptor molecule in a lock-and-key manner.

NON-OBSERVABLENESS OF CONSCIOUSNESS

The almost universally held impression that consciousness is immaterial, must be due to a very considerable extent to its being unobservable as a third person object. Were it not for the non-observableness of consciousness as well as

traditional thinking, I believe the concept of consciousness could be considered to be physical as readily and as logically as it can be regarded to be non-physical. Yet, it is quite natural that something which can "neither be seen nor touched," which cannot be observed in any manner, would be regarded as non-physical. In this regard, consciousness bears some resemblance to the soul or a ghost. Ryle (1949) even referred to consciousness as "the ghost in the machine" in a derisive description of Descartes' dualist view of consciousness. In accord with its unobservability, it is well recognized that consciousness is entirely subjective and private (Strawson, 1997, p. 407; Velmans, 1993, p. 86). Consciousness is the intimate experience of the conscious individual alone and is completely unobservable. In support of the belief that the consciousness of objects consists of qualities, one needs to recall that the physiology leading to qualities results from the reactions to energies conveyed from objects and that the qualities are "incorrectly" interpreted as if they are on objects in the environment. As evidence of the "incorrectness," one should bear in mind that in dreams the brain contains complete, very "real" qualitized images of objects without the assistance of current sensory inputs from objects in the external environment. The qualities exist only within the mind/brain.

In order to observe an object, an individual does so from a position outside the object. An entity can be observed only as a third person object, as an "it." However, consciousness cannot be observed by a theorist or by any person who is "outside" the consciousness, outside the brain of the conscious individual. Even from the "inside" perspective of the conscious individual, consciousness is not available for observation. An individual is only able to *experience* consciousness, not to observe it. A number of theorists refer to consciousness as experiencing. Velmans (1993), Chalmers (1996, p. 16), Clark (1995), and Brooks (2009-2010, p. 165)—while Kant (1965, pp. 68, 267; and others) made occasional reference to consciousness as "experience."

The individual may be intellectually aware of the neurons, but even then, similar to any observer, the consideration of consciousness is as if one is attempting to do so from an "outside" perspective. Together with a number of other theorists, *I believe humanity is restricted from both the "inside" and the "outside" perspectives from observing the mechanism of consciousness.* Brooks (2009-2010, pp. 164-167) presents a more thorough discussion of the unobservability of consciousness in which the circumstance is considered to be of sufficient importance to regard the unobservability as a "restriction principle."

Allow me to repeat, in my view it is the unobservability of consciousness which is largely responsible for its having remained unexplained for millennia. *It is most important that the unobservability of consciousness be clearly recognized in order to assist in countering the deeply engrained intuition of its immateriality.* Thus, consciousness and the senses hold a unique position in the mind, a position in which they can only be experienced; they can only be "felt."

McGinn (1989, p. 350) is quoted as indicating that consciousness is unobservable and states:

> [W]e are cut off by our very cognitive constitution from achieving a conception of that natural property of the brain (or of consciousness) that accounts for the psychophysical link.

At the neural level, the unobservability of consciousness appears to result from its physiological position in the brain where it constitutes the very base of the perceptual or epistemological process. There is no mechanism with which to perceive it. A similar understanding is expressed by Clark (2005, p. 47) who reasons that the unobservability of consciousness is due to its position as a "first order" structure which therefore cannot be "represented by the system." In addition to his own statements Clark (2005, p. 47) quotes Metzinger (2003), the reference for which I find to be page 387:

> Another way to express this is that sensory representations are . . . cognitively invisible to us even though they are, of course, neurally instantiated in our heads.

In summary, consciousness cannot be observed from *outside* a brain since it is experiencing within the brain of an observer. It also cannot be observed from *inside* the brain because there is no more basic sensory mechanism by which to do so. *As a result, consciousness is completely unobservable* from a first person perspective and as a third person object.

In my judgment there is nothing miraculous or mysterious about consciousness. Consciousness is experiencing and *experience has no neural mechanism for experiencing itself*. The problem is analogous to the circumstance in which one cannot see one's own eyes without the use of a mirror. One's eyes are at the end of the extra corporeal visual process and we possess no visual system with which to see our eyes from a position within our brains. The situation resembles the expression in which "the microscope cannot examine itself." In effect, consciousness lies completely hidden behind the wall of its "rock bottom" status in the perceptual process. The wall is both physiological and epistemological since "knowing" involves consciousness.

PHYSICALITY OF CONSCIOUSNESS

It is not surprising that an explanation of a subject which has been pondered for millennia would involve ideas which are counterintuitive and would therefore meet with much intellectual and emotional resistance. There is an almost universally held and very deeply engrained conventional concept that consciousness is non-physical. This has been the view since the time of the ancient Greeks. The view was strongly reinforced in the 17th century by the authoritative opinion of Descartes who regarded consciousness to be a paradoxical

non-physical "substance." It is still viewed by most philosophers today as somehow being "above" the physical—a rather vague, unexplained, ethereal entity. There are those who have considered consciousness to be the soul (Popper & Eccles, 1977) and those who, apparently influenced by its being unfathomable, look for an answer to the mysterious and unexplainable phenomena of quantum mechanics (Clark, 1995; Hameroff & Penrose, 1996; Zohar, 1990). Others seem to straddle the fence between the physical and the mental. Chalmers (1995) writes of consciousness both as an unknown fundamental, analogous to gravity or electromagnetism, and as a form of "information." Searle (2004) describes it as "airy-fairy" but also asserts (1997, p. 138) that ". . . mental states are identical to states of the brain."

I am among those (Armstrong, 1968; Brooks, 2009-2010, p. 149; Lewis, 1966; and others) who consider everything in the world to be physical. Armstrong (1968) observes:

> But in this century, the view that mental states, events and processes are purely physical states, events and processes in the brain did not win much favor among philosophers until the work done by Ulin Place (1954), Herbert Feigl (1958), and Jack Smart (1959).

Armstrong (1968, p. 25) also implies that the mental is physical in a statement critical of dualism: "[T]he essential point about Dualism is its denial that the mind is a spatial thing." Nagel (1993, p. 2), makes a similar, even stronger statement:

> So even if many of the things we say about the world do not employ explicitly physical concepts, the fundamental facts of the world are physical facts, the most complete description of everything that exists or happens is physical, and anything else that is true must in some way depend on those facts—not just causally but ontologically.

In further support of the idea that physical entities are central elements of consciousness, even abstractions, which are conventionally regarded as immaterial, are described in Brooks (2002, p. 133) as arising from the memories of concrete, physical experiences:

> Let us describe how the abstract concept of "motherhood" probably develops. We have to make some assumptions because we cannot experience what the infant experiences. Assume that the infant begins its mental development by experiencing pain from the usual spank on the buttocks. (The exact order and intensities of the early stimuli are irrelevant; it is the principle which interests us.) After the initial spank, which we shall assume stirs the infant into consciousness, there is touch (being held), sound (being spoken to), and light (the light within the room), and so forth. Visual objects begin to become distinct and to be associated with sound. Early on, the infant associates feeding with the relief of hunger. Still later it associates the bottle or the breast with such relief. Later yet these are associated with a person and with the word "mother." Once the

> concept of mother is understood, it is but a short step to learning that other children have mothers and the abstract concept of "motherhood" has then been acquired.

Shaffer (1965, p. 98) observed that physical explanations of consciousness tend to drift toward the non-physical and that, conversely, non-physical explanations tend to drift toward the physical:

> (A)s we begin to think of mental events in a more physical way we at the same time begin to think of physical events in a more mentalistic way. As we drift toward materialism, materialism must drift toward idealism.[1]

It appears to me that the drifts result from the peculiar situation of consciousness in which *consciousness is actually physical but presents the appearance of being non-physical*. As a consequence, theorists have found it difficult or untenable to follow exclusively in either direction. Even though the most highly regarded current theories of consciousness are stated in physical terms, they are either openly dualistic or simply indicate, with little or no support, that the physical elements are substrates or correlates rather than actualizations of qualities. I feel that consciousness should no longer be viewed as an entity for which one needs to attempt to explain how a *physical entity is also "mental" or immaterial.* Efforts, involving a dual concept, seem to necessarily end in disappointment short of an adequate explanation in which the concept of consciousness remains ethereal and its mechanism or origin is left unexplained.

Despite tradition, I maintain that each of the qualities (senses) should be considered to be physical as well as conscious and in the aggregate to constitute consciousness. The qualities would, of course, need to be elicited by sensory stimulation which may originate outside or within the body. It is well known that *stimulation physiologically causes proteins to be altered or extruded into neural synapses and causes activation of the postsynaptic neuron* (Vander et al., 1975). On the very face of the matter it is highly unlikely that the nervous system and consciousness are different from all of the other systems of the body in regard to physicality. If consciousness is real, as it is generally regarded, then scientifically considered it must consist of something physical. Most attempts to explain consciousness have been in overtly physical terms yet it seems that the theorists, either with full awareness or unconsciously, consider consciousness to be non-physical. Furthermore, the theorists have a strong intuition that it is impossible for consciousness to be physical. If a theorist, either unconsciously or in full awareness, regards consciousness to be non-physical, it has become rather clear that he or she cannot explain consciousness in physical terms, such as neurons or brain activity. Conceptually physical and non-physical elements are mutually exclusive. For an explanation to be logically and epistemologically sound, the

[1]Quotation mentioned by Robert A. Kunzendorf, Ph.D. in a personal communication.

explanation must either regard consciousness as non-physical or as physical but not both.

The view of the non-physicality of consciousness is supported by millennia of convention rather than by realistic empirical or scientific evidence. It is counter-intuitive and difficult to discard one's deeply engrained view of consciousness as immaterial and to think of consciousness as a physical entity. The disparate views have traditionally been held as totally incompatible and as part of the so-called mind/body enigma. Had the faulty concepts of consciousness not been entrenched and had they not emotionally hindered the more probable concepts from being objectively considered, the more logical concepts would likely have been brought to active attention much sooner. Even though the two views indicate an incompatibility between the physical and the mental, *in the view that the "mental" is actually physical, the discrepancy is non-existent.* In the Ontology Theory, perhaps better named the Physical or Molecular Theory, physical elements constitute consciousness.

The mind-body enigma has long obscured the manner in which consciousness produces motor activity. Indeed, if one views consciousness as immaterial, it is difficult or impossible to relate consciousness to the production of motor activity, which is clearly physical. Something which is non-physical cannot directly be the cause of something which is physical. The two are in entirely separate conceptual domains. Yet the dilemma is easily resolved by the Ontology Theory (Brooks, 2010-2011) which holds that consciousness is physical. It is but a short step to postulate that consciousness, consisting of neural activity and physical "consciousness entities," may readily stimulate motor activity. The neurons involved in establishing consciousness simply need to stimulate appropriate neurons in motor areas of the brain. One's past experiences, with their associated emotions, may either facilitate or inhibit motor neurons (Vander, 1975). Since motor activity is obviously a major function of the brain, in a comparison between physical and "mental" theories of consciousness, the physical theories appear to be considerably more parsimonious.

In summary, it is not only plausible that consciousness is physical rather than ethereal but there is now also considerable evidence that particular proteins constitute the central elements of several of the qualities. However, to regard consciousness as physical, a revision of its traditional conception is required. The sensations (qualities) have heretofore not provided the impression of being components of a physical consciousness since the qualities are unobservable as physical objects—they have never been "seen or touched."

CONSCIOUSNESS AS QUALITIES

As in the usual philosophical understanding, I refer to "qualities" as they include the sensations of light, sound, touch, pain, kinesthesia, sensations from one's lungs, bowel, and so on. Some of these are additions to the "secondary

qualities" of John Locke (1975, p. 134; Brooks, 2002, p. 45ff). The qualities are each known to be subjectively unique experiences which suggests that they are constituted of discrete entities. I consider *each quality to be its own individual form of consciousness.* All or most theories have considered consciousness to be a single overall entity while in distinction I am concerned with consciousness as consisting of separate individual or combined elements (qualities, physical entities). The latter have been discussed in Brooks (2011-2012, p. 222), consciousness having been previously described as "multiple" in Brooks (2004-2005, pp. 271-280).

Emotions fulfill the requirements of uniqueness and subjectivity for being regarded as qualities, yet they are often overlooked in consciousness writings. Emotions may be perceived alone but may also be present to a greater or lesser extent in conjunction with other qualities.

Colors are known to be stimulated by light energies in the environment, while sound results from energies in the form of vibrations in the air. Similarly, odors and tastes stem from stimulation by molecules in the air or in foods, and so on (Vander et al., 1975, p. 488-489). The various stimulating energies themselves are imperceptible *as energies* and there is no perception of the corresponding qualities until after the energies stimulate one's sense receptor organs and after nerve cell impulses travel to the brain. The original light energy is then perceived as phenomenal light and sound energy is perceived as phenomenal sound, etc. *The environmental energies are perceptible only as qualities* located in one's brain where it is most plausible that the qualities, as being brain phenomena, must have physical origins and consist of physical entities.

In addition to the usual understanding of "qualities" as sensations, I make a further refinement. I regard qualities to be the *central physical elements* of the sensations. By the "central physical elements," I refer to particular neurons or molecules, or in accord with the transgenic evidence cited earlier, to certain proteins. The central elements, existing as physical entities, will be expounded in the next section. These elements give each quality its individual subjective character, such as light or sound, and are integrated into the larger cognitive structures of the brain. By the "larger cognitive structures" I have in mind aspects of qualities such as shape, size, and motion, which I regard as being intellectual compositions or overlays of additional qualities, rather than as being the central unique characterizing sensations. (I may refer to either the central element alone or to the "larger cognitive structure" as a "quality.") The cognitive structures correspond to Locke's "primary qualities."[2] A considerable amount of

[2]In my view, Locke's naming of the qualities should be the reverse. He named the qualities of size and shape, etc., as "primary" because they were objective. Colors and sounds, etc., were considered to be "secondary" since they were subjective. Per (Brooks, 2002, p. 45ff), physically and physiologically the "primary qualities" are comprised of the unique, more elementary "secondary qualities" as the central elements. However, the concepts and their roles in the perceptual process, and not their names, are the important considerations.

neuronal processing involved in consciousness is already known and is understood particularly in the sensory mode of vision as located in the neuronal layers of the occipital cortex and in certain neuronal "nuclei" (aggregates of particular neurons). "Neural network" theory, as initiated by Hebb (1980) offers a neurological explanation for the cognitive processes but not for the central characterizing qualities.

It is a most important misconception that qualities of objects are conventionally thought to exist within the environment. The green of a tree is normally but incorrectly assumed to be on the tree and the odor of an onion to reside in the onion. Similarly the pain from a splinter in one's finger is thought to exist in the finger. Such conventional beliefs are entirely normal and it is very counterintuitive to think otherwise. Nevertheless, the beliefs represent a deep misunderstanding of physics and physiology. Most theorists of consciousness, as well as individuals acquainted with human physiology, agree that all qualities are located in the brain. (There is, however, per a suggestion from myself (Brooks, 2011-2012, p. 220) as well as from substantial empirical evidence in a book by Kunzendorf (in press), that the initial central elements of qualities may well reside in receptor cells located in the peripheral nervous system rather than in the brain.)

In support of the view that the consciousness of objects consists of qualities, one needs to recall that the physiology leading to qualities results as the reactions to energies conveyed from objects and that the qualities are "incorrectly" interpreted as if they are on the objects. As evidence of the "incorrectness," one should bear in mind that in dreams the brain contains complete, very "real" qualitized images of objects without any stimulating energies from objects in the external environment. In dreams, the qualities perceived as objects, having been engendered from memory of previous experience, exist only within the mind/brain.

Since the qualities of sight, smell, sound, touch, taste, etc., of objects and indeed all of reality, depend upon energies conveyed from environmental objects, we may consider perceptions to not only depend upon but to consist of qualities. *Note that there are no perceptual features of one's environment which do not consist of qualities.* Therefore, it is accurate to state that *consciousness is comprised of qualities and that objects, as they are perceived as being "clothed" in qualities, exist only in the mind*. The perception of a house or of an automobile consists of no more than the qualities engendered. Even the interoceptive sensations are comprised of qualities.

The perception of objects as being in the environment is made possible by the projection (referral) of qualities and phenomenal objects to the points of origin of conveyed energies from external objects (Brooks, 2007-2008, p. 362). The projections are to the *supposed* points of origin and may not be accurately referred. Inaccurate projection to environmental sites is true particularly of sounds and odors, the correct sources of which are often poorly known. Whitehead (1925) was apparently the first to explicitly describe projection and in doing so also expressed the relationship of qualities to objects:

> [T]he mind in apprehending also experiences sensations which, properly speaking, are qualities of the mind alone. These sensations are projected by the mind so as to clothe appropriate bodies in external nature. Thus the bodies are perceived as having qualities which in reality do not belong to them, qualities which in fact are purely the offspring of the mind.

Qualities cannot be further reduced as sensory percepts. For example, color cannot be described in terms of sound and sound cannot be described in terms of odor. At the "psychological" level of organization, qualities are unique experiences. It is largely because of their irreducibility, combined with the principle that all things are physical, that I regard qualities to be physical experiential entities such as neurons, molecules, or specifically as proteins. Molecules, particularly proteins, seem to be the most highly reduced elements capable of acting as diverse physiological units of qualities. Quantum or other physical entities such as neural networks, electromagnetic fields or "consciousness neurons" could conceivably be central elements of consciousness but each element would need to be distinct to coincide with the large variety and uniqueness of qualities. Being genetic in origin, physical entities *constitute* the qualities and all experience.

It is highly improbable that consciousness (or perception) is a mysterious, non-physical matter. Instead, it is a physical process composed of energies which stimulate one's sensory receptors which, in turn, stimulate entities in one's brain. Because the brain is regarded as being physical, it is reasonable that the elements stimulated in the brain are physical entities.

The qualities, or "consciousness entities," possessed by an individual give rise to the only qualities which an individual is *capable* of experiencing. The ultraviolet sensibility common to bees or the sense of echo location available to bats, the latter pointed out in Nagel's well known article (1974), as well as other qualities available to a host of "lower" animals, are simply imperceptible to humans. It appears to be quite conceivable that "new" or even synthetic qualities will eventually be placed in robots or installed in human beings as was done with the animals mentioned in the initial paragraphs of this article. It is also conceivable that the replacement of lost qualities, such as vision or hearing, will become possible in the not too distant future.

There is an important difference, in my understanding, between the manner in which the perception of objects is generally viewed and the way perception actually occurs. Theorists generally ascribe to a theory of representationalism—that an individual forms representations of objects within his or her mind and that the representations are relatively accurate neural renditions of the objects. (The objects would then be experienced in a Cartesian theater which requires a homunculus.) In actuality, one does not perceive objects from current sensory inputs alone. Very different from seeing objects directly, one merely receives light energies (or sound energies, etc.). The energies, which are transmitted from objects, result in stimulation of one's receptor organs with the initiation of processes in which *memory adds in very large measure to perception.* In short, I

hold that the theory of representationalism is inadequate and a more correct understanding of the physical and physiological process is crucial to the understanding of perception and consciousness in general. Anglin states in his introduction to a book by Bruner (1973, p. xxii):

> Construction [perception] usually involves a recursive process in which the first step is an inferential leap from sense data to a tentative hypothesis achieved by relating incoming information to an internally stored model of the world based upon past experience. The second step is essentially a confirmation check in which the tentative hypothesis is tested against further sense data. In the face of a match the hypothesis is maintained; in the face of a mismatch the hypothesis is altered in a way that acknowledges the discrepant evidence.

As a percipient one normally thinks that one "internalizes" objects and perceives their qualitized representations but the reverse directional shift of the phenomenal objects is the case. Energies from objects are internalized but the qualitized perceptions are developed in the brain as phenomenal objects and are externalized (projected, referred) to the environment (Brooks, 2007-2008).

PROTEINS AS QUALITIES AND CONSCIOUSNESS

As theorized by myself (Brooks, 2009-2010, 2011-2012) and as given confirmation by the empirical research described earlier, there is evidence that the qualities are physically instantiated by particular proteins. Stated differently, *the proteins constitute the sensations of the qualities*. The research also strongly indicates not only that the central constituents of consciousness are physical but also that an explanation of consciousness has no need for a "mental" factor. This is difficult or impossible to conceptualize for one who must cling to the belief that qualities (light and sound, etc.,) are non-physical. *The protein molecules which, of course, are physical entities, are regarded to have the ontologies of consciousness.* From the "inside" perspective, the perspective of an individual whose consciousness is being considered, the proteins have the characteristic of qualities; but from the "outside" perspective of a theorist, they are only molecules. They have not previously been viewed in this manner by other theorists. To avoid confusion let me clearly state that the molecules are not construed in the present article as having identity with consciousness, or as being correlates of consciousness, or as possessing dual aspects of consciousness. I view the molecules as constituting the central or principal elements of consciousness. The molecules are located in neurons or their synapses and their meanings are integrated within the further cognitive structures of the brain. Within the causal sequence resulting in consciousness, the transgenic experiments cited earlier have demonstrated particular proteins as the most plausible candidates for comprising putative principal elements of consciousness.

"No other class of organic molecules plays so many functional roles in living organisms" (Vander et al., 1975, p. 19). Yet for purposes of theory it is not necessary that the elements of consciousness need only be proteins. Elements other than proteins may be central to consciousness but *the principle, nevertheless remains the same—that consciousness reduces to central or core elements* which are integrated into the cognitive processing within the brain. Such cognitive processing is best known in the sensory modality of vision, occurring in the neuronal layers of the occipital (rear) cortex, and there can be no doubt that there are comparable structures and mechanisms which serve all of the senses. I think that the establishment of the core elements of sound perception, in addition to the qualities already demonstrated, would be decisive for the role of "consciousness proteins" to be well recognized. Such core elements should be discovered relatively soon since human stem cells have already been used to successfully replace the required nerve cells in deaf gerbils (Rivolta, 2012).

I wish to emphasize the central point that *physical elements have the unexpected and amazing characteristics of being sensations, that is, the characteristics of being qualities and consciousness.* In order to find this credible, it will be most helpful to understand the extremely variable chemistry of proteins: ordinary proteins consist of any number of units called amino acids, each unit being composed of a relatively few atoms. The amino acid units are connected, like links in a chain, to form individual protein molecules which fold into countless shapes and sizes.

The chemical and biological properties of a protein depends upon the specificity and arrangement of amino acids in the molecule. *A most important characteristic of proteins is that their shape can be altered by nerve cell impulses thereby transforming them into a different molecule. Each of the molecules acts as a different substance, each having different characteristics.* The different characteristics are often amazing and their existence would seem very unlikely or impossible if they were not known to actually occur. A very few of the almost innumerable and extremely varied properties are described by Brooks (2011-2012, p. 230):

> For examples of proteins, the molecules result in any number of immunity reactions; hair consists of protein which is soluble within skin cells but becomes insoluble upon being extruded; the hemoglobin protein collects oxygen in the lungs but releases it in the muscles; proteins in muscles change shape and shrivel (contract) when stimulated electrically by nerve cell fibers; other proteins emit electrical impulses which stimulate the heart beat.

I believe the millennia of thinking that consciousness is immaterial must now yield to science. If one has an open mind, the transgenic research of the past 10 years presents substantial evidence that consciousness is physical and, more specifically, that it is most likely a type of protein.

Yet, one may still ask how it is possible for a protein (or any physical entity) to be consciousness. An important part of the answer is that the theorist needs

to be aware of a conceptual shift. From a perspective outside the brain of the conscious individual, entities, such as "consciousness proteins," are physical; but from an "inside" perspective they are qualities.

It appears to be an epistemological impossibility to conceptualize, from the "outside" perspective alone, a smooth, seamless transition from physical entities to the experiences of qualities. However, it is a major thesis of this article, that a transition is not needed for the establishment of consciousness and that there is no transition in the experience of the individual. Instead, I offer that physical entities, most likely "*qualitative proteins," have the characters of qualities and that consciousness consists of qualities.* Qualities should be regarded as *facts of nature* analogous to the manner in which one accepts as facts of nature that salt tastes salty and that sugar tastes sweet. The physical entities, whether they are actually proteins or other entities, are simply the experiencings of nature. Again, in accordance with the principle that everything in the world is physical, qualities must consist of physical entities or physical processes.

An individual ordinarily does not find consciousness strange or consider its origin since one never has experience without consciousness and knows nothing that does not reduce to consciousness. *The qualities have been comprised since birth of physical entities, that is, "consciousness molecules" or "qualitative proteins," etc.,* and as a result consciousness is generally taken for granted and accepted as a part of being alive and awake rather than as a natural function of the brain needing explanation. I have previously (Brooks, 2002, p. 210ff) referred to the analogy of the proverbial fish which has never been out of the water. We have never been outside of consciousness. To the fish, the water is the world. To us, the "consciousness entities," brought into action as the result of energies conveyed from noumena, are the qualities and consciousness.

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