**A SIMPLE, TESTABLE MIND-BODY SOLUTION?**

**Abstract** Neuroelectrical Panpsychism (NP) offers a clear, simple, testable mind-body solution. It says that everything is at least minimally conscious, and electrical activity across separate neurons creates a unified, intelligent mind. NP draws on recent experimental evidence to address the easy problem of specifying the mind’s neural correlates. These correlates are neuroelectrical activities that, for example, generate our different qualia, unite them to form perceptions and emotions, and help guide brain operations. NP also addresses the hard problem of why minds accompany these neural correlates. Here, the real nature of matter-energy (beyond how it appears to sense organs) is consciousness that occupies space, exerts forces, and unites neuroelectrically to form minds. This doesn’t reduce consciousness to observable neural activities, nor posit any radically different entities. NP also deals with panpsychism’s combination problem by explaining how the mind’s subject and experiences arise by electrically combining simple experiences in brains.

**1. The Problematic Nature of Minds**

We’re directly aware of our own minds, but their relationship to our bodies isn’t so easily accessible. This mind-body problem is one of the oldest, most persistent problems in the history of philosophy and science. It’s also cast in terms of minds and brains, or the mental and physical.

 Minds and brains are intricately connected, but (to rephrase McGinn, 1989) how can our technicolor experiences arise from our soggy grey matter? How can the feeling of burning pain or the image of a rainbow come from neurons activating? All this seems just as mysterious “as the appearance of the Djinn, when Aladdin rubbed his lamp” (Huxley, 1896). So, while the Greek atomists (and ancient Indian Caravakas) tried to physically explain everything in terms of atoms, Socrates scoffed at explaining our aims and decisions thusly (Plato, *Apology*).

 It’s hard to see how such radically different minds and brains can be identical or even just causally related. All accounts of their relationship seem deeply obscure. None has prevailed. The mind-body problem thus resembles a multi-faceted dilemma. But before delving into this ancient conundrum—and a possible solution to it—the nature of minds and bodies needs clarifying.

 Minds are consc by defn, but some of thr operatns (memory, Rng) arnt fully conscious.

**1.1 What Are Minds and Bodies?**

Physics has replaced old ideas of bodies with newer ideas of matter-energy. The traditional mind-body problem now addresses how minds relate to the brain’s material structures and energy states. These are primarily electromagnetic in nature.

 Minds aren’t so easily characterized. They will be treated here as having several related traits. To start with, the mind can be loosely classified as conscious intelligence. Arguably, some intelligence needn’t be conscious (as in computer chips), and some consciousness needn’t be intelligent (as in panpsychism, where all is conscious). But the two overlap in minds, which have both. The following elucidations on this point touch on well-known views about minds.

 Minds have intelligence or problem-solving abilities. These include powers to represent the world and evaluate options (though these and the other traits come in degrees). Minds thus have distinctive operations for perceiving, feeling, thinking, and acting. They’re guided by the mind’s subject (its thinking, controlling center). This subject has feelings and a subjective point of view that shape what it’s like to be that subject. The subject’s operations arise from brain circuits yet might help guide brain operations and possibly even become partly autonomous of brains.

 Minds have not only intelligence but also consciousness—privately experienced inner life. This is lost in comas, for example. **The mind’s** consciousness has sensory and emotional qualities (qualia), such as pain and fear. It also has unity—for example, the myriad shapes and colors in a visual image are experienced as a whole, such as a friend’s face. Indeed, all of a mind’s experiences at each instant are united (unless the mind fractures). This occurs in such a way that we can’t access each other’s experience (privacy).

 Note that this account of **the mind’s** consciousness refers to qualia and the subjective feeling of what it’s like to be a particular being (as well as similar overlapping traits above). It’s thus a so-called “qualitative” or “phenomenal” view of consciousness. Other accounts of consciousness exist, but they’re limited. For example, “access consciousness” is the availability of information for acting, speaking, and reasoning. Also, “self-consciousness” is awareness of one’s own thought and individuality.

 Both the access and self-consciousness accounts rely on attention and thought. Both accounts overlook that much (if not most) of consciousness is preattentive (Lamme, 2004). For example, as we scan a crowd for a friend, most of the scene lies outside the focus of attention at any moment (Koch, 2019). We’re also preattentively aware in fatigue trances as we stare blankly with unfocused eyes at objects.

 Full accounts of **the mind’s** consciousness must cover not just attention but all of our privately experienced inner life. The point is that this inner life is best characterized broadly in terms of qualitative, subjective consciousness with its qualia, unity, and thinking subject—not narrowly in terms of just attention and reasoning.

 To summarize, the mind is characterized here by its conscious unity and qualia, and its intelligent operations and subject. It will be argued below that existing theories face both hard and easy problems in explaining these traits—and that a proposed theory might avoid these problems.

**1.2 Hard and Easy Problems**

The so-called “easy problem” of consciousness is specifying which brain activities correlate with consciousness or minds, and how they operate. The “hard problem” is explaining why these activities accompany consciousness in the first place (Chalmers, 1996). The easy one is looking for correlations, while the hard one is explaining them. The latter arises from the issue above of how such radically different minds and brains can be related by identity, causality, et cetera.

 Get rid of hard/easy problem for most part: just say at outset that hard problem of how to get from processing to consciousness involves numerous metaphysical perennial mind-body problems. So best to dispense with talking of HP and better to focus on list of mbps.

 Concerning the easy problem, neuroscience has isolated various candidates for the neural correlates of consciousness (NCCs plural, NCC singular). They have two basic forms. Specific NCCs are for different kinds of consciousness, such as perceptions or memories—or particular cases of these, such as visual face recognition. The full NCC is for consciousness in general, irrespective of these particular forms. This consciousness occurs whenever we’re awake and alert.

 Two leading examples of NCCs appear in the Integrated Information Theory (IIT) of Giulio Tononi and others—and in the Global Neural Workspace Theory (GNWT) of Stanislas Dehaene and others. These NCCs reside in the cerebral cortex. IIT describes an NCC specifically for sensory consciousness, namely, the “hot zone” of electrical activity in this cortex’s parietal and occipital lobes (Tononi & Koch, 2015). GNWT describes an NCC for consciousness in general at the cortex’s frontal lobe. This NCC is the global workspace that arises as interactions between thalamocortical areas trigger high-level sites for integrated information, short-term memory, et cetera. In this workspace, information is globally available for higher processing (Dehaene et al., 2011). This space offers an account of access consciousness.

 Such theories address NCCs and how they work (their structures, dynamics, and functions or cognitive roles). But they don’t adequately explain why the activities are conscious. It’s hard to say why the hot zone or global workspace is conscious versus nonconscious.

 What makes this latter, hard problem so hard? It’s not that we lack any proposed explanations for why consciousness accompanies neural activity. Instead, it’s that the two seem so radically different that all accounts of why they occur together seem obscure. That is, no account is fully and clearly understood, and what makes each obscure seems to differ from case to case. (“Obscure” will be used below instead of the harsher term “unintelligible” because the latter doesn’t reflect how criticisms of these accounts are debatable.)

 Another (related) reason that the hard problem is so hard is that while we can empirically test (by observation and experiment) claims about what the NCCs are, further claims about why these NCCs are conscious become difficult to test and falsify. So, theories about why brains are conscious are metaphysical—they’re untestable speculations about the basic nature of reality. No mind-body theory can succeed until it deals with both the hard and easy (metaphysical and empirical) problems. But all such theories (including IIT and GNWT) face issues with one or both. We’ll now look at how traditional theories fail to deal with these problems (the metaphysical one mainly). Then we’ll see how both problems might be addressed without these traditional pitfalls.

**1.3 Prominent Mind-Body Theories**

Various mind-body theories exhibit the metaphysical (and at times the empirical) problem above. Both these theories and the critiques of them are controversial, so the aim below isn’t to enter into the irresolvable debates about them, but just to list them so as to avoid them. What follows is just a very brief, partial list—for much fuller arguments, see Jones (2016).

 Many mind-body theories have religious roots. For example, traditional dualism treats minds and brains as different substances that interact yet can exist apart. But it’s unclear how such different substances can have any causal relations. For example, how do our nonspatial, immaterial minds cause our bodies to move? One dualist reply has been to diminish the differences between physical and mental causality (e.g., Lowe, 2006; Lindahl & Arhem, 2016). These debates have been hard to decisively resolve.

 Dual-aspect theory traditionally treats the mental and physical as two (out of infinite) aspects of an underlying substance (God or nature). This evades dualism’s specific causal issues, but its causality is nonetheless highly obscure. For it shifts causation to a deeper level—the underlying substance, whose nature and aspect relations are deeply mysterious.

 Idealism traditionally reverses the physicalist reduction of minds to bodies. It claims that bodies just exist as perceptions in the mind or spirit. While this is hard to refute, it controversially relies on God to explain what causes the objective world of bodies we perceive. It’s also rather obscure about why minds and brains are so intimately conjoined.

 Physicalism treats everything as physical. Its traditional reductive form tries to fully explain minds via physical science so that they’re nothing over and above brain activity. The main problem is that the two seem too different to be identical. This can be cast in various terms involving, for example, explanatory, conceivability, and knowledge problems (Levine, 1993; Chalmers, 1996; Jackson, 1982). But Leibniz (1714/1973) put it most clearly: if we could enter our bodies like we enter a building, we wouldn’t find anything there that explains our perceptions. That is, we can’t see visual images by peering into brains, so how can they be identical? One reply is that science’s history is full of things once thought to be beyond understanding, so being currently unknown doesn’t entail being always unknowable. Such debates seem irresolvable.

 Today’s dominant view is nonreductive physicalism, in which minds and bodies are dual properties of certain physical substances. For example, pain is a function involving information processing that detects and reacts to tissue damage. Pain can be realized in multiple hardwares, organic or nonorganic, which abstracts it from any particular hardware. This view ends up with three quite different entities—abstract information, nonconscious brains, and conscious pains—with obscure, complicated interrelations. For example, how can the pains we feel be abstract, relational information processing? And how can these abstract functions be realized in neurons (which seems as mysterious as Plato’s ideal forms being embodied in matter)? And how can pain pop into existence from nonconscious neurons once they process information in certain ways?

 Another view today is Russellian monism. It typically says that physics describes the world only in terms of abstract mathematical structures and dynamics. Objects are thus described extrinsically via what they do to each other, not intrinsically via what they are in themselves. These monists say that these intrinsic natures exist and ground the abstract descriptions. Without this ground, the world would exist only as abstract structure lacking substance or qualities. An example is Chalmers’ (1996, p. 305) dual-aspect view, in which “Experience is information from the inside; physics is information from the outside.” These monist views are highly complicated. They’re also quite obscure about how pains can be the intrinsic nature of abstract information structures, and how they can help make them exist in substantial ways. Also, their grounding relation has the same obscurity as the realization relation mentioned above.

 These prominent mind-body theories are obscure about how such radically different minds and bodies can be related by identity, causality, realization, third entities, et cetera. Endless debates involving these and various other mind-body theories have raised many further claims and counterclaims. These theories have long been crafted to be consistent both internally and with known facts about the world. They’re thus hard to refute empirically. For example, how can we experimentally test whether minds and bodies can exist apart—or whether the world exists in God? Debate is therefore unending. The result is obscurity and deadlock.

 The hard mind-body problem is thus hard because of this perennial impasse among obscure, untestable theories about why minds accompany brain activities. If it ever has any solution, it will come from a theory that avoids the metaphysical problems in other theories while also avoiding metaphysical problems of its own. Yet these metaphysics have arguably continued in the opposite direction—becoming ever more obscure, complex, and logjammed.

**2. A Clear, Simple Theory**

I’ll now try to avoid the hard and easy problems with a theory that makes mind-body relations clearer and simpler than in the theories above. It’s called Neuroelectrical Panpsychist Theory of Mind, or Neuroelectrical Panpsychism (NP) for short. For it combines a neuroelectrical approach to the easy empirical problem with a pure-panpsychist approach to the hard metaphysical problem.

 In NP’s metaphysical approach, we’re directly aware of our own conscious thoughts and feelings. Yet we’re just indirectly aware of the external world through (for example) reflected light, instruments, and sense organs. The world is thus hidden, and its real nature is up for grabs. So, for all we know, consciousness may be the real, underlying nature of the world beyond how it appears to our senses and instruments. In NP, consciousness is thus the world’s real, underlying substance (where “substance” merely denotes the fundamental stuff comprising the universe). It occupies space, exerts forces, and is the universe’s sole constituent. This “pure panpsychism” treats everything purely as consciousness. Physicists can’t object to this view, for they describe all particles and fields solely by their observable effects, while NP refers to what particles and fields are in themselves, apart from their observable effects. So, the reason that NP can’t be dismissed out of hand is that we don’t really know the world’s underlying nature—it’s up for grabs.

 As argued below, NP’s metaphysics posits just one entity, so it avoids radically different entities with obscure relationships. It also avoids simple but obscure reductions of minds to neuroscience’s observable events. NP may be a particularly clear, simple mind-body metaphysics.

In NP’s empirical approach, the brain’s neurons and molecules are discrete and separated by gaps, such as the synaptic gaps between neurons. So, their consciousness remains separate. But as brain circuits activate, their electromagnetic (EM) activity generates a continuous EM wave between neurons that unites their separate, atomized consciousness. A unified consciousness (a mind) arises along brain circuits. This neuroelectrical activity also creates the various qualia in our mind. These claims about unity and qualia are testable. The upshot is that the mind is the brain’s electrical activity. It gets its existence and characteristic traits from this EM activity, including its unity, qualia, and intelligent operations. The mind is the real, hidden nature of this EM.

To summarize, in NP, consciousness is the sole substance of the universe, and the brain’s EM unites the consciousness in its neurons to form the overall mind. This view synthesizes two existing views—one metaphysical, the other empirical. Metaphysically, NP is a very simplified, clarified version of Strawson’s (2016) panpsychism. Empirically, NP is a heavily modified version of EM-field theories of mind (ranging from, e.g., Libet, 1993 to McFadden, 2021—see §5). These field theories treat minds as identical to, or derivative of, neural EM fields. While NP’s resulting principles are clear and simple, they’re not always so simple when spelt out into neural details. All neurophilosophies are complex when it comes to their neuroscience. NP is no exception.

 We’ll now turn to how this theory tries to avoid the hard problem by using panpsychism to steer clear of obscure metaphysics—and how it tries to avoid the easy problem by making unique, testable predictions about how the mind’s key traits arise through neuroelectrical activity.

**3. Addressing the Hard Problem**

NP tries to offer a clear, simple solution to the hard problem of explaining why consciousness accompanies brain activity. The theories listed above have a hard time doing this because it’s hard to see how such different entities can be related by identity, causality, realization, intrinsic natures, third entities, et cetera. NP’s proposed solution to why consciousness accompanies brain activity is that consciousness is the brain’s hidden nature. But a proper solution must (1) avoid the metaphysical problems in other theories and (2) not create new ones of its own. Can NP do both?

 (1) Does NP avoid the metaphysical problems in other theories? Let’s look more deeply into this now. To start with, NP steers clear of different entities—only consciousness exists. This avoids the radically different entities and obscure causality of traditional dualism and dual-aspect theory.[[1]](#footnote-1) NP also avoids the proliferation of entities—minds, bodies, and abstractions—in nonreductive physicalism and Russellian monism. Their obscure relationships are avoided too, including the realization and grounding relations linked to abstractions. Nor does consciousness mysteriously pop into existence from nonconscious neurons, as in nonreductive physicalism.

 NP also avoids the obscurity of both physicalist and idealist reductions. Physicalist reductions identify minds with the observable activity of neuroscience. But this doesn’t explain, for example, why visual images can’t be observed inside brains. In contrast, NP doesn’t identify minds with observable brain activity. Instead, minds are the underlying reality of this activity—hidden beyond neuroscientists’ observations of it. Idealists reduce bodies to perceptions in minds. In contrast, NP says that bodies exist outside minds. This avoids idealism’s controversial claims about why we see a world of bodies that seems to exist outside us. NP’s electrical approach also avoids idealism’s further troubles in explaining why minds and brains are so intimately connected.

 (2) Does NP avoid creating new problems of its own? Its panpsychism does raise the so-called “combination problem” concerning how simple (micro) experiences in atoms, molecules, etc. combine to form the brain’s larger (macro) experiences, such as visual images—and ultimately, overall minds with subjects.

 But this may actually turn out to be an easy problem, not a hard one. To start with, NP’s main combination problem concerns the mind’s subject. One assumption is that it must arise from microsubjects (which possess microexperiences) in quarks. But this leads to a metaphysical quagmire full of obscurities. Moreover, even if minimally conscious microsubjects do exist in quarks, they’d be so utterly simple that it’s hard to see how they could combine to form anything more than the microexperiences they bear. So, it’s difficult to see their relevance to creating the complex macrosubjects (selves) that control our minds.

 Yet it’s not hard to see the broad outline of how *microexperiences* could combine to form macrosubjects—without any need for the obscure *microsubjects* above (whether or not the latter exist). In the rest of this paper, NP will use neuroelectrical activity to explain this emergence of complex macro forms of consciousness from simple micro forms (for the combination problem)—and to similarly explain how the mind’s unity, subject, etc. arise (for the easy problem). NP draws here on considerable experimental evidence. Also, the most crucial parts of the explanation are testable. So, NP’s combination problem may turn out to be an experimentally resolvable easy problem, not an irresolvable hard one. NP may in this way turn out below to avoid the metaphysical problems in other theories while avoiding new ones of its own.

 For these two reasons above, NP can arguably be adopted as a Kantian regulative idea for making psychology intelligible—or as a case of abductive inference to the best mind-body explanation. However, NP will be further justified below on empirical grounds.

**4. Addressing the Easy Problem**

Having argued in the previous section that NP deals with the hard problem, I’ll now try to show how NP deals with the easy empirical problem and closely linked combination problem (both concern how the mind’s complex qualia, subject, etc. arise from simple roots). These two arguments offer support to my overall claim that NP provides a mind-body solution. Below, I’ll draw several of my papers into a succinct empirical account, while citing them for details. The aim is to show step by step how all the traits of the mind—its conscious unity and qualia, and its intelligent operations and subject—arise neuroelectrically from subliminal micro-levels.

**4.1 The Mind’s Unity**

My step-by-step neuroelectrical account of how the mind’s traits arise will now begin with its trait of unity. More details on this particular topic appear in Jones (2017).

 Neuroscience today typically treats brains as computers (augmenting computationalism, which treats minds as computers). This computational neuroscience hasn’t explained how separate, distributed circuits bind together to support the unified experience of, say, a talking, smiling friend—nor of the unified mind as a whole. This is the so-called “binding problem.”

 To start with, cortical circuits for color and shape in visual images of the smiling friend aren’t systematically connected. Zeki (2003) says that “the colour and the visual motion systems . . . occupy geographically distinct locations in the visual cortex.” He added that “there are few, if any, direct connections between V4 and V5 in the monkey.” Nor do synchronized interactions of neurons firing in lockstep together unify these circuitries into a conscious whole, as GNWT and other theories have proposed. Indeed, synchrony is neither necessary nor sufficient for binding (e.g., Koch et al., 2016; Jones, 2017). Other proposed binding mechanisms are problematic too (Jones, 2017). It’s thus understandable that while IIT assumes that conscious systems have unified causality, it hasn’t actually explained how this unity arises. No existing computational views specify the NCC of this crucial trait of minds.

 NP suggests a solution to this problem. It’s based on the brain’s EM field, which arises mainly from electrical impulses (action potentials) traveling along neurons via their membrane channels. This initiates synaptic signals to other neurons. The electrical impulses typically occur in bursts, causing oscillations of a certain frequency that are reflected in the fields.

 A key feature of this EM wave is that it’s the brain’s only continuous, unified substance. It’s this continuous substance that can unify different experiences, pooling them together. It’s strongest around the diffuse ion currents that run along and between neurons (it’s especially strong among well-aligned cortical cells that fire together coherently). This field degrades exponentially with distance, so consciousness isn’t united between brains. Even within each brain, the field is at times too weak to fully unify consciousness, leaving much brain activity merely subliminal.

 Evidence that unified consciousness comes from EM takes three forms. First, no other mechanism explains this unity (as noted above). Second, unified perceptions correlate well with local neural fields detected by EEGs (Koch et al., 2016). Third, EM fields alone, not any particles or synapses, propagate signals across slices in hippocampal tissue (Chiang et al., 2019; cf. Libet, 1993)—so fields alone seem to unify this activity.

 So, in NP, consciousness is unified not by neural computations, but by the field’s continuous substance where it’s most intense. In this theory, consciousness is thus a *substance*, not abstract *computations*. Neural computations do occur in NP, but just as subliminal electrochemical interactions (not multiply realizable abstractions.)[[2]](#footnote-2)

 In NP, the mind’s unity is tied to another of its key traits—its privacy. Our minds are private (inaccessible to each other) in NP because EM fields happen to be exceedingly weak between our brains, as just noted. Another source of privacy in NP is that we can’t observe other people’s minds by peering into their brains—they’re necessarily hidden in brains beyond what is physically observable. This privacy underlies the subjective-objective contrast of phenomenology and physical science, respectively.

 To summarize, while computational neuroscience hasn’t explained how consciousness is unified, NP explains this neuroelectrically. The brain’s EM field can unify simple consciousness to form complex consciousness and overall minds. This helps NP defuse its combination and easy problems concerning how minds arise. It also implies that minds are substances, not computations.

**4.2 The Mind’s Qualia**

The next step in dealing with NP’s easy and combination problems is explaining how the mind’s various qualia arise neuroelectrically. More details on this topic appear in Jones, 2019.

 Computational neuroscience has trouble explaining how brains produce our various qualia. It relies on labeled lines for the different sense modes (colors, tastes, etc.). These lines have lower-level detectors to spot (for example) different light wavelengths, and higher detectors that compare the lower detectors’ outputs to resolve ambiguities about what wavelength is actually present. But these computations are too similar across the various sense modes to account for all our starkly different qualia. So, this standard account of qualia fails to specify their actual neural correlates.

 IIT and GNWT fare no better. For example, IIT’s computational accounts of qualia involve differentiating each in myriad ways from all other experiences (sensory and non-sensory). These qualia spaces are thus so staggeringly complex that they’re incapable of spelling out precise correlates for different qualia (Aaronson, 2014)—let alone in testable ways. So, once again, existing views face difficult problems in specifying the NCCs of crucial traits of minds.

 NP offers a potential solution to this problem too. It relies on growing evidence from many studies that the different sensory qualia correlate with different sensory-detector proteins (which are intensely electrical). Examples are that temperatures correlate with unique ion channels, such as TRPM8 for cold, TRPV3 for warm, and TRPV1 for hot. Also, sweet tastes correlate with the unique GPCR complex T1R2/T1R3, savory correlates with the T1R1/T1R3 complex, and bitter correlates with the GPCR family TAS2R (see <https://www.genecards.org/> for details). Additionally, the primary colors correlate with OPN1LW, OPN1MW, and OPN1SW, which are GPCRs of the opsin class (ibid.).[[3]](#footnote-3)

 There are far too many correlations across the various sense modalities to cover here (see Jones, 2019, for a much fuller list with citations). There’s also evidence that such correlations hold between emotional qualia and limbic hormonal receptors. For example, oxytocin and vasopressin proteins correlate with feelings of love, while estrogen and testosterone correlate with lust (Fisher, 1996), endorphin correlates with euphoria (Sprouse-Blum et al., 2010), and adrenaline correlates with vigilance (e.g., Bayerl & Bosck, 2018). One of my papers now under review lists 36 proteins that correlate with primary emotional and sensory qualia, which on most accounts number in the dozens (excepting odors, whose numbers aren’t fully known).

 The experimental procedure for establishing these correlations generally relies primarily on J.S. Mill’s method of differences. For example, it was shown that intracerebroventricular infusion of oxytocin—which activates the oxytocin receptor OXTR—induced partner preference in un-mated females (Insel & Hulian, 1995), while oxytocin antagonist blocked this mating-induced pair-bonding (Ross & Young 2009). Also, vasopressin may substitute for deactivated oxytocin (Berendzen et al., 2023). NP thus treats these different qualia as the hidden substances of these different proteins.

 Note that this attribution of love to oxytocin is only meant to account for the innate emotional feeling (sheen) of love experiences, not the crucial conceptual components of love experiences, which are highly complex and learned. Also, feelings of love are tinged with other emotions with different hormonal sources, such as joy, lust, jealousy, and anguish. Finally, levels of oxytocin are affected by interactions with other hormones, so love feelings are complexly modulated by various hormones. Similar modulations occur with other hormones.

 Similarly, in sensory pathways, cross-fiber comparisons modulate different protein activity levels and thereby modulate qualia levels. For example, the three OPN1 proteins in retinal cones have overlapping sensitivities to specific wavelengths of light. The relative intensities of their reactions help sort out which wavelength is actually present. Here, short-wavelength light mainly activates OPN1SW with blue qualia, while simultaneously inhibiting other OPN1s. The upshot is that, in NP, blue resides in this OPN1SW, not in the cross-fiber comparison circuitries, which just modulate the levels of OPN1 activities. Qualia are thus protein *substances*, not *computations*.

 It may seem that neuroplasticity threatens this account of qualia. For example, if visual cortex is recruited for somatosensory processing by blind subjects, and these cortical detectors are activated, then subjects report somatic qualia. This familiar point threatens NP’s claim that visual-detector proteins correlate with visual qualia. But NP isn’t threatened if neurogenesis and plasticity yield not only new detector synapses but also new detector GPCRs and channels. Many somatosensory GPCRs and channels already exist in occipital and parietal lobes (Su et al., 2004), so neurogenesis of more of them would hardly be surprising.

All this has implications for the easy and combination problems. In NP, qualia proteins, when activated, generate EM currents and fields that bind these charged proteins to form overall unified perceptions and emotions (these currents are exceedingly powerful in these ion-channel and GPCR detector proteins, which helps explain why perceptions and emotions are so intensely conscious). The conscious EM fields *reach into and unify* the proteins’ qualia. Simple (micro) experiences in proteins can thus combine to form our familiar complex experiences. This further helps NP with the easy and combination problem. This proposed combination via fields isn’t implausible. Consider EM fields and visual images, for example. Both arguably arise from discrete neurons and reach across space in a continuous, unified, intangible form. Also, the images pictorially resemble EM activity across retinal neurons—and across brain neurons (such as grid cells) that map onto retinas. So, it’s not implausible to claim that complex visual images arise electrically from simple neuronal levels in continuous, unified forms—hidden beyond what EEGs show of this electrical activity.[[4]](#footnote-4)

While NP’s account of how qualia combine to form images draws in these ways on its neuroelectrical approach, NP’s account of how these various qualia actually originate additionally derives from NP’s panpsychism. For, as it turns out, the only known features of these proteins correlated with our different qualia are these proteins’ masses and their derivative rest energies (see Jones, 2019). The different qualia thus seem to ultimately reside like a rainbow in narrow bands of rest energies of electrically bound protein masses. This leads to panpsychism in that other electrically bound masses would thus probably have their own qualia, right down to the fundamental fermions (which all differ in their masses).

So, how does all this help NP deal with the easy and combination problems concerning how minds arise? It helps NP explain the mind’s qualia and unity (which neuroscience fails to). NP’s panpsychism explains how qualia are protein substances, while its electrical approach explains how neural EM fields reach as a continuous whole into proteins to bind them into the overall unified experiences of our minds.

**4.3 Testable Predictions About Qualia and Unity**

NP’s account above of the mind’s qualia and unity is based on considerable recent evidence. Also, its panpsychist and neuroelectrical approaches together yield the following two unique, testable predictions about (respectively) how different qualia arise and how they unite to join simple experiences into complex ones. Both are thus important to the easy and combination problems.

 (1) The first prediction—about how different qualia arise—isn’t a single experiment but a series of them. For it necessarily pertains to numerous neural correlates of qualia, not just a single one. The existing list of qualia-protein correlations has primarily come from fairly standard experimental procedures in which qualia (in the form of loving behavior, pain behavior, etc.) are shown to appear when a certain protein is activated—and not to appear when the protein is deactivated. Now the prediction is that these existing procedures will ultimately go beyond already discovered qualia-protein correlations (and qualia-mass correlations) to fully establish that all primary sensory and emotional qualia correlate with proteins. This is a real test of my hypothesis about the origins of qualia because it offers a clear path to falsifying the hypothesis. For example, primary odor qualia (whose precise correlates aren’t yet known) might not turn out to correlate systematically with detector proteins. However, the degree to which the qualia-protein correlations do continue to hold up is the degree to which my qualia-protein-correlation hypothesis is experimentally tested and confirmed.

 (2) The second prediction—about how qualia combine—is more complex. My hypothesis is that EM fields unify the qualia of myriad proteins to form images. My prediction is that blocking the oscillating EM field between proteins will block the images from forming. This can be tested by altering a proposal in Libet (1993). He suggested that a slab of human sensory cortex—about to be therapeutically removed—could be isolated from surrounding cortex (by, for example, slicing their connections with lasers). He predicted that if this isolated slab is artificially stimulated, it will continue contributing to reportable experiences. For experience doesn’t reside in neural connections but in the conscious field arising from cortex as a unified whole (pp. 396, 400).

 My alterations are as follows. The test subject should be a mouse trained to respond with leg motions when three blue spots appear in a row to one eye (the other eye is covered). Its head and eyes would be held in place while a small cortical slab corresponding to one of the blue spots is sliced out by lasers. My prediction is that the mouse will continue responding to the three spots, but only when the slice is under approximately 400 microns thick. (This distance is derived from Chiang et al., 2019, who discovered that EM fields—not synapses or gap junctions—propagate signals across sliced rat hippocampus tissue up to 400 microns.)

 If this second prediction is verified, it will indicate that the EM oscillating field in this cortex (but not any neuronal particles or structures) unifies color detectors together to form overall images. But this indication could be strengthened by a second step designed to show that if the EM field disappears, then the color detectors will fail to unify. Here, a strip of the mouse’s cortical tissue could be removed from inside the slab and artificially stimulated to fire. Voltage clamps would be applied in the strip of tissue (this strip is intact, not sliced) to cancel out the EM components of the oscillating signals running through the tissue (for details of this sort of procedure, see Shivacharan et al., 2019; Chiang et al., 2019). The prediction is that canceling the field will block propagations of the signals across the intact cortical tissue.

 Experiment #2 (both of its steps) show that signals are propagated across cortex via EM fields even when the cortical fibers are cut, and the signals fail to propagate if the field disappears. Experiments #1-2 are important because, as already noted, standard neuroscience fails to explain how the key mental traits of qualia and unity arise. These experiments offer a real test of NP because no other empirical theories can make or account for these predictions. Standard neuroscience explains qualia and unity in terms of information in overall computational circuits. So, it can’t make predictions about qualia and unity in terms of neural substances at protein levels. Other field theories besides NP have trouble accounting for some of these predictions too (see §5).

 Furthermore, besides NP’s panpsychist metaphysics, no other metaphysical theories can clearly make or account for these predictions about qualia and unity. Few other metaphysical theories can say that conscious EM fields reach into protein masses and unify their qualia together. Reductive physicalism might try to. But it doesn’t explain why visual images are unobservable across neural space, while NP does explain how they’re hidden there. Nonreductive theories usually tie images to abstract functions, so they too have trouble explaining how images can reach across neural space. Dualist theories typically outright deny that images are spatial. Other field theories besides NP rely on metaphysics that also face troubles explaining images (again, see §5).

 In summary, although neuroscience has failed to explain how our various qualia arise and how they bind to form unified experience, NP offers a neuroelectrical account here that’s based on growing empirical evidence and is testable. This basic electrical mechanism helps NP defuse the easy and combination problems concerning how simple experiences unite to form complex minds.

**4.4 The Mind’s Subject**

Now we come to the final step in dealing with the easy and combination problems—explaining how subjects arise in neuroelectrical terms. The subject is the mind’s controlling center. Accounts of its nature, origin, and NCCs are rather speculative.[[5]](#footnote-5) In NP, the subject arises neuroelectrically from simpler levels. The aim below isn’t to demonstrate how this evolution occurred but just to sketch its possible course in line with evidence from existing science.

 At its lowest level, this evolution begins in the electrical activity that binds the simple consciousness in neurons to create overall perceptions and emotions, as described above. These combine to form simple desires. Some emotionally charged experiences are stored in electrochemical form as long-term memories. They’re reactivated electrically in working memory, which holds various items in consciousness together via oscillating EM activity (Lisman et al., 2013). Working memory thus enables thought to envision obstacles and options. This is the level of attention and access consciousness, whose mechanisms have been investigated by Lamme (2004), Dehaene (2011), and others.

 This electrical activity is fully conscious, but it involves the subliminal use of circuitries underlying conceptual skills. The fully conscious aspect of these skills allows flexible, creative use of their automated, subliminal aspects—as in modifying routines, putting ideas into words, or searching for relevant memories. This involves higher cortical areas with conceptual and executive functions. In this way, new skills are created, further enhancing the powers of thought. All these activities are neuroelectrical (electrochemical).

 The subject is nothing but all these neuroelectrical strands—emotion, perception, memory, and thought—combined together to address not only the external world and its challenges, but also inner mental life and its conflicting needs and ideas. The subject isn’t something we can spot within us in addition to these strands—it’s just all these electrochemical strands working together to solve problems. It’s the real, underlying nature of all their conscious EM energy.

 There’s some evidence that subjects are EM energy. As just argued, the subject resides in the brain’s unified electrical activities of perception, emotion, memory, et cetera. Also, as Zeki (2003) notes, we haven’t found any single, unified cortical area where all conscious pathways converge. The best candidate for the subject’s location is thus the brain’s single, unified EM field. Furthermore, as argued below, the subject uses electrical activity to guide brain operations.

 This conscious subject is the prime source of our creativity, intelligence, and autonomy. It frames problems, seeks options, considers solutions, then executes decisions by triggering motor neurons. Arguably, the subject is an autonomous agent which controls its own activity.

 The familiar reply is that the subject’s conscious deliberations don’t affect events any more than the moving shadows in an intersection affect traffic flow. Deliberations are epiphenomena (entities without powers to affect anything). They’re just puppets of neural causality.

 However, we have direct introspective evidence that our deliberations occur consciously, yet there’s no physical evidence that they’re instead made just by nonconscious brain circuits. Pockett (2006) finds no neuroscientific evidence that deliberations are epiphenomenal. Nor are epiphenomena credible on grounds of evolution by natural selection (Lindahl & Arhem, 2016).

 In NP, there is no room for epiphenomena for three additional reasons.

 (1) NP’s pure panpsychism treats minds, brains, and everything else as forms of consciousness that occupy space and exert forces. So, neither minds nor consciousness in general can be epiphenomenal.

 (2) NP presents evidence that minds actually affect brains and thus aren’t epiphenomena of brains. That is, in addition to the evidence above that mind is a unified neural EM field, there’s also fast-growing evidence that this field not only arises from brains but also affects brains. It has long been felt that the effect of this field on neurons is instead negligible. But the point is that there’s now evidence that fields alone—without the particles exchanged by neurons—can transmit nerve impulses and even jump across complete slices in neurons to do so (Chiang et al., 2019). There’s also recent evidence that oscillating fields produce oscillating firing in nearby neurons—and that these oscillating circuitries help guide cognition by (for example) sculpting the focus of attention and the content of working memory and imagination (Bastos et al., 2018; Kay et al., 2020). So, there’s now evidence that neuroelectrical activity not only creates our qualia and binds them into unified experiences, but also gives these experiences the means to guide brain activity—quite contrary to epiphenomenalist claims.

 (3) NP implies that the mind’s causality is partly autonomous of brain activity and thus not an epiphenomenon of brains. While neuroscientists can detect an EM field shifting across a brain, they can’t show how the field weighs moral choices or even chooses which foods taste best. For example, if we compare wines, the decision of which tastes best comes ultimately from intuitive, conscious qualia comparisons that are hidden in the field. In NP, all causality is conscious, and we’re directly aware of consciously making choices involving these qualia. So, these choices can’t be made by nonconscious circuits. They’re made by conscious energy fields. The same is true of our conscious ideas. The evolution of applied geometry came partly from geometers’ direct, conscious insights into the relations between geometric figures. Imagination thus brings an unfolding conscious logic of ideas to our behaviors that transcends neural causality.

 For these reasons, in NP, subjects are autonomous agents, not puppets of neural and other causes. The subject’s autonomy extends into its ability to influence the jungle of emotions from our genomes and the towering institutions of our societies. While the subject is profoundly shaped by its neural, biological, and social roots, it isn’t a mere puppet of them. With its conscious plans and ideas, the autonomous subject can arguably modify these roots to a degree. It can reform society, control emotions, and modify brain activities.

 In NP, the evolution of autonomous subjects marks the transition from the mind’s neurobiological foundations (sketched above) to its psychological and sociocultural foundations. The synergy of all these fortifies **our** intelligence. For example, our genes promoted ever-more powerful minds and cultures. This cultural motor created technologies, including language, that transformed our societies and minds. It led us from the confined world of beasts into the wide-open possibilities of civilization and reason. We alone can choose who and what we are.

 These endless possibilities are the source of not just our distinctive autonomy but also of our peculiar predicament. Due to our powerful yet limited foresight, we roam between the sure-footed realms of the beastly and divine. We wander as lost souls through the uniquely human world of warring ideas and daunting choices.

 To summarize, in NP, the subject arises neuroelectrically from the unifying of perception, emotion, memory, and other activities. The brain’s unified EM field is the only site available in brains for this unified subject. This is the final step in NP’s defusing of its easy and combination problems. It shows how the subjective mind can arise by combining simple experiences in neurons to form complex forms. It also shows how the mind is partly autonomous of the neural and sociocultural factors that create it. This rise of the autonomous mind marks the transition from the mind’s neurobiological foundations to its psychological and cultural foundations. This transition helps show how impoverished purely neural approaches to minds are.

**5. NP Yields a New EM-Field Theory of Mind**

I’ve tried above to show how NP offers a mind-body solution by overcoming the hard and easy problems without existing pitfalls. I’ll now close with ideas about NP’s status as an EM-field theory of mind.

 Such theories are nearly a century old (see Kohler & Wallach, 1944). They treat minds as identical to, or derivative of, neural electromagnetic fields (Jones, 2013). Field theories have been very rapidly proliferating recently, for they draw on considerable experimental evidence, withstand past criticisms, and help avoid serious problems that neuroscience has in explaining the mind’s unity, qualia, and subject in purely synaptic terms (Jones, 2019; Jones, in review).

 These field theories now take numerous forms. Yet they share certain core problems. As already noted, in such theories, the mind is generally identified with, or derivative of, neural EM, which unifies the mind and allows it to interact with brains. For most current field theorists (e.g., McFadden, 2002, 2019; Hunt & Schooler, 2019; Keppler, 2021), the mind is emergent from, or intrinsic to, information in the global field patterns pervading brain areas. This information approach raises three problems that NP tries to avoid (for details, see critiques of field theories from Kohler to the most recent ones in Jones, 2013; Jones, 2019, and Jones, in review).

 (1) If qualia and their combinations in pictorial images are all encoded in field information, why have no such codes been found? Theories from Pockett (2000) to Hunt & Schooler (2019), Keppler (2021), etc. assume they can be found, but fail to specify any. While images of objects have been inferred from field patterns detected by EEGs (e.g., Nemrodov et al., 2018), these inferred images only roughly resemble the actual objects, and they come from areas like fusiform gyrus, which merely help recognize certain objects but don’t actually create actual images (lesions to this area harm the former ability, not the latter— Jones, in review). By contrast, in NP, qualia and images aren’t abstract EM information. They’re conscious EM substances that have colored, pictorial form because they reach across cortical maps which connect into retinas’ (Jones, 2019).

 (2) If information in field patterns encodes images, how do we get from these codes to the images we actually experience? Information approaches offer three radically different entities—abstract information, field patterns, and conscious images—with obscure relations between each (§1.3 above). Even if the codes for images could be found, it would still be deeply mysterious how colored, pictorial images emerge from field codes that lack colored, pictorial form. NP is clearer and simpler. Again, images are just the underlying nature of neuroelectrical activity laid out in pictorial form across neural maps, and hidden behind what beyond what EEGs detect. Retinal EM activity contributes to images’ pictorial form, V4 EM contributes to images’ colors, V1 EM contributes to images’ pictorial detail, and EM across all levels contribute to images’ unity.

 (3) If minds are global fields inside brains, why don’t intense fields from MRIs, etc. unite these mental fields together? This issue faces virtually all field theories, except perhaps Ward and Guevara (2022), who limit qualia to the Thalamic EM field. In NP, fields aren’t fully conscious globally—they’re just fully conscious where they’re strongest (right in the currents along circuits). Fields between brains are quite negligible relative to these intense local fields created right inside currents at atomic distances. So, experience is effectively unified in brain circuits, yet not between brains (Jones, 2019). As noted above, these locally conscious fields fit evidence in Koch et al. (2016) that the best way to track images is via locally activated EEGs, which spot local EM fields.

**6. Conclusions**

Neuroelectrical Panpsychism (NP) deals with the hard problem by treating everything as conscious beyond what instruments and sense organs detect of it. NP deals with the easy (and combination) problem by giving evidence that neuroelectrical activity unifies consciousness in neurons to form minds, from their simplest qualia to their overall subjects. NP does this while avoiding the pitfalls in existing neuroscientific and metaphysical theories. It may offer a clear, simple, testable mind-body solution.

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1. NP’s contrast between observed matter and its underlying reality might seem dualist. But it isn’t actually, for only the underlying matter is real. Observed matter is just perceptual appearances. [↑](#footnote-ref-1)
2. Some cortical activity is weak and subliminal (e.g., routine conceptual skills). It’s thus of little use in unifying consciousness. By contrast, some cortical activity is strong and conscious (e.g., creative thinking). Its extensive feedback loops and phase-locked EM fields produce a powerfully unified consciousness. [↑](#footnote-ref-2)
3. These various electrically active membrane proteins appear not just in peripheral levels but also cortical levels in sensory circuits. These qualia proteins actually activate electrical activity in the circuits at peripheral levels. These electrically charged proteins also reside within the circuits’ electrical activity at cortical levels. So, the proteins are vital parts of this electrical activity at all levels. [↑](#footnote-ref-3)
4. This account of images as inner pictures in our heads does not commit the fallacy of positing a little man in an inner theater who makes sense of incoming images. For in this theory images are already conscious and meaningful. No little man is needed to make sense of them. [↑](#footnote-ref-4)
5. The subject’s existence has been doubted on grounds that, firstly, it’s not observable introspectively. But it is observable in the form of the mind’s decisions, which involves plans, values, and memories. This controlling center gives the mind’s contents a continuous, coherent identity. Secondly, there’s arguably no central subject where all information converges—just multiple parallel channels, which precludes binding. But there is in fact considerable evidence today that binding actually does occur. [↑](#footnote-ref-5)