

Consciousness: a Natural History*

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[W]e always start at the sensory end and try to come out at the motor side. I very much agree with the late von Holst when he suggests that we start at the other end and work our way (sic) back toward sensation.... It requires some different way of looking.

H.L. Teuber¹

If any person thinks the examination of the rest of the animal kingdom an unworthy task, he must hold in like disesteem the study of man.

Aristotle (*Parts of Animals*, 645a26.7)

1 Introduction

Thomas Nagel, in a review of John Searle's (1992) book, *The Rediscovery of the Mind*, states that "we do not really understand the claim that mental states are states of the brain." He follows this statement more finely with the remark that, "We are still unable to form a conception of *how* consciousness arises in matter" (Nagel, 1993, p. 40). The missing conception is, of course, really a missing answer: How *does* consciousness arise in matter?

Nagel implicitly raises the question at the culmination of a discussion of what he categorizes as Searle's first arguments against materialists. He lays out these arguments after summarizing Searle's view of how various theories of mind have attempted to reduce the mental to the physical and of how they all fail to take consciousness into account. Without an account of consciousness, according to Searle, none of the theories can rightfully claim to be a theory of mind. Quoting Searle, Nagel points out that "The crucial question is not 'Under what conditions would we *attribute*

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¹ Teuber (1966), pp. 440f. He is discussing D.M. MacKay's paper "Cerebral Organization and the Conscious Control of Action," the theme of which is "the controlling function of the brain in voluntary agency."

mental states to other people?’ but rather, ‘What is it that people *actually have* when they have mental states?’” (p. 38). Nagel’s agreement with Searle that “the subjective” is precisely the crucial question to address is exemplified in his recognizably-worded statement that “Facts about your external behavior or the electrical activity or functional organization of your brain may be closely connected with your conscious experiences, but they are not facts about *what it’s like* for you to hear a police siren” (p. 39, italics added). The question of “*how* consciousness arises in matter” thus appears absolutely central for both Nagel and Searle.

In this paper I outline basic reasons for thinking the question spurious. This critical work will allow me to pinpoint troublesome issues within the context of definitions of life and in turn address the properly constructive task of this essay: to demonstrate how genuine understandings of consciousness demand close and serious study of evolution as a history of animate form. I should note that this demonstration will omit a consideration of botany, though plant life is indisputably part of an evolutionary history of animate form. The omission has nothing to do with importance, but with keeping a manageable focus on the question of consciousness; and it has nothing to do either with a trivialization of the ways in which plants are animate, but with an intentional narrowing of the complexity of an already complex subject. As will be shown in the concluding section, the demonstration has sizable implications for cognitivists generally and for philosophers in particular, notably: (1) a need to re-think the common assumption that unconsciousness historically preceded consciousness; (2) a need to delve as deeply and seriously into natural history as into brains and their computational analogues; (3) a critical stance toward arm-chair judgments about consciousness and a correlative turn toward corporeal matters of fact.

2 Reasons For Critically Questioning the Question

To begin with, while the question seems to phrase the difficult point in exacting terms, it in fact assumes certain metaphysical distinctions in advance of identifying them, showing them to be the case, and/or justifying them theoretically. To that degree, the question either undermines or precludes any answer that might be proposed.² The assumed metaphysical distinctions are actually three in number. Two of them have a relationship to a particular history, the relationship in each case depending upon the interpretational latitude given to the word “arises.” In the most general sense, the question assumes a historical distinction between the organic and the inorganic, i.e. an arising of the former from the latter. Thus, in a broad sense, the question assumes a certain placement of consciousness with respect to cosmic history. At closer range, the question assumes a historical distinction between “higher” and “lower” forms of life, i.e. a time at which “higher” capacities arose. In a broad sense, it thus assumes a certain placement of consciousness with respect to the evolution of life, most especially, human life. In still finer perspective, the question assumes a distinction between mind and body, i.e. an arising (development, emergence, issuance) of the mental from the

² Whether it undermines or precludes depends upon the degree to which the assumptions are recognized and acknowledged.

physical. In a broad sense, it thus assumes a certain placement of consciousness with respect to (merely) corporeal being. The first two distinctions are plainly historical; the third distinction has no particular historical character, though some people — for example, philosopher Daniel Dennett — accord it one in ontogenetic terms. Writing of human infants, Dennett says that “[consciousness] arises when there is work for it to do, and the preeminent work of consciousness is dependent on sophisticated language-using activities” (Dennett, 1983, p. 384). To acquire a bona fide historical character rather than being assigned one on the basis of an unsubstantiated ontogenesis, the third distinction would have to address the question of the origin of consciousness within the context of the two earlier distinctions, since it is only in the context of those distinctions that the third distinction actually comes to prominence. In effect, an answer to the question of “how consciousness arises in matter” does not reduce to saying how a certain physical or neurological maturity drives consciousness; it must specify how consciousness comes to be in the context of a progressively finer natural history, one that takes into account the actual lives of individual living forms as they are understood within cosmic and animate evolutionary histories. To answer the question in this way, however, necessitates a revision in the question itself, precisely because the historical character of the first two distinctions demands it. In particular,

consciousness does not arise in *matter*;
it arises in organic forms, forms that are *animate*.

What is required is thus an exact rendering of how consciousness is grounded in animate form. How does consciousness come to be in the natural history of living creatures and to inhere in the animate?³

³ A reviewer wrote that “giving an explanation of ‘how’ if one cannot identify ‘what’ seems difficult, since the object of the inquiry is not specified.” In practice, where the study of consciousness is concerned, the distinction between “how” (consciousness arises) and “what” (consciousness is) is far less straightforward than this remark implies.

As may be apparent from the discussion thus far, a perusal of current literature on consciousness shows no consideration of the distinction, and thus no apparent inclination on the part of writers to be concerned with it or to think that *what* must be clarified before a consideration of *how*. Indeed, writers on consciousness launch their inquiries straightaway, even sometimes specifying in the beginning what consciousness is in terms that beg the question of saying just what it is — e.g., “we can say that a mental state is conscious if it has a *qualitative feel*. . . . The problem of explaining these phenomenal qualities is just the problem of explaining consciousness” (Chalmers, 1996, p. 4). The muddle strongly suggests that clarification of the distinction requires an acknowledgment of what is called “the hermeneutic circle.” In classic terms, one already understands that which one is on the way to interpreting; and conversely, one has already interpreted that which one has already understood. In more scientific terms, one already knows *the what* that one is about to investigate; and conversely, one has already investigated *the what* that one already knows. In short, a researcher could hardly investigate anything if there were not already a known delimited subject at hand, a subject that the researcher already knows at least to the extent that s/he wants to investigate it. Moreover the process of investigation is itself a hermeneutic circle: as what is investigated becomes known in more exacting ways, that new knowledge becomes the basis for further investigation. In just this way, *what* consciousness

Approaching the question of consciousness from an historical perspective is certainly not unique. Neurobiologist Gerald Edelman has emphasized repeatedly the necessity of genetic understandings, genetic not in the sense of genes, but in the sense of origins. As he insists, “There must be ways to put the mind back into nature *that are concordant with how it got there in the first place*” (Edelman, 1992, p. 15, italics added). His approach is to consider morphology and history at all levels: not just at the level of the embryological development of brains, but continuing through to the level of actual life, thus to the level of movement and of experiences of moving, and to a consideration of the effects of these experiences on morphology. Through an attentiveness to an experiential history and its morphological moorings and effects, Edelman conjoins typically separated aspects of creaturely life. He discovers cells, anatomy, and morphologically structured mappings within the brain as undergoing “continuous electrical and chemical change, driving and being driven by animal movement.” He furthermore finds animal movement itself to be “conditioned by animal shape and pattern, leading to behavior” (p. 15). Though he does not term it such, *animate form* is clearly central to his investigations.

Whether or not one is persuaded by Edelman’s theory of the origin of consciousness, his focal emphasis upon the need for a proper history of consciousness cannot be dismissed. It articulates from an explicitly evolutionary vantage point the implicit but unexamined historical claims of Nagel and Searle. The essentially evolutionary convergence is not surprising given Searle’s insistence on “biological naturalism”⁴ and Nagel’s famous inquiry about a bat (Nagel, 1974); each evinces overtones of a natural history of the animate. Conversely, when Edelman (1992) writes, “[I]t is not enough to say that the mind is embodied; one must say how” (p. 15), he is giving voice to a *how* as pressingly and provocatively “subjective” (e.g., “each consciousness depends on its unique history and embodiment,” p. 139) as that of Searle and Nagel, but a *how* explicitly tethered to the evolution of life.

Philosophers of mind commonly pursue the same *how* question as Searle and Nagel but many, if not most, take quite other paths and enter at a decisively earlier point. Daniel Dennett and Paul Churchland are notable in this respect and warrant special attention. Both endeavour to offer a historical perspective by placing consciousness first of all in cosmic time. Their respective attempts are not protracted by any means — they do not reflect at any length upon the cosmic beginnings of life — and neither speaks explicitly of *the organic* and *the inorganic*. In what is nonetheless a clearly cosmological answer to the *how* question, both advert straight off to the advent of replicators and of the process of self-replication. Churchland’s opening sentence of the first section (“Neuroanatomy: The Evolutionary Background”) of a chapter titled “Neuroscience” reads: “Near the surface of the earth’s oceans, between three and four billion years ago,

is may be continually elucidated in the process of elucidating *how* it arises. The present paper progressively does just that: it answers the *what* question in the course of specifying *how consciousness arises in animate form*.

⁴ “Mental events and processes are as much part of our *biological natural history* as digestion, mitosis, meiosis, or enzyme secretion” (Searle, 1992, p. 1, italics added).

the sun-driven process of purely chemical evolution produced some *self-replicating molecular structures*” (Churchland, 1984, p. 121, italics in original).⁵ Dennett’s opening sentences of the second section (“Early Days”) of a chapter titled “The Evolution of Consciousness” reads: “In the beginning, there were no reasons; there were only causes.... The explanation for this is simple. There was nothing that had interests. But after millennia there happened to emerge simple *replicators*” (Dennett, 1991, p. 173, italics in original). Clearly, in both cases there is an attempt to separate out the inchoate creaturely from the “purely chemical,” thus to specify the cosmic beginnings of life and thereby the nature of the cross-over from the inorganic to the organic.

Dennett’s and Churchland’s modest nod in the direction of a natural history is short-lived, as such nods generally tend to be among cognitivist philosophers. Their respective “findings” from studies of the beginnings of life on earth are neither carried forward in a consideration of the evolution of animate forms nor examined in the light of a diversity of intact, actually living bodies. Their respective allusions to self-replication suffice to locate the origin of a natural history of consciousness. In finer terms, self-replication offers for them a fully satisfactory answer to the historical question of “*how consciousness arises in matter*” because self-replication is where it all began and where it all began is where it still is: consciousness is a matter of matter. The molecular explanation of consciousness is succinctly exemplified in Churchland’s *Matter and Consciousness*. Whatever Churchland says of the self-replicating beginnings of life at the end of his book is predictably cued in advance by what he has stated at the beginning of his book about human life:

[T]he important point about the standard evolutionary story is that the human species and all of its features are the wholly physical outcome of a purely physical process.... We are notable only in that our nervous system is more complex and powerful than those of our fellow creatures.... We are creatures of matter. And we should learn to live with that fact. (Churchland, 1984, p. 21)

The problem comes not in living with that fact but in living hermetically with that fact. Living hermetically with that fact comes at the expense of a viable natural history, for the fact passes over fundamental understandings of animate corporeal life. These omissions in understanding emerge in a striking way in the metaphysical relationship Churchland proposes between the organic and inorganic (though again, not specifically using these broadly cosmic terms). He insists that “living systems” differ from

⁵ It is of interest to point out that Churchland’s idea of a natural evolutionary course of events, a kind of biological determinism with respect to life and intelligence, conflicts with prominent ideas and experimental findings in biology. Churchland states that “[G]iven energy enough, and time, the phenomena of both life and intelligence are to be expected as among the natural products of planetary evolution.” Stephen Jay Gould is a strong proponent of the view that evolution is a thoroughly contingent, non-repeatable historical process (see, e.g., Gould, 1989; 1995). See also McDonald, 1995. The article summarizes microbiologist-zoologist Richard E. Lenski’s intricate experiments and their results, which show the play of chance in the course of evolution and the unrepeatability of natural history.

“nonliving systems” “only by degrees”: “There is no metaphysical gap to be bridged” — or as he says a paragraph later with respect to “the same lesson” (i.e. difference “only by degrees”) applying to intelligence: “No metaphysical discontinuities emerge here” (p. 153). This, perhaps at first surprising, viewpoint on the organic and inorganic is not *shown* to be true by Churchland, not even through his “lessons” in how to forge definitions of life that will be opaque to discontinuities, such as claiming that “the glowing teardrop of a candle flame ... may just barely meet the conditions of the definition [of life] proposed,” i.e. life is “any semiclosed physical system that exploits the order it already possesses, and the energy flux through it, in such a way as to maintain and/or increase its internal order.” In brief, Churchland’s viewpoint is of *necessity* true in virtue of Churchland theory: if human consciousness is mere matter — relatively “more complex and powerful” matter (p. 21), but mere matter nevertheless through and through — then the organic can differ from the inorganic “only by degrees.” Metaphysical distinctions are blurred by fiat as only they can be in such a theory.

At least one consequence of the blurring should be singled out in order to demonstrate the questionable propriety of claiming that “No metaphysical discontinuities emerge here.” A continuous metaphysics creates a problem for distinguishing in traditional western ways between life and death. However rationally doubtful, on the smudgy face of things, quasi-eternal life (“quasi” insofar as eternal life is apparently punctuated from time to time but not wholly discontinued) suddenly emerges as a viable metaphysical future possibility — if only materialist philosophers can deliver up their stone, aided, of course, by deliveries on promises by western materialist science. Of course, the notion of cosmically differing “only by degrees” is in a metaphysically twisted and thoroughly ironic way also supportive of eastern notions such as reincarnation and of so-called “primitive” notions of life after death, notions exemplified by non-western burial practices in which dead persons are interred along with items they will need in their ongoing journeys. With respect to these latter notions, however, it is rather some form of the mental that is primary; matter is simply contingent stuff for the instantiation of spirit. What differs “only by degrees” is thus not fundamentally matter at all but a principle of life — *spiritus*, *pneuma*, or whatever else might be conceived to constitute invincible and inexhaustible animating vapours.

The consequences and ramifications of holding a “no-gap-here” metaphysical theory about the organic and inorganic aside, the major question is how — and to what extent — such a theory actually clarifies consciousness. In particular, however much information Churchland gives us, whether about self-replication, “energy flux” (pp. 152-4), neurophysiology, or any other material aspects of living systems — and whether in direct terms or in terms of computational networks — and whatever the progressively refined definitions he gives us of life, we never seem to arrive at an elucidation of consciousness. The reductive equation of consciousness to matter is not *in fact* shown. The reductionist programme is at best a matter of correlation; that is, when there is consciousness, there is a certain kind of electrical activity ongoing in a brain; when there is not consciousness, there is not that certain kind of electrical

activity ongoing in the brain, but electrical activity of another kind, or no electrical activity at all. No actual identity has ever been shown to exist between a thought, an awareness, a concept, an intention, a meaning, or any other kind of “mental” happening and a particular constellation of material happenings, i.e. neural events in a brain. As physiologist Benjamin Libet has observed, “One can only describe relationships between subjective phenomena and neural events, not how one gets from one to the other” (Libet, 1985, p. 568). The reduction of the mental to the physical — or the identification of the former with the latter — is thus evidentially ungrounded. In effect, without collateral substantiating facts, it is impossible to cash in reductionist- or identity-theory.

Impediments other than the metaphysical ones discussed above similarly plague accounts of “how consciousness arises in matter.” Primary among these is the claim that consciousness is a brain activity exclusive to humans, hence that short of a *human* brain, there is no consciousness, or at least no consciousness worthy of the name. This thesis impedes an understanding of consciousness in a number of ways. Most importantly, it hazards a conceptual break with evolutionary theory. Not that new capacities and/or new modes of living cannot emerge that are discontinuous with previous capacities or modes in the manner specified by punctuated equilibrium theory, but that a disposition to set humans categorically apart from the rest of nature — whether on the basis of language, art, or whatever — goes unexamined and unchecked. Indeed, with such a thesis, one form or another of creationism can easily hold sway. This is because the core concept of evolution in a historical sense — *descent with modification*, to use Darwin’s exact phrase — is ignored. Humans may in turn be conceived as special creations, even “Special Creations,” as one well-known philosopher affirms (Sellars, 1963, p. 6). A fundamental problem with the view may be stated in the form of a historical truth: while all humans are hominids, not all hominids are human. In particular, with the notion that consciousness is exclusive to *human* brains, aspects of *hominid* evolution become virtually impossible to understand — the beginnings of stone tool-making, for example, by members of the species *Homo habilis* some two and a half million years ago and the development of progressively more complex tool-making techniques by other nonhuman hominid species over the span of those same two and a half million years.⁶ Furthermore, nonhuman animal social behaviours, especially those of our nearest extant primate relatives that have unequivocal affinities with our own social behaviours, become virtually impossible to accredit — patting another individual to reassure, for example, or hiding something from another. Grounds vanish for delimiting these social phenomena as behaviours in the first place, which in turn makes grounds for behavioural categorization, much less grounds for warranted human interpretation and assured comprehension of these nonhuman animals, nonexistent. If consciousness is something only human brains produce, then no matter how much a nonhuman brain, even a *hominid* nonhuman

⁶ The burial practices of nonhuman hominids also become virtually impossible to understand since such practices entail a concept of death. See Sheets-Johnstone (1990), chapter 8, “On the Conceptual Origin of Death.”

brain, might resemble a human one anatomically, creatures that are not human are not conscious but merely robotic pieces of matter. Hence, however much their practices in tool-making or their social interactions might evidence continuities with our own, there are no “mental” connections linking us together. In short, to espouse the notion that consciousness is an exclusively human capacity means that human mental powers are evolutionarily discontinuous with those of other creatures whose behaviours are actually the point of origin of many fundamental human ones and even basically resemble human behaviours. Discontinuity in this instance thus means not an espousal of punctuated equilibrium but an espousal of the view that, however close any particular lineal relationships might be, the connection is purely physical.

It is important to consider this kind of privileging because for all its inconsistencies with evolutionary thought, it is not that disfavoured a view. Dennett’s conception of consciousness, for example, strongly exemplifies and even urges just this privileging of humankind. Unequivocally tethering his view of consciousness to the having of language, Dennett is loath to find consciousness in any creature that does not speak. He claims specifically that “languageless creature[s]” such as bats and lobsters are severely hampered in having no “center of narrative gravity,” and thus have a “dramatically truncated” consciousness “compared to ours.” After making this claim, he asks — himself as much as the reader — “Isn’t this an awfully anthropocentric prejudice?” He goes about answering the question in an even bolder and more radically separatist way, for he immediately counterposes to himself the question, “[W]hat about deaf-mutes? Aren’t they conscious?” His answer: “Of course they are — but let’s not jump to extravagant conclusions about their consciousness, out of misguided sympathy.” Dennett’s criterion is austere and unwavering. No matter a human pedigree, as with bats and lobsters, unless there is language, there is a decidedly impoverished consciousness, if any at all. Dennett concludes that “Many people are afraid to see consciousness explained” because they fear “we will lose our moral bearings”; that is, we might get into bad habits, “treating animals as if they were wind-up toys, babies and deaf-mutes as if they were teddy bears, and — just to add insult to injury — robots as if they were real people” (Dennett, 1991, pp. 447f).

We are a long way from a natural history of consciousness. Given the ultraexclusive defining terms Dennett insists on, it is no surprise that that history is hard to come by. By radically privileging language, Dennett pulls the evolutionary rug out from under us.⁷ Whatever modest nods made in the direction of an evolutionary history at the

⁷ He continues to do so in his later writings (1995; 1996). Not only does his consistent use of quotation marks (e.g. “Clever experiments by psychologists and ethologists suggest other ways in which animals can try out actions ‘in their heads’” [1996, p. 91]) to make distinctions between “us and them” alert us to the hazards of making simple comparisons among extant creatures over the benefits of examining natural history (cf. Sheets-Johnstone, 1992; 1994 [chapter 2]; 1996); but his consistent assessment of nonhuman animals in terms of tasks not common to the behavioural repertoire of the species (e.g. 1996, pp. 133, 157) alerts us to the hazard of making self-serving prescriptions (e.g. “[W]e must not assume that [nonhuman animals think],” 1996, p. 160) over the benefits of examining the presumptions underlying those prescriptions, including the assumption-laden claim that

beginning of his quest to “explain consciousness,” he does not follow through. A consideration of language itself in the terms he conceives it shows his lack of follow-through unequivocally. If, as Dennett explains, human language explains consciousness, then consciousness arose in the form of human language. The question Dennett does not ask himself is how human language itself arose.⁸ Clearly, he *should* ask the question. Indeed, he should ask not only how human language could even have been conceived short of an already existing consciousness but how human language in the beginning could even have been standardized short of already intact consciousnesses.⁹ Dennett does not seem remotely aware of such questions, much less aware of their needing answers — which is why only linguistic creationism can explain a Dennettian consciousness.

In sum, we cannot arrive at an understanding of “how mind got there in the first place” by espousing biological naturalism but neglecting natural history, by wondering what it is like to be a body other than the one one is but neglecting penetrating studies of other animate forms, by championing a metaphysical theory that shackles inquiry before it even begins, by giving selective definitions of life, by privileging human brains, or by explaining consciousness in narrative terms. In none of these instances do we arrive at an elucidation of consciousness as a dimension of the *animate*. Until such an elucidation is given, a viable answer to the question of “how mind got there in the first place” will be consistently baffled.

3 Life and Its Definitions: A Question of Animation and Justification

It is instructive at this point to examine definitions of life more closely — both to exemplify the import of the animate and to highlight in a proper manner the troublesome textual use of quotation marks as a means of apportioning mental credit and distinguishing among mental attributes. Biological texts often devote some pages to definitions of life. Among the constituents of those definitions is self-replication. Order and energy — features Churchland too comes to incorporate in his progressive definitions of life — are also named. Responsivity is specified as a further prime constituent. As one text notes: “Plant seedlings bend toward the light; mealworms congregate in dampness; cats pounce on small moving objects; even certain bacteria move toward or away from particular chemicals.... [T]he capacity to respond is a fundamental and almost universal characteristic of life” (Curtis, 1975, p. 28). Oddly enough, this “fundamental and almost universal” dimension of life does not typically figure in definitions of life (living systems, consciousness) offered by cognitivists

“[T]hose who deplore Artificial Intelligence are also those who deplore evolutionary accounts of human mentality” (1995, p. 370).

⁸ Even in his latest book, he takes the invention of language completely for granted: “There is no step more uplifting, more explosive, more momentous in the history of mind design than the invention of language. When *Homo sapiens* became the beneficiary of this invention....” (Dennett, 1996, p. 147).

⁹ For a discussion of these matters in detail, see Sheets-Johnstone (1990), chapter 6, “On the Origin of Language.”

generally, nor philosophers of mind in particular, especially those in either category who are wedded to information-processing, computational models. Yet responsiveness — bending, congregating, pouncing, moving toward or away, in short, *animation* — commonly appears an integral part of phenomena such as cognition, hence part and parcel of consciousness. If queried on the matter, cognitivists and philosophers might respond — in a manner consistent with pervasive present-day western thought — that it depends on what is doing the bending, congregating, pouncing, or moving toward or away, whether the terms “cognitive” or “conscious” apply, that is, whether the terms are proper ascriptions or not. This answer unfortunately skirts the critical point at issue: justifying the cognitive distinctions one makes diacritically. The point is neatly exemplified by Churchland precisely because his account of consciousness, i.e. eliminative materialism, conceptually precludes diacritical practice to begin with. If the distinction between the organic and the inorganic is blurred, then of course distinctions among the organic are also blurred — just as Churchland in fact says they are blurred with respect to intelligence: there are differences “only by degrees.” But the blurring between organic forms is necessarily finer than the blurring between the organic and the inorganic since organic forms are comparatively more closely related to each other than they are to the inorganic. In effect, to be consistent with Churchland theory, common textual practice should be altered. Quotation marks typically surrounding cognitive functions as they are ascribed to what are termed “lower” forms should be erased. A difference “only by degrees” does not justify them.

To counter that a difference “only by degrees” does not entail that we cannot justly distinguish between degrees of consciousness (cognitive abilities, intelligence) within the organic — that we cannot justly make distinctions on the basis of *who is doing the pouncing*, for example — is a claim difficult to uphold. Proper justification is lacking in the form of wholly objective supporting facts. This is because what basically matters is not who is doing the pouncing; what matters is the ability to provide a wholly unprejudiced rationale for common textual practice. Indeed, the original charge can still be pressed because a fundamental mandate exists; namely, specification of the exact degree(s) at which quotation marks are appropriate. *This mandate exists regardless of what metaphysical theory one espouses.* It is as necessary to Searle’s account of consciousness, for example, as to computational cognitivists’ accounts. But as might be evident, the mandate poses an insuperable problem. Whatever might be claimed to constitute a criterion for distinguishing among degrees of consciousness (intelligence, cognitive abilities) is not a matter of fact but a matter of human judgment. While cranial capacities, neuron counts, dendritic branchings, and body size, for example, certainly constitute matters of fact, these matters of fact do not *in themselves* specify anything whatsoever in the way of a standard. One need only recall what Darwin wrote on the basis of his study of Hymenoptera:¹⁰ “It is certain that there may be extraordinary mental activity with an extremely small absolute mass of nervous matter.”¹¹ In short, the mandate to show appropriateness appears doomed from the

¹⁰ A glossary of biological terms is provided at the end of this article.

¹¹ Darwin (1871/1981), p. 145. Darwin goes on to say: “[T]hus the wonderfully diversified

start. Specification — whatever its theoretical context — turns out to be as completely arbitrary as it is absolutely mandatory; a wholly objective supporting base is nowhere to be found. Indeed, in its arbitrariness, specification can only be labelled “subjective”; a standard completely impervious to human bias cannot possibly be identified. In consequence, a cancelling of all quotation marks appears warranted — though as indicated not necessarily on the grounds of Churchland theory at all. The following description of a bacterium moving “toward or away from particular chemicals” is an especially interesting as well as exemplary candidate in this respect.

Processing in a bacterium may be thought of as a sort of molecular polling: ... the positive “votes” cast by receptors in response, say, to increasing concentrations of a sugar are matched against the negative votes produced by increasing concentrations of noxious compounds. On the basis of this continuous voting process, the bacterium “knows” whether the environment, on the whole, is getting better or worse. The results of this analysis appear to be communicated by electrical signals to the response centers. The final stage, the response, consists of a brief change in the direction of rotation of the several stiff, helical flagella that propel the bacterium. The result is that the bacterium founders briefly and then strikes out in a new direction, once again sampling to see whether the environment is improving or deteriorating (Keeton & Gould, 1986, p. 452).

In addition to being an exemplary candidate for diacritical erasure, the descriptive passage demonstrates in an intimately related way why responsivity — the “fundamental and almost universal characteristic of life” — is of critical import. Sampling, foundering, and striking out in a new direction are precisely a matter of animation and animation is precisely in some sense cognitive or mindful — as in assessing propitious and noxious aspects of the environment. Cognitive aspects of organic animation — in this instance, cognitive aspects of a bacterium’s animation — cannot thus reasonably be considered mere figurative aspects. More generally, cognitive capacities cannot reasonably be reserved only for what are commonly termed “higher-order” organisms.¹²

The unjustifiable use of diacritical markings to distinguish cognitively among organisms leads to a series of interlinked demands: a cessation of reliance on what is in fact a conceptually lazy, inapt, and/or obfuscating textual practice; a corollary recognition of the import of animation; a consequent investigation of the animate in terms of its natural history; a delineation of what it means cognitively to be animate. In a quite provocative sense, one might say that Churchland’s blurring of metaphysical lines itself leads to such a series of interlinked demands. His overarching metaphysical blurring on behalf of an unrelenting materialism — whether one finds the latter credible or not — forces an examination and justification of common textual practice and typical western thinking regarding so-called “higher” and “lower” forms of life. It

instincts, mental powers, and affections of ants are generally known, yet their cerebral ganglia are not so large as the quarter of a small pin’s head. Under this latter point of view, the brain of an ant is one of the most marvellous atoms of matter in the world, perhaps more marvellous than the brain of man.”

¹² For an even more impressive indication of a bacterium’s cognitive capacities, see Losick and Kaiser (1997).

clearly calls our attention to a fundamental question about where and on what grounds cognitive lines are diacritically drawn in order to distinguish among capacities of various forms of organic life. All the same, it is important to emphasize that in answering to the fourfold demand, we are not charged with the task of *understanding matter*, that is, of making appropriate distinctions in material complexity by taking neuron counts and the like. On the contrary, we are charged with the task of *understanding the animate*, precisely as the bacterium example demonstrates. Accordingly, the quest begins from the other side. We take the phenomena themselves as a point of departure, not theory, and earnestly inquire into what we observe to be living realities. Denying distinctions thus becomes in this instance and in a heuristic sense epistemologically salutary rather than metaphysically catastrophic.

Searle's intense concern with preserving distinctions between kinds of intentionality by maintaining diacritical markings is decidedly topical in this context. After giving examples of what he terms "metaphorical attributions of intentionality," and insisting on the necessity of distinguishing between "intrinsic intentionality" and "as-if intentionality," he states rather hyperbolically that "if you deny the distinction [between the two] it turns out that everything in the universe has intentionality" (Searle, 1990, p. 587). Because he is concerned not just with the animate world but with carburetors, computers, and such, his broad claim is perhaps less rash than it might at first appear. Understood specifically in terms of present concerns, his point is that when language is used as in the bacterium passage quoted above, intentionality must be read as describing an "as-if" intentionality — not the real "intrinsic" thing. To accede to Searle's line of reasoning and broad warning, however, is precisely to miss the epistemological challenge, and indeed to forego examining what might lead to foundational¹³ understandings within "biological naturalism." In this latter respect, it is of course also to miss the challenge of a descriptive metaphysics that would adequately comprehend natural history and on that account offer fundamental understandings of the animate world that are informed by evolutionary thought. While the penalty of blurring distinctions can certainly be confusion, it does not necessarily "turn out" that one reaches "absurdity" if one blurs them, as Searle claims (*ibid.*). If the phenomena themselves are taken as a point of departure, it in fact turns out neither that "everything in the universe [is] mental" nor that everything in the universe is material. It turns out only that everything in the *animate* universe needs to be considered as what it is — *animate* — and that in consequence we need to take seriously the historical perspective of evolutionary thought: by examining the lives of living creatures, by determining the corporeal matters of fact that sustain those lives, and by tracing out in an evolutionary sense how consciousness arises in animate form. Only by doing so are we likely to get our conceptual bearings, justify new textual practice, if any, and in the end come to sound understandings of the complexities as well as provenience of consciousness.

¹³ "Foundational" is a perfectly good English word, as in the sentence, "Evolutionary understandings are foundational to understandings of what consciousness is all about."

4 Corporeal Consciousness: A Matter of Knowing

“Know thyself” is a Socratic imperative. It may also be said to be a built-in biological one in a special and fundamental sense. It is important to set this biological imperative explicitly in the mainstream of general cognitivist trends in current western thought and American philosophy of mind. In so doing, we can show in unequivocal terms how the imperative offers a more exacting evolutionary understanding of consciousness. We can furthermore expose, and in equally unequivocal terms, what is typically omitted in the way of empirical evidence in contemporary theories of consciousness. Accordingly, a longer but proportionally richer and more informative route will be taken to its exposition. We might call this route “The Liabilities of a Paradigmatic Cognitivist Account of the Socratic Imperative.” The account is based on descriptive remarks Dennett makes about “The Reality of Selves” in the process of explaining consciousness.

Energetically affirming that “every agent has to know which thing in the world it is!” Dennett (1991, p. 427) begins by specifying what this knowing entails. He considers first “simpler organisms” for whom “there is really nothing much to self-knowledge beyond the rudimentary biological wisdom enshrined in such maxims as ‘When Hungry, Don’t Eat Yourself!’ and ‘When There’s a Pain, It’s Yours!’” In this context, he says of a lobster that “[It] might well eat another lobster’s claws, but the prospect of eating one of its own claws is conveniently unthinkable to it.” He goes on to say that “Its options are limited, and when it ‘thinks of’ moving a claw, its ‘thinker’ is directly and appropriately wired to the very claw it thinks of moving.”

The situation is different, Dennett says, when it comes to controlling “the sorts of sophisticated activities human bodies engage in,” because “there are more options, and hence more sources of confusion” (*ibid.*). He states that “the body’s control system (housed in the brain) has to be able to recognize a wide variety of different sorts of inputs as informing it about itself, and when quandaries arise or scepticism sets in, the only reliable (but not foolproof) way of sorting out and properly assigning this information is to run little experiments: do something and look to see what moves” (pp. 427f). The experimental approach is the same, Dennett says, whether a matter of “external signs of our own bodily movement” or “internal states, tendencies, decisions, strengths and weaknesses”: “Do something and look to see what moves.” With respect to internal knowledge, he adds that “An advanced agent must build up practices for keeping track of both its bodily and ‘mental’ circumstances” (p. 428).

Dennett’s descriptive passages of course readily offer themselves as candidates for erasure no less than passages in biology, not on cosmic historical grounds — Dennett’s materialism does not appear to run so far as to blur the distinction between the organic and the inorganic — but on evolutionary and mind/body ones: Dennett marks “mental” phenomena diacritically both in order to make distinctions between “higher” and “lower” forms of life and in order to maintain a thoroughly materialized consciousness. In short, his theory of consciousness demands that he temper the meaning of “the mental” at both metaphysical levels. What his diacritical markings actually allow is having his material cake and eating it too. However loose his vocabulary (e.g. a *thinking*

lobster), and however much it strays from purely materialist theory (e.g. *mental* as well as bodily circumstances), it is diacritically reined in to accord with the theoretical distinctions he wants to maintain and the materialist doctrine he wants to uphold.

What makes both the entailments and elaboration of Dennett's energetic affirmation such a compelling and richly informative point of departure for examining the bio-Socratic imperative is precisely what they overlook in theory, method, and fact. It is as if proprioception in general and kinesthesia in particular¹⁴ did not exist; whatever the talk of movement with respect to humans, for example, it is as if the *sense of movement* were nonexistent. Thus, one has to *look* and *see* what is moving.¹⁵ In such an account, the kinesthetic is more than overridden by the visual; it is not even on the books. Were one to examine Dennett's theory of human agency with respect to infants, one would straightaway discover its error. Were one to examine his theory with respect to blind people, one would do the same. In a word, and *contra* Dennett, we humans learn "which thing we are" by moving and listening to our own movement. We sense our own bodies. Indeed, we humans, along with many other primates, must *learn* to move ourselves. We do so not by *looking* and *seeing* what we're moving; we do so by attending to our bodily feelings of movement, which include a bodily felt sense of the direction of our movement, its speed, its range, its tension, and so on. Our bodily feelings of movement have a certain dynamic. We feel, for example, the swiftness or slowness of our movement, its constrictedness or openness, its tensional tightness or looseness, and more. In short,

we perceive the *qualia* of our own movement;
our bodily feelings of movement have a certain *qualitative* character.

It is instructive to recall Sherrington's experiential account of proprioception in this context. However inadvertently he excludes kinetic qualia from his account, Sherrington explicitly if briefly affirms it in the course of specifying and describing the nature of our experiential awareness of movement. Underscoring first of all the fact that we have no awareness of neural events, e.g., of nerve fibres "register[ing] the tension at thousands of points they sample in the muscles, tendons, and ligaments of [a] limb," he says "I perceive no trace of all this [neural activity]." With respect to the limb, he states that "I am simply aware of where the limb is, and when it moves." In this context, he also points out that we are not even aware that the limb "possess[es] muscles or tendons" (Sherrington, 1953, p. 248). He goes on to emphasize the lack of

¹⁴ Proprioception refers generally to a sense of movement and position. It thus includes an awareness of movement and position through tactility as well as kinesthesia, that is, through surface as well as internal events, including also a sense of gravitational orientation through vestibular sensory organs. Kinesthesia refers specifically to a sense of movement through muscular effort.

¹⁵ Lest it be thought that Dennett is idiosyncratic in his procedure, consider the nineteenth century German philosopher J.J. Engel's criticism of British philosopher David Hume's account of the derivation of the concept of force: "He ought to use his muscles, but instead he uses his eyes; he ought to grasp and struggle, and instead he is content to watch" (Quoted by Scheerer, 1987, p. 176).

this kind of anatomical awareness in actual experience when he describes the experience of moving the limb “to pick up a paper from the table”: “I have no awareness of the muscles as such at all” (*ibid.*, pp. 248f).¹⁶ The lack of direct experiential awareness of “muscles as such,” however, does not impede an experiential awareness of the movement. As Sherrington affirms, though “I have no awareness of the muscles as such at all, . . . I execute the movement rightly and without difficulty. It starts *smoothly* as though I had been aware precisely of how tense and how long each muscle and how tense each tendon was, and, thus aware, took them as my starting point for shortening or paying out as may be, each one further” (italics added). Interestingly enough, he then points out that if he had moved “*clumsily*,” it would not do much good “*to look at my limb*” (p. 249, italics added). As he himself says, *looking* provides him no more than an *additional* sense of where his limb is. In effect, with respect to one’s own body, he affirms that vision is not a primary but a supplemental spatial sense. Sherrington concludes his experiential account of movement by characterizing “[t]he proprioceptive percept of the limb” as “a mental product,” a product “derived from elements which are not experienced as such and yet are mental in the sense that the mind uses them in producing the percept” (*ibid.*). Insofar as “[s]uch mental products are an intimate accompaniment of our motor acts,” he says that “[w]e may suppose therefore there obtains something like them in our animal kith and kin as accompaniment of their intentional motor acts” (*ibid.*).

Now clearly, if we carefully examine Sherrington’s account and reflect both on what he is implicitly affirming and at the same time on what he is inadvertently excluding, we find an open avowal of kinetic qualia. An awareness of *smoothness* is first of all an awareness of something over and above an awareness of *where* a limb is and of *when* it is moving. It is an awareness of *how* a body part or the body as a whole is moving; *how* precisely *not* in the neurophysiological sense Sherrington himself details as impossible, but *how* in the same experiential sense as *where* and *when*. Moreover *smoothness* is not “a mental product,” any more than jerky or swift or hesitant or expansive or collapsing or intense or constricted or weak or abrupt are “mental products.”¹⁷ Neither is weight

¹⁶ It should be noted that Sherrington uses the word *tension* in a purely neuromuscular sense when he says, in tandem with his statement that “I have no awareness of the muscles as such at all,” that “I have no awareness of tension in the muscles” (p. 249). *Tension* is absent in the specified neuromuscular sense, but it is *not* absent in an experiential sense. Sherrington could hardly go on to describe his awareness of his movement as *smooth* if he did not move with a certain tensional quality coincident with smoothness: a certain kinetic tension is integral to smooth movement. That kinetic tension is not a constituent of jagged movement, for example, or of myriad other movements between the two extremes of smooth and jagged. It would thus be an epistemological mistake to think Sherrington’s disavowal of an awareness of discrete muscle tensions a disavowal of a direct experiential awareness of the tensional qualities of movement. This would be to conflate neuroscience with experience. On the other hand, it would also be an epistemological mistake to think Sherrington’s characterization of proprioception as a “mental product” correct since the *smoothness* Sherrington experiences is not only there, directly evident in his movement; the *smoothness* is created by his movement and exists in virtue of his movement.

¹⁷ One might claim that terms such as swift and weak describe movement directly, while terms

“a mental product,” the weight one perceives in the felt heaviness or heft of one’s body or body parts in moving; neither is mass “a mental product,” the mass one perceives in the felt three-dimensionality or volume of one’s body and in its felt smallness or largeness. In short, *qualia* are integral to bodily life. They are there in any movement we make. They are differentially there in the bodily life of animate forms. They are not a “mental product,” but the product of animation. They are created by movement itself. Accordingly, any time one cares to attend to the felt sense of one’s movement, one perceives *qualia*.

When we learn to move ourselves, we learn to distinguish just such kinetic bodily feelings as smoothness and clumsiness, swiftness and slowness, brusqueness and gentleness, not in so many words, but in so many bodily-felt distinctions. Short of learning to move ourselves and being attentive in this way to the *qualia* of our movement, we could hardly be effective agents — any more than a creature who “does something and then looks to see what moves” could be an effective agent. In neither case is there an agent in the true sense of being in command of — or as phenomenological philosopher Edmund Husserl would say, of “holding sway in” — one’s own body. An agent who holds sway is a bona fide agent precisely insofar as she/he is aware of her/his own movement, aware not only of initiating it, but aware of its spatio-temporal and energy dynamics, which is to say of its rich and variable *qualia*.¹⁸ With respect to Dennett’s injunctions, were they taken literally to the letter, his agent — so-called — would suffer not only from having to have in sight at all times all parts of his/her body in order to see where they were and what they were doing. His

such as “hesitant” describe an affective state derivative from movement. The claim is a provocative one, bearing out the etymology of the word “emotion.” The term “expansive,” for example, describes a generous, open person, one who is affectively sympathetic toward others, a usage clearly tied to movement, i.e. to an expansive — open, generous — spatiality of the body in moving. Observations of infant psychologist and psychiatrist Daniel Stern support the idea of a coincidence, if not a derivation, of affect from movement. In particular, Stern describes what he calls “vitality affects”: “qualities [of experience] that do not fit into our existing lexicon or taxonomy of affects [but that] are better captured by dynamic, kinetic terms, such as ‘surging,’ ‘fading away,’ ‘fleeting,’ ‘explosive,’ ‘crescendo,’ ‘decrescendo,’ ‘bursting,’ ‘drawn out,’ and so on” (Stern, 1985, p. 54). Affects may well be “better captured by dynamic, kinetic terms” than special feeling terms because they have their origin in the tactile-kinesthetic body. From this perspective, complexity of affect may be tied to complexity of movement. If this is so, then the evolution of affect might be studied from the viewpoint of the richness and variability of tactile-kinesthetic bodies, and not just from the viewpoint of a social world. A passing remark of anthropologists Sherwood Washburn and Shirley Strum is suggestive in this respect. In their discussion of the evolution of speech, they write that “Attempting to teach a monkey to make more sounds is like trying to teach it to have more emotions” (Washburn and Strum, 1972, p. 475). If the emphasis is on the making of sounds and not on the sounds themselves, then a relationship between species-specific possibilities of movement and species-specific possibilities of affect is clearly adumbrated. In turn, however superficial and abbreviated the suggestion, one may well ask, is kinetic complexity the basis of affective complexity?

¹⁸ It might be noted that the degrees-of-freedom problem is intimately related to the fact that movement creates rich and variable *qualia*.

agent, being oblivious of qualia, could in no way build up practices in the manner Dennett suggests, for the build up of such practices depends upon kinesthesia and kinesthetic memory, i.e. upon an awareness of the spatio-temporal and energy dynamics of one's movement. An agent devoid of kinesthesia in fact belongs to no known natural species. Agents — those having the power to act — necessarily have a kinesthetic sense of their own movement.

When Dennett considers “simpler organisms” such as lobsters, the perceptual situation is no different from what it is with humans. Kinesthesia, or its counterpart, is nowhere acknowledged as a feature of these “lower” creatures. The idea that these creatures have a sense of their own body and body movement is alien to the theory of a thoroughly materialized consciousness as well as an alien thought in itself. Whoever “the thinker” might be in Dennett's zoology — a lobster “thinker,” a bat “thinker,” a lion “thinker” — it appears to get what it wants, if it gets it at all, simply in virtue of its impeccable motor wiring, nothing more. “The thinker” in other words appears not to have — or need — any proprioceptive connections to its body; its body, in fact, is on Dennett's account no more than a “directly and appropriately wired” mechanical contrivance for getting about in the world. Yet we should ask what it means to say that a lobster will eat another's claws but that *conveniently*, as Dennett puts it, it finds eating one of its own claws unthinkable. Does it mean that there is actually a rule “Don't eat your own claws!” wired into the lobster's neurological circuitry? But it is patently unparsimonious to think that there is such a rule and just as patently absurd to think that every creature comes prepared with an owner's manual, as it were, a rulebook replete with what Dennett calls “maxims.” Such a maxim, for example, would be only one of an indefinitely great number of maxims that a lobster (or, in analogous terms, any other “simpler organism”) could be said to carry around in the neural machinery that counts as its “Headquarters”:¹⁹ “Don't try to go on land!” “Don't try to eat a squid!” “Shovel in new sand grains after molting!” “The large claw is for crushing!” “The small claw is for seizing and tearing!” And so on. What makes eating its own claws “conveniently unthinkable” is clearly something other than a rule of conduct. The putative evolutionary sense of convenience that Dennett invokes is misguided. “Convenience” is not a matter of an opportune adaptation but of an astoundingly varied and intricately detailed biological faculty that allows a creature to know its own body and its own body in movement.

Dennett is not alone either in his omission of the kinesthetic or in his privileging of the visual. Typically, kinesthesia never makes an appearance in discussions of “the senses” — the *five* senses. Any cursory glance at indices of relevant books in biology, psychology, and philosophy discloses either a radically abbreviated treatment of kinesthesia in comparison to vision (and audition), or a complete lack of treatment altogether. One might say with good reason that the mind/body problem is written into the very texts themselves. Moreover the topic of body movement, if making an appearance at all, typically comes on the scene only marginally in these books. The way

¹⁹ Dennett (1991), e.g. p. 106: “The brain is Headquarters, the place where the ultimate observer is.”

it does so is through reduction to *the* brain and its efferent pathways. In both typical instances, we come up painfully short of a sense of movement. In one respect it is not surprising that kinesthesia is omitted or slighted and that we believe ourselves to have only five senses. As adults, we have long since forgotten how we learned to move ourselves — in a very real sense, how we learned our bodies. Only if now, as adults, we pay kinesthetic attention — for example, to what it feels like, or rather, *does not feel like* when our arm falls asleep — might we begin to realize how fundamental kinesthesia is. It is fundamental not only to our knowledge of “which thing in the world we are”; it is fundamental both to our ability to make our way in the world — to move knowledgeable in it — and to our knowledge of the world itself. Though we may have forgotten what we first learned of the world through movement and touch, there is no doubt but that we came to know it first by moving and touching our way through it, in a word, through our tactile-kinesthetic bodies.²⁰

The astoundingly varied and intricately detailed biological faculty that allows knowing one’s own body and body movement and that in the most basic sense allows knowing the world is a dimension of consciousness. Inversely, consciousness is a dimension of living forms that move themselves, that are *animate*, and that, in their animation, are in multiple and complex ways engaged in the world. The earlier description of a bacterium’s cognitive capacities is relevant precisely in this context. What the description points to is a chemically-mediated *tactile* discrimination of bodies apart from or outside of the body one is. Given its stereognostic sensitivity, a bacterium’s discriminative ability might justifiably be termed a “meta-corporeal” consciousness, a consciousness of something beyond itself. Clearly, the essentially tactile ability to discriminate bodies other than oneself is not the same as a proprioceptive ability to discriminate aspects of oneself as an animate form, though just as clearly tactility is a vital dimension of that proprioceptive ability. Proprioceptively endowed creatures are not only always in touch with something outside themselves; they tactilely compress and deform themselves bodily in the process of moving. When a creature bends its leg, for example, it brings two surfaces in contact with each other — in mutual

²⁰ For a detailed account of the tactile-kinesthetic body, see Sheets-Johnstone (1990). In an ontogenetic sense, the priority of movement and tactility is not surprising. The sequence of development of embryonic neural tissue underscores their significance. In particular, there is early beginning development (the fourth week of life) of the semicircular ear canals which, through vestibular sensations, provide a sense of balance or imbalance, and (at the fetal stage) of receptors in the muscles which, through kinesthetic sensations, provide a sense of position and movement. Though rudimentary, the sensory system for balance is in place by the beginning of the fourth month. By the beginning of the fourth month too, reflexive behaviour appears, which means that the movement of the fetus is coordinated in response to stimulation. The comparatively early development of neural tissue related to movement is of particular interest in conjunction with physiological studies suggesting that neural development of the motor cortex is stimulated by the body movements of the fetus itself. In other words, form does not develop solely on its own. Movement influences morphology. Myelination studies also show that motor neurons myelinate early and that acoustic-vestibular neurons myelinate next. For a discussion of prenatal development and behaviour, see Robeck (1978) and Windle (1971).

deformation. Tactility thus enters into the essentially kinetic cognitional abilities by which a creature discriminates aspects of itself as an animate form. In the most fundamental sense, these kinetic cognitional abilities constitute a *corporeal consciousness*, a consciousness that, as I shall try now to show at some length, is an astoundingly varied and intricately detailed biological faculty. The purpose of the demonstration is to link understandings of consciousness to corporeal matters of fact and thereby to an evolutionary history. In other words, with a recognition of this biological faculty, and with attendant understandings of its rootedness in corporeal matters of fact, we can begin to grasp the possibility of a true evolutionary history of consciousness. It bears emphasizing that *we do this by direct consideration of the topic at issue: consciousness*, and not by appeal to constituents in definitions of life — to self-replication, organization, and so on. The notion of consciousness as fundamentally a corporeal phenomenon in fact already suggests a radical revision of the common evolutionary characterization of consciousness both as “a higher-order” function, i.e. a function having nothing to do with bodies, and as a “higher-order” function exclusive to “higher” forms of life, i.e. a preeminently human endowment. Similarly, it already suggests a radical revision of the materialist’s characterization of consciousness as identical with neurological brain events. The key to the reconceptualization of consciousness and to the evolutionary import of that reconceptualization is the realization that bodies in the form of living creatures are not mere physical things but animate forms.

Consciousness is thus not in *matter*;
it is a dimension of living forms,
in particular, a dimension of living forms that move.

Transposed to this context, Searle’s “biological naturalism” — his biological naturalization of consciousness — properly begins with movement. It would show how consciousness is rooted in animate form. Indeed, it would show concretely how, in the evolution of animate forms, consciousness emerged not as a “higher-level” or “intrinsic” stalk that one day sprouted out of a neural blue, but as a dimension that itself evolved along with living, moving creatures themselves.

What is necessary to the task of reconceptualization is a sense of the evolutionary history of proprioception, including a sense of the history of its derivation. It should be clearly evident that a sense of this history does not entail a concern with the evolution of the neural circuitry of proprioception in general, an assessment of the neurology of proprioception in mammals in particular, nor of the neurology of proprioception in humans in singularly fine detail. It entails a concern with the proprioceptive lives of living creatures, invertebrate and vertebrate, insofar as they have been studied and recorded by naturalists, zoologists, and biologists, and insofar as one can discern within such studies what is at times left unsaid with respect to an awareness of movement. However neglected or understated, proprioception is a corporeal matter of fact. Its roots are embedded in the kinetic possibilities of the earliest forms of life. Thus a sense of its evolutionary history means coincidentally a concern with organisms such as bacteria and protozoa. In short, understandings of the evolution of proprioception

lead precisely to understandings of the provenience of consciousness. With these understandings come a vocabulary consistent with corporeal matters of fact and conceptual clarifications by which one can formulate a standard for linguistic practice that is neither arbitrary nor superficial — a mere diacritical band-aid — but a standard warranted by the evidence from natural history.

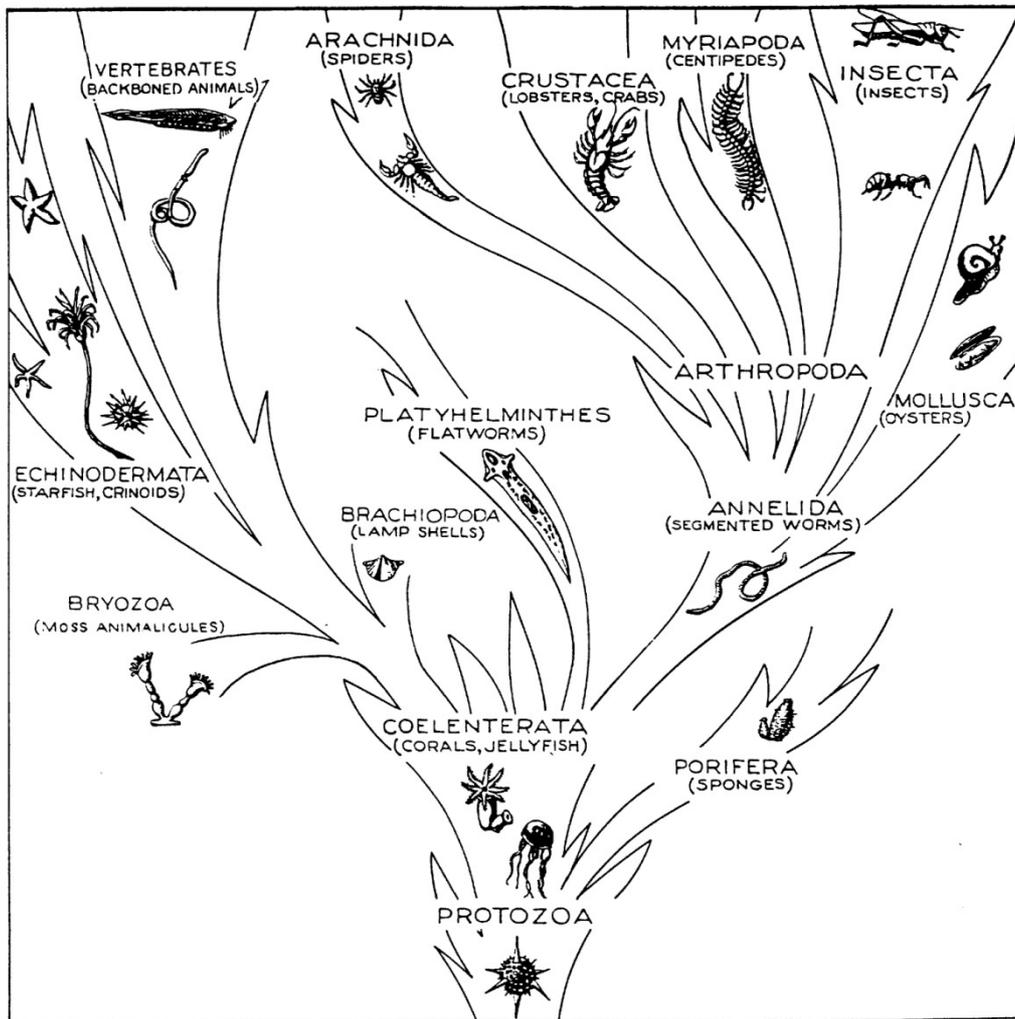


Figure 1: A simplified family tree of the animal kingdom, to show the probable relationships of the vertebrates. (After Romer, *Man and the Vertebrates*, University of Chicago Press.)

5 To the Things Themselves: Corporeal Matters of Fact²¹

Animate forms are built in ways that are sensitive to movement. Their sensitivity can be doubly reflected; they can be sensitive to dynamic modifications in the surrounding world and to dynamic modifications of their own body. They can, in other words, be sensitive to the movement of things in their environment, including the very medium in which they live, and to the movement of their own bodies. A moment's serious reflection on the matter discloses a major reason why this sensitivity to movement is both basic and paramount: no matter what the particular world (*Umwelt*)²² in which an animal lives, it is not an unchanging world. Hence, whatever the animal, its movement cannot be absolutely programmed such that, for example, at all times its particular speed and direction of movement, its every impulse and stirring, its every pause and stillness, run automatically on something akin to a lifetime tape.²³ Consider, for example, an earthworm, its body pressed against the earth as it crawls along, or a beetle walking along the ground. In each case, the immediate environment is tangibly inconsistent; it has topological and textural irregularities — bumps here, smoothness there, moisture here, hardness there, and so on. Both earthworm and beetle must adjust kinetically to what they find in the immediate moment. A prominent invertebrate researcher makes this very point: “Information regarding the absolute disposition of the body is imperative in order that minor adjustments of muscular activity may be made to cope with irregularities in the surface” (Laverack, 1976, pp. 4f). Clearly, the world is less than consistent in its conformations and any animal that survives must literally or figuratively bend to its demands. Consider further the very fluid or changing medium in which some animals live. Air and water move, and that movement in the form of currents or winds — currents and winds that themselves shift from gentle to moderate to turbulent — agitates, deforms, or otherwise impinges on the animal's body. In effect, such movement influences how the animal moves from moment to moment; it influences what the animal can do and what it actually does. A locust is proprioceptively sensitive in just this way to air currents. Its face is covered

²¹ Evolutionary studies of proprioception are no longer fashionable. Indeed, attention should be called at the beginning of this descriptive analysis to the fact that contemporary study of proprioception lags so far behind studies of vision and audition that it is barely perceptible in the literature. Moreover most of the journal literature is devoted to proprioceptive injuries to the knee, to knee surgery, and to topics related to the loss of proprioception. Of the 27 articles on proprioception published in scientific journals in 1994 and the first six months of 1995, 14 of them were devoted to such topics. Accordingly, where evolutionary references are pertinent or seem necessary, I use earlier writings, the most comprehensive text being the 686-page volume *Structure and Function of Proprioceptors in the Invertebrates*, edited by P.J. Mill (1976).

²² von Uexküll (1928). Cf. Ernst Cassirer's concise explanation of why there are *Umwelts*: “Every organism ... has a world of its own because it has an experience of its own” (Cassirer, 1970, p. 25).

²³ As, for example, philosopher Peter Carruthers indicates when he writes that “brutes” have only “nonconscious experiences,” and so experience “nothing” (Carruthers, 1989, pp. 268, 259).

with hairs that respond to the movement of air across their surface: “Each hair responds maximally to wind from a specific direction, with the optimal direction being determined by the angle of curvature of the hair shaft” (pp. 5f). Sensitivity to its facial hair displacements facilitates the locust’s control of lift during flight and is informative of orientation in flying. The intricateness of a spider’s external proprioceptive system offers equally impressive testimony to the importance of proprioception. Spiders also have hairs on their body that, when bent, inform them, for example, of the disposition of their body relative to their web (p. 27). Far more numerous than their hairs, however, are other surface sensory organs called slit sensilla. These are single or complex proprioceptive organs, the complex ones — lyriform organs — being located on their appendages, pedipalps, and walking legs. A spider’s slit sensilla are functionally analogous to an insect’s campaniform sensilla (see, e.g., Wright, 1976, pp. 353f); both are sensitive to deformation, i.e. cuticular stress through compression. To give an idea of the singular importance of such proprioceptors, consider that the hunting spider *Cupiennius salei* has over 3000 slit organs on its walking legs (*ibid.*; see also Laverack, 1976, pp. 24f). Given the quantity of such organs, it is no wonder that “the quantity of proprioceptive information ... from an appendage at a particular time (e.g. during walking) may be considerable (Wright, 1976, p. 354).

The above corporeal matters of fact can be put within the purview of a more explicit evolutionary history of animate form by a proportionately broader consideration of invertebrates. Broader consideration of these forms of animate life provides an especially edifying evolutionary viewpoint insofar as ninety percent of animal species are invertebrates — creatures ranging from sponges and coral to lobster, scallops, mites, centipedes, segmented worms, spiders and hosts of other animals, although most are insects, of which the largest category comprises species of beetles.²⁴ Fuller consideration will furthermore bring to the fore the immediacy of most creatures’ lives with respect to their surrounds. Indeed, it would be erroneous to judge invertebrates by human standards, especially fully-clothed western ones, for external proprioception functions far more as a form of movement detection for them than for humans.

An invertebrate may be soft- or hard-bodied. Hard-bodied invertebrates are so called because they have articulable body parts attached to an exoskeleton. As suggested by the above examples, hard-bodied invertebrates have external sensilla of various kinds: hairs, exoskeletal plates, epidermal organs, cilia, spines, pegs, slits, and so on. It is these external sensory organs that make possible an awareness of surface events in the double sense noted above: an awareness of the terrain on which and/or the environment through which the animal is moving and an awareness of bodily deformations or stresses occurring coincident with moving on the terrain and/or through the environment. To appreciate in a beginning way the difference in proprioceptive sensitivity between hard- and soft-bodied invertebrates, compare, for example, a beetle and a polyp. A beetle that is walking on the ground has tactile contacts that allow an awareness of the ground’s irregularities — bumps, stones, holes,

²⁴ There are approximately 800,000 species of insects of which approximately 275,000 are species of beetles.

and so on — and tactile contact with the air — breezes, vibrations, and so on — as well as an awareness of itself as topologically deformed or agitated by these contacts. Proprioception is thus distinctively informative of both body and surrounds. A sedentary hydrozoan polyp has tentacles bearing cilia that are sensitive to vibrations in the surrounding water. When vibrations occur, the polyp bends its tentacles toward their source, thus toward food particles such as barnacle nauplii. English marine biologist D.A. Dorsett states, “The response is reflexive rather than proprioceptive in that it [the polyp] is not responding to movements generated by or imposed upon the animal itself” (Dorsett, 1976, p. 447). What Dorsett means is that the response is characterized as reflexive because the bending movement is neither generated by the polyp — it is generated by the vibrations — nor imposed upon the polyp — it is not the result of actual surface to surface contact, i.e. contact of animal body with solid object. His point is more broadly made in the context of an analysis by M.S. Laverack, another English marine biologist, who distinguishes among four basic modes of external proprioception in invertebrates (Laverack, 1976, pp. 3f). The simplest mode is through distortion of the body, whether through muscle contraction or passive deformation: external proprioceptors are in either case affected. The second mode is tethered to the fact that animals move relative to space; in effect, contact of the surface of an animal’s moving body with a solid object results in proprioception concerning its movement and position relative to the object. The third mode is also tethered to the fact that animals move relative to space; it is a reiteration of the second mode of proprioceptive stimulation but with reference to a substrate rather than to a solid object. The fourth mode derives from the circumstance in which movement of one body part tactilely stimulates another body part through contact of external sensors of one kind or another, e.g., hairs, such contact providing information regarding movement and position of the two body parts. To say that the polyp’s bending movement is reflexive is thus to say both that the polyp is not stimulated to move by bodily deformation or stress (the first mode)²⁵ nor is it stimulated to move because a surface of its body has come into contact with a solid object (the second mode). That the polyp is sedentary means, of course, that it does not budge from its base; hence, the third mode of stimulation is not a possibility. Neither is the fourth mode since the movement of the tentacles does not proprioceptively stimulate another body part.

Polyps belong to a class of animals called coelenterates, “primitive aquatic animals” (Keeton and Gould, 1986, p. 161). It might be tempting to generalize about proprioception in coelenterates — and perhaps in other soft-bodied invertebrates such as annelids and molluscs as well — on the basis of the above example and discussion, but given the diversity of coelenterate forms of life, it would be a mistake to write off proprioception altogether in such creatures. Different proprioceptive capacities — or counterparts thereof — are highly suggested by the movement of creatures within the same class and even within the same phylum. The somersaulting hydra, for example, is

²⁵ If one considers that tentacle cilia are passively deformed by vibrations in the surrounding water, then of course a polyp’s bending response *is* proprioceptive, not reflexive. See further in the text itself Laverack’s remark about cilia as the beginning of specialized sense organ structure.

an exception to what might otherwise be considered “the sedentary hydrozoan polyp rule” with respect to the third possible mode of external proprioception; fighting sea anemones (anthozoans rather than hydrozoans) are sensitive to the touch of an alien form of anemone, thus sensitive in ways consistent with the second possible mode of external proprioception; in moving from one place to another on a rock — one inch per hour — a fighting sea anemone changes contact with a substrate, thus, like the somersaulting hydra, it too is open to proprioception through its own movement in space; an anemone belonging to the genus *Actinostola* — a “swimming anemone” — though normally sessile, not only moves to distance itself from chemical substances emitted by starfish but writhes and somersaults in the process (McConnaughey, 1978, pp. 270ff). Clearly, there is a diversity of possible proprioceptive acuities commensurate with the diversity of life itself. In spite of the fact that proprioception is less evident in soft-bodied invertebrates and is difficult to document (Dorsett, 1976, p. 479), marine biologists readily affirm a range of proprioceptive possibilities in soft-bodied invertebrates. Laverack, for example, states that “Proprioceptive units in the flexible body wall of soft-bodied animals are probably legion, [although] ... few have been shown either anatomically or physiologically (Laverack, 1976, p. 11); Dorsett states with respect to soft-bodied invertebrates generally that “abundant opportunities for true proprioception occur” (Dorsett, 1976, p. 479). Their affirmation in the face of comparatively slim evidence warrants a moment’s reflection as does the related conceptually challenging notion of “true proprioception.”

The best evidence for proprioception in soft-bodied invertebrates comes from studies of gastropods (molluscs). In their complex feeding behaviour, a number of species protract and retract a buccal mass in coincidence with whose retraction, a radula rasps against the substrate, taking up bits of plant or animal tissue in the process. The behaviour is modulated by proprioception according to load. Given the difference in animate form between a gastropod and a sedentary hydrozoan polyp — which difference of course means a difference in movement possibilities, thus a difference in behavioural possibilities²⁶ — it is not surprising to find proprioceptive capacities readily evident in the one and not in the other. It is precisely in this context of recognizing differences in animate form that the significance of both the affirmation and the idea of “true proprioception” becomes apparent: What would dispose marine biologists to affirm “proprioceptive units” in the face of slim evidence if not an intuitive sense of the central importance of proprioception to animate life in general, and in particular, of its necessity in carrying through observed complex life-enhancing behaviours such as those of certain gastropod species described above? What if not this intuitive sense generates the idea of such a phenomenon as “true proprioception,” thus the idea that there are lesser forms of the same, forms one might historically call

²⁶ For an excellent discussion of morphology in relation to movement and of the evolution of arthropods from annelids with respect to that relationship, see Manton (1953). The eminent biologist J.B.S. Haldane spoke laudingly of Manton’s work, saying “Manton has done for a phylum what comparative ethologists have done for small vertebrate groups such as the Anatidae.” He described her as a “pioneer” with respect to her phylogenetic focus on movement (Haldane, 1953, pp. xvi, xvii).

proto-proprioception? Consider the following remark that validates just such *evolutionary* notions: “[I]n passing from the coelenterates to the annelids and molluscs, we are looking at some of the earliest stages in the evolution and organization of the nervous system and must ask ourselves at what stage does a true proprioceptive sense arise” (Dorsett, 1976, p. 443). The question is indeed provocative: at what stage *does* “a true proprioceptive sense arise”? Does it arise with molluscs, for example? Or can it be said to have arisen with some of the presumably earlier evolving coelenterates? On the other hand, what is “true proprioception”? And can a “stage” be pinpointed as its inception? — that is, is it possible to say with respect to any particular group of creatures and with respect to any particular evolutionary period, “true proprioception starts here”? In view of the diversity of creaturely life, one might rather say that “true proprioception” arises for each creature according to the animate form it is, and that if “true proprioception” does not arise, the form does not arise either because it is not kinetically viable. In other words, one might want to say that the origin of proprioception is not an historical event as such; it is an event tied to the evolution of *animate* forms. Indeed, the evolution of formal diversity speaks to the evolution of a diversity of proprioceptive capacities because it speaks of the same phenomenon: the evolution of forms of life as forms of animation.

On the basis of the above corporeal matters of fact, we can in fact begin to distill a sense of the evolution of proprioception,

from a meta-corporeal consciousness to a corporeal consciousness
through the evolution of external sensors.

As all of the above examples suggest, the undoubtedly multiple beginnings of proprioception are in each instance tied to *surface recognition sensitivity*. Not only are the cilia of polyps tactilely sensitive to movement, but the surface sensitivity of cilia themselves, organelles that are present in groups of creatures from protozoa (unicellular eukaryotic organisms such as paramecia and amoebas) to mammals, attests to the significance of an original tactile faculty subserving movement and the recognition of something outside of one’s own body. Laverack’s remark about cilia is in fact highly suggestive in this respect. He writes that “If the cilium may be taken as at least a simple starting point for sense organ structure we may look for receptors even amongst the protozoa. Sensitivity towards physico-chemical events is well known, but specialized receptors much less so” (Laverack, 1976, p. 17). His remark may be glossed in the following way: the evolution of sense organs at the most primitive eukaryotic level heralds a new kind of sensitivity, one mediated by specialized sense organs, i.e. cilia, rather than by physico-chemical events, but still serving the same basic function: movement and the recognition of something outside one’s own body. While this surface sensitivity is spoken of in terms of “mechanoreception” (*ibid.*), it is clearly, and indeed, from the viewpoint of living organisms, more appropriately specified as a form of *tactile-reception*. The protozoan ciliate species *Stentor*, for example, uses its cilia to sweep away noxious particles and the *Stentor* itself bends away from the tactile disturbance.²⁷ Tactility in the service of movement and of recognizing something

²⁷ Cf. Curtis (1975) p. 311: After bending away from a noxious stimulus, and if “the offensive

outside one's own body similarly describes the cilia-mediated tentacle movement of a sedentary hydrozoan polyp toward a food source. From the viewpoint of cilia as the beginning of specialized sense organ structure, a polyp's movement is not reflexive but proprioceptive.²⁸ More broadly, the notion of "true proprioception" is definitively recast. It is not a historical attainment; it is a function of animate form.

Specified in animate terms, living forms disclose even broader evolutionary continuities. A bacterium that goes about sampling the environment, as described earlier, shows a related sensitivity. The bacterium — a prokaryotic organism, that is, a single-celled organism without a nucleus and without membrane-enclosed organelles — is environmentally sensitive not to shape or to movement but to the chemical composition of its environment (but see also below on a further mode of bacterial sensitivity). Its sensitivity is all the same similarly mediated by touch, it similarly subserves movement, and it is similarly meta-corporeal. Hence, in both prokaryotic and early unicellular and multicellular eukaryotic forms of life, tactility determines what a particular organism does: a bacterium's surface sensitivity and a ciliated protozoan's and cilia-mediated polyp's sensitivity are founded on contact with something in the environment, a meta-corporeal phenomenon or meta-corporeal event which excites the organism to move in some way. An evolutionary pattern thus begins to emerge with respect to *surface recognition sensitivity*. The pattern is evident in prokaryotic organisms, which are tactilely sensitive to their physico-chemical environment and which move dynamically commensurate with that sensitivity, i.e. sampling, foundering, changing direction; eukaryotic forms of life emerge, which are tactilely sensitive to the environment through specialized sense organs and which move in ways coincident with that sensitivity, protozoan ciliates responding to noxious elements in the environment by bending or sweeping movements, for example, the cilia of sedentary polyps responding to vibrations in the surrounding medium and exciting the polyp to bend a tentacle toward food, mobile forms such as annelids and molluscs moving in strikingly more intricate and varied ways on the basis of more complex external organs sensitive to deformation and stress. In sum, the pattern is a *dynamic* one. Whatever the form of surface sensitivity in prokaryotic and early unicellular and multicellular eukaryotic forms of life, it is ultimately in the service of movement: toward or away from chemicals in the environment, toward sources of food, away from noxious elements or alien creatures, and so on.

A surface sensitivity subserving movement becomes apparent the moment one looks to corporeal matters of fact, analyses them in sensory-kinetic terms, realizes the centrality and significance of movement to creaturely life, and begins thinking in

stimulus persists, the *Stentor* will reverse its cilia and try to sweep the particles away. If bending and sweeping are not successful, it contracts and waits. Once it has contracted, it does not bend or sweep again, but it may reach out to sample the water several times before it finally swims away. The length of time it tolerates the noxious stimulus apparently depends on whether or not its site had previously proved a good feeding area. Thus, even ciliates show some flexibility in behavior."

²⁸ See footnote 25 above.

terms of a natural history of *animate forms*. It clearly suggests the basis on which proprioception arises and is clearly suggestive too of its crucial significance. A commonly cited definition of proprioceptors justly acknowledges a prime aspect of this significance: “Sense organs capable of registering continuously deformation (changes in length) and stress (tensions, decompressions) in the body, which can arise from the animal’s own movements or may be due to its weight or other external mechanical forces.”²⁹ In a word, proprioceptive sensitivity is *continuous*. Not only is a creature’s surface in contact continuously with other surfaces in the environment, whether it is moving or whether it is still, but its own conformations continuously change in the course of moving. Continuous sensitivity is thus doubly indicative of how a moving creature profits from such organs: it is sensitive both to the changing world in which it finds itself and to its own movement and changing bodily form. Moving creatures — animate forms — are, in fact, topological entities, changing shape as they move and moving as they change shape. Proprioception implicitly articulates this truth. Deeper and more detailed study shows it to articulate a further factual truth; namely, that animal movement, however centrally programmed, cannot be considered to be wholly devoid of proprioception.³⁰

To understand this further factual truth, we need first to note that understandings of consciousness on the basis of animate form are conceptually revisionary in many respects, perhaps not least in calling into question the practice of bestowing consciousness in miserly and self-serving fashion. The practice flies in the face of corporeal matters of fact, precisely as those detailed above. To those facts may be added the following: Any creature *that moves itself*, i.e. that is not sessile, senses itself moving; by the same token, it senses when it is still. Distinguishing movement from stillness, motion from rest, is indeed a fundamental natural discrimination of living creatures that is vital to survival. The lack of constancy of the everyday world demands such discrimination. As emphasized earlier, whatever the particular *Umwelt* might be

²⁹ Lissman (1950), p. 35 (quoted in Mill, 1976, p. xvi). Lissman amends Sir Charles Sherrington’s original 1906 coinage and definition of the term “proprioceptors” — sensory organs stimulated by “actions of the body itself” — in that, as Lissman states, Sherrington’s definition “does not appear quite adequate, because, clearly, there are few types of sense organs which cannot be stimulated by actions of the body itself” (p. 35).

³⁰ “[P]roprioceptive information plays a vital part in the control of movements and orientation.” It is of interest to note in this context the remarks of zoologist M.J. Wells with respect to the question of the relationship between proprioception and learning: “Because it is normally impossible to eliminate all the proprioceptors and never be quite certain that one has succeeded in eliminating all other sensory cues, it is rarely possible to be certain that an animal is using proprioceptive information when it learns.... One must examine cases where animals learn in circumstances that, *prima facie*, imply that they are taking into account information derived from within their own joints and/or muscles and/or organs of balance and explore these cases rather carefully to see what alternative explanations are possible. It should be emphasized that the object of this exercise is not to establish whether particular sorts of animal can possibly learn from proprioceptive inputs in *any* circumstances (since that question is unanswerable), but rather whether they normally appear to do so (in Mill, 1976, pp. 567f).

for any particular moving creature, that world is not consistent: weather fluctuates; terrains are irregular; surrounds change with growth and decay; the movements and habits of other creatures alter the environment; different creatures themselves appear and disappear each day; sequences of events shift: what occurred progressively yesterday is not what occurs progressively today; and so on. Clearly, no undeviating world presents itself day in and day out for any creature; *Umwelts* repeat themselves neither spatially nor temporally nor dynamically. By the same token, creaturely movement is not the same from one day to the next, “the same” in the sense of an undeviating replication of some master program. Certainly a creature’s basic behaviours do not normally change, but they are nonetheless context-dependent in a spatial, temporal, and dynamic sense. A creature does not pursue something that is not actually there for it, for example. What a creature does, that is, how and when it *moves*, is determined at each moment by the situation in which it finds itself. The new and challenging mathematical science of cognition dynamics underscores these very points in its emphasis on “*real-time*.” Cognition from a dynamic standpoint is processual, not a static series of representations. It takes place “in the *real* time of ongoing change in the environment, the body, and the nervous system.” With respect to these three factors, dynamic analyses show the structure of cognition to be “*mutually and simultaneously influencing change*.”³¹ Accordingly, however rote its basic behaviours might be with respect to its day to day living in the world,³² a creature is necessarily sensitive in a proprioceptive sense to the present moment; it begins crawling, undulating, flying, stepping, elongating, contracting, or whatever, in the context of a present circumstance. It is *kinetically spontaneous*. Elucidation of this further truth about the nature of animate form will show in the most concrete way how animate form is the generative source of consciousness — and how consciousness cannot reasonably be claimed to be the privileged faculty of humans.

6 From Corporeal Matters of Fact To Corporeal Consciousness

A creature’s corporeal consciousness is first and foremost a consciousness attuned to the movement and rest of its own body. When a creature moves, it breaks forth from whatever resting position it was in; it *initiates* movement, and in ways appropriate to the situation in which it finds itself. The inherent kinetic spontaneity of animate forms lies fundamentally in this fact.³³ Kinetic spontaneity may be analysed in terms of

³¹ van Gelder and Port (1995), p. 3. In the same text, see also Beer (1995) and Giunti (1995). See also, for example, Schöner (no date).

³² We might note that it is only specified behaviours that are chosen for observation and recording, not behaviours outside a set protocol to begin with. Thus the conveniently discardable file called “anecdotal behaviour.” See, for example, the consternation with which some researchers greet the idea of “tactical deception in primates” as put forth by primatologists Whiten and Byrne (1988).

³³ Kinetic spontaneity describes fundamental dimensions of *animation*. The term is not tied in any way to a centralist doctrine. Hence, the term should not be confused with the older notions of “innervation sensations,” “willing,” “volition,” or “effort,” or in any other way confused with the classic efferent side of the efferent/afferent divide. (For a thoroughgoing

kinesthetic motivations, a species-specific range of movement possibilities, a repertoire of what might be termed “I cans,” and – by way of proprioception and, more particularly, of kinesthesia – a sense of agency. As might be apparent, these dimensions of spontaneity are keenly inter-related. A creature’s initiation of movement is coincident with its kinesthetic motivations, its dispositions to do this or that – turn, pause, crouch, freeze, run, or constrict; its kinesthetic motivations fall within the range of its species-specific movement possibilities – an ant is not disposed to pounce any more than a cat is disposed to crawl; these possibilities are the basis of its particular repertoire of “I cans,” a repertoire that may not only change over the lifetime of the animal as it ages, but that may be selectively distinguished insofar as the animal can run faster, for example, or conceal itself more effectively than other members of its group; as enacted, any item within its repertoire of “I cans” is undergirded proprioceptively (kinesthetically) by a sense of agency. A creature’s corporeal consciousness is structurally a composite of these four kinetic dimensions of spontaneity. It is a composite not in a studied analytical comparative sense – e.g., “I, a horse, cannot fly like a bird” – and certainly *not* in the sense of demanding linguistic formulation, but in an existentially kinetic sense, in the sense of being *animate*. In effect, creatures know themselves – “they know which thing in the world they are” – in ways that are fundamentally and quintessentially consistent with the bodies they are. They know themselves in these ways not by *looking*, i.e. not by way of what is visible to them of their visual bodies, but proprioceptively, or more finely, kinesthetically, i.e. in ways specific to movement alone, sensing their bodies as animate forms in movement and at rest.

This form of creaturely knowing can be spelled out along evolutionary lines, indeed, along the lines of descent with modification. The evolutionary pattern sketched above emphasized the basic phenomenon of surface recognition sensitivity – beginning with bacteria and proceeding to ciliated protozoa, to sedentary invertebrates, and to molluscs and annelids. This beginning sketch can be amplified. Creatures such as lobsters and spiders are creatures with an articulable skeleton, hence they have not only external sensors but internal ones as well, particularly around their jointed appendages. Generally termed chordotonal organs in invertebrates, these internal proprioceptors are sensitive directly to stresses within the body itself. On the basis of organic analogues and structural homologies, biologists believe these internal proprioceptors to have derived from external sensory organs, that is, to be the result of a migration of certain formerly external proprioceptive bodily structures. Such structural migrations are, of course, not unknown in evolution. A quite commonly cited homology concerns three reptilian jaw units that over time came to form the auditory ossicles of the mammalian middle ear: the stapes, malleus, and incus. Using a different example, Laverack makes this very comparison between invertebrate and vertebrate organ derivations or homologies. After noting that “Evolutionary trends in several groups [of invertebrates] show a gradual removal of proprioceptors from the surface to

criticism of the idea that there is “a consciousness of the motor discharge [from the brain],” see James, 1950, p. 494).

a deep or internal placement,” he points out that this derivation, while apparent in some invertebrates, “is demonstrable in vertebrates,” giving as example “the change in position of the acoustico-lateralis system in fish and amphibian” (Laverack, 1976, p. 19). Laverack in fact gives various examples of analogous proprioceptive organs in invertebrates: for example, the exoskeletal plates of a hermit crab are analogous to limb proprioceptors in other invertebrates (p. 10). He later gives a specific example of a possible invertebrate proprioceptive homology or derivation: “[T]he chordotonal organs of decapod Crustacea [e.g., lobsters] may have originated ... from groups of hairs, very similar to hair plates of insects, of which the individual sensilla have shortened, lost their contact with the surface, and finally been incorporated in a connective tissue strand or sheet. The remaining vestiges of hairs are evident as scolopidia [the complex cellular unit of a chordotonal organ].” Further, with respect to the similarity of decapod chordotonal organs to insect hair plates, he adverts to research that, on anatomical and ontogenetic grounds and in consideration of the process of molting, suggests that “the cuticular sheath of sensory hairs and campaniform sensilla [in insects] are homologous to the extracellular cap or tube of scolopidia” (p. 21).

If the thesis is correct that external proprioceptors were modified and internalized over time, then a singularly significant consequence obtains: internally-mediated proprioception, however variously accomplished in terms of anatomical structures, remains nonetheless epistemologically consistent in its results, viz., a directly movement-sensitive corporeal consciousness.³⁴ Such a proprioceptive consciousness is kinesthetically rather than tactilely rooted. Corporeal consciousness thus evolved from its beginnings in tactility into kinesthesia, into a direct sensitivity to movement through internally mediated systems of corporeal awareness. In effect, through all the intricate and changing pathways of descent with modification, *know thyself* has remained a consistent biological built-in; a kinetic corporeal consciousness informs a diversity of animate forms.

The thesis that internal proprioceptors evolved from external proprioceptive organs may be expanded and in a challenging and perhaps unexpected direction. Laverack writes that external sensors have two major disadvantages: “(1) A lack of discrimination between stimulation generated by movement of the body and that generated by external tactile events. (2) A vulnerability to wear and damage. A superficial placement is bound to expose hairs and pegs to abrasion and other accidents” (p. 46).³⁵ He states that these disadvantages “may have placed adaptive

³⁴ Cf. Laverack, 1976, p. 48: “If the thesis that many internal receptors may derive from external receptors, (sic) is valid, then it would be anticipated that the properties of all mechanoreceptors will be similar. Variety may be expected as a result largely of anatomical rather than physiological attributes.”

³⁵ We might clarify the first disadvantage by noting that tactility is a reflexive sense, that is, one in which what is touching and what is touched coincide — or blend. Hence, the sense of touch can indeed be ambiguous, precisely as Laverack points out in general rather than sensory-specific terms.

significance upon the subsequent development of parallel, internal proprioceptors.” His perspective on the disadvantages of external sensors and the adaptive significance of internal ones has certain unexpected affinities with the perspective of molecular biochemist R.M. Macnab who, writing on sensory reception in bacteria, conjoins within a single perspective two otherwise opposed viewpoints on “the sensory apparatus of a unicellular prokaryote” (Macnab, 1982, p. 98). Macnab discusses the sensitivity of a bacterium to surface events or environmental phenomena on the one hand, and to its own kinetic potential or energy level on the other, thus actually calling into question an account of bacterial knowing as only meta-corporeal. Being sensitive to its own kinetic potential, a bacterium can be said to have a rudimentary corporeal consciousness, rudimentary not in the sense of being less than functional – incomplete or underdeveloped, for example – but in the sense of there being no proprioceptive organ other than the organism – the bacterium – itself. Indeed, the source of a bacterium’s motility is PMF – “proton motive force, [or] proton electrochemical potential” (p. 78) – and it is described as both the “motor” and “the true sensory input” (p. 77); “the motor is an autonomous PMF sensing system” (p. 98). Clearly, movement and the potential for movement are at the heart of a rudimentary corporeal consciousness. The specific contrast in viewpoints that Macnab reconciles bears this out. The contrast concerns a “sensing of the physiological consequences of an environmental parameter [such as light, oxygen, and so on]” and a “sensing of the parameter itself” (p. 77). In other words, a bacterium can either sense itself with respect to the environment or sense the environment. Macnab points out that “Even in the rudimentary behavioural system of bacteria, both capabilities are present” (p. 77) – a remark of considerable interest to anyone concerned to provide a bona fide evolutionary account of consciousness. He later specifies explicitly the advantages and disadvantages of each kind of sensibility: in physiological sensing, “the signal can be thought of as: ‘For reasons unspecified, your current direction of travel has already resulted in your PMF ... falling dangerously low’”; in environmental sensing, “[the signal can be thought of] as: ‘Based on the following specific information – increasing aspartate in your external environment – your current direction of travel may offer enhanced opportunities for growth’.” In the first instance, the freely moving bacterium relies on a sense of its own energy to determine the benefits of continuing travel in its present direction. If it senses its energetic potential running low, it is not getting what it needs from its immediate environment and moves elsewhere. In this instance, the freely moving bacterium is monitoring its environment *internally* through an electrochemical sensitivity to the effect of the environment on its kinetic potential. In the second instance, the freely moving bacterium relies on specific sensing abilities, i.e. external chemoreceptors for amino acids and sugars, in order to determine whether the path it is following is likely to continue being propitious or not. Macnab points out the value and liability of each mode of sensing in what are actually exacting epistemological terms: “The physiological consequence of sensory information [i.e. physiologically-derived sensory information] has the advantage that the information is certain, but the disadvantage that it is late; the anticipatory sensory information has the advantage that it is early, but the disadvantage that it is uncertain, because the physiological consequence is presumed, and may in fact never occur” (p. 100).

The certainty of a bacterium's internally-generated information — as of an animal's internal proprioception — is clearly of moment. As the earlier definition of proprioception implied, continuous sensitivity to one's own bodily condition means knowing with exactitude the nature of that condition — whether one's kinetic potential, one's postural conformation, or the spatio-temporal dynamics of one's movement. An *internally* structured corporeal consciousness is from this viewpoint both kinesthetically indubitable and kinesthetically unambiguous. For a bacterium, this mode of consciousness translates into knowledge that is similarly indubitable and unambiguous. The adaptive significance of a continuous bodily sensitivity in the form of an internally structured corporeal consciousness of movement or of movement potential can thus hardly be minimized. It is the generative source of a creature's immediate kinetic spontaneity. A creature's initiation of movement, including the initiation of a change of direction, is always from a particular corporeal here and now — positionally, energetically, situationally, and so on. Given its particular corporeal here and now, certain species-specific kinetic possibilities exist for it — here and now; other species-specific kinetic possibilities may emerge only when another, different corporeal here and now obtains, the different corporeal here and now that comes with growth, for example, thus with a changed animate form. Similar possibilities and constraints hold with respect to a creature's repertoire of "I cans": given its own particular strengths and liabilities, it has certain corporeal possibilities and not others — here and now. Even a bacterium cannot automatically upgrade its PMF just because the environment is right. For example, while aspartate might be present in its environment, the bacterium's aspartate transport system may be defective. The bacterium may thus be unable to take advantage of the amino acid, precisely as Macnab suggests with respect to physiological consequences being presumed.³⁶ Finally, indubitable and unambiguous knowledge is basic to a creature's sense of agency. Lacking an internally structured corporeal consciousness that is both peculiar to the animate form it is and epistemologically resonant at each moment, a creature could hardly initiate movement — change direction, increase speed, pause, reach out with an appendage, turn itself around, avoid an obstacle or predator, explore, flee, or move purposefully in innumerable other ways — *or stop* — all such movement or cessation of movement being consistent both with the situation in which it finds itself

³⁶ Macnab (1982), p. 100. A tangential but critical point might be made with respect to the twofold sensitivities of a bacterium, the one sensitivity being described as immediate, the other as anticipatory, the one informative of the bacterium's present energetic state but not of the environmental cause of that state, the other informative of particular aspects of the bacterium's environment but not of what its consequences will be. A caveat might be in order with respect to what amounts to an equipotential weighting of a corporeal consciousness and meta-corporeal consciousness. A bacterium can be conceived profitably attuned to the future only with a certain reserve. If the bacterium has both capabilities, then its sensitivity to its own body is paramount. If there is no guarantee that present environmental munificence will continue and even grow, there is no guarantee either that the bacterium itself will continue and even prosper. If its sensitivity to its own energetic level becomes deficient for any reason, it could conceivably exhaust itself in the midst of plenty or in the pursuit of more.

and with its own immediate spatio-temporal corporeality.

Clearly, the corporeal path by which we can trace the evolution of consciousness can be richly elaborated in terms of the inherent kinetic spontaneity of animate forms. Such elaboration decisively challenges the putative evolutionary notion of an agent as something that “does something and then looks to see what moves.” Attention to corporeal matters of fact demonstrates that a bona fide evolutionary account of consciousness begins with surface recognition sensitivity. It thereby acknowledges a meta-corporeal consciousness. It furthermore takes into account the emergence of a diversity of animate forms, showing how surface recognition sensitivity, while mediated by touch, is actually in the service of movement for creatures all the way from bacteria to protists to invertebrate forms to vertebrate ones. It strongly suggests how a form of corporeal consciousness is present in bacteria.³⁷ Indeed, it shows how a bacterium, being an animate form of life, is something first of all that *moves* and is capable of moving on its own power rather than being always impelled to move from without; it shows further how it is something that feeds, that grows, that changes direction, that, in effect, can stop doing what it is doing and begin doing something else. A bona fide evolutionary account shows how, with the evolution of varied and complex external sensors, a different form of corporeal consciousness is present, and how, with the evolution of internal sensors from external ones, a still different form of corporeal consciousness is present. It shows how each of these forms of corporeal consciousness is coincident with the evolution of varied and complex animate forms themselves, and equally, how each form of proprioception that evolved, from the most rudimentary to the most complex of kinesthetic systems, is coincident with particular forms of life. It shows all this by paying attention to corporeal matters of fact and by presenting concrete sensory-kinetic analyses.

There is a final point to be made. For an invertebrate or vertebrate, an internally structured corporeal consciousness is not directly vulnerable to environmental wear and tear and in this sense is protected. As Laverack’s second remark suggests, a creature with internal proprioceptors is not at the direct mercy of the surrounding world. For a bacterium, such protection is not of course of moment; being unicellular, it has no sensory or internal organs as such. Some soft-bodied invertebrates such as annelid worms have hydrostatic skeletons, muscles lengthening and shortening the body against semi-fluid body contents that do not compress so that volume remains constant while segments of the animal increase and decrease in diameter. Although internal proprioception has been suggested via studies of stretch response, and although some annelids have very tough outer cuticles which *inter alia* would offer protection for internal proprioceptors, a strong case cannot reasonably be made for protection or the need for protection in the sense Laverack suggests, i.e. the evolution of internal proprioception as a means of protecting sensory organs from environmental wear and tear. The decisive turning point for proprioceptive protection is clearly evidenced in the evolution of an articulable skeleton. Arthropods and

³⁷ See also Losick’s and Kaiser’s (1997) account of how “[b]acteria converse with one another and with plants and animals” (p. 68).

vertebrates are notable in this respect. Though their evolutionary lineages are distinct, species within each phylum are similar in having a skeletal structure and in being extremely mobile forms.³⁸ Although their respective skeletal structure is differently placed, the attaching muscular structure is in each case internal and functions in a similar manner; when a muscle contracts, skeletal joints close, pulling two body segments toward each other. A direct and continuous sensitivity to movement thus appears to have evolved in two distinct but highly mobile forms of life and with the same advantage: an internally-mediated corporeal consciousness of movement that is not dependent on external stimuli, hence on tactility, but that is internally mediated. This kind of corporeal consciousness is not only relatively protected as well as continuous in comparison to an externally-mediated corporeal consciousness. Being internal, its possibilities for elaboration are quite different. In particular, what is being sensed in the case of an internally-mediated corporeal consciousness has the possibility of opening up, of expanding into a richly variable and complex domain of awarenesses. The possibility of such a domain is adumbrated in the question “What is it like to be a bat?” Indeed, the question “What is it like to be a bat?” presumes the existence of an internally-mediated corporeal consciousness that has already opened up into a range of kinetically tied and internally felt phenomena and acts. In other words, it presupposes a range of experiences that a bat has of itself as an animate form.

Proprioception is in this sense an *epistemological gateway*,
one that, by descent with modification,
may clearly be elaborated both affectively and cognitively.

In just these ways, corporeal consciousness shows itself to have the possibility of expanding into a sense of self. The evolution of proprioception foundationally explains this possible expansion. “The Reality of Selves” has its roots in corporeal consciousness.

7 Implications

Three implications in particular warrant mention. First, the natural history of consciousness described above demands a re-thinking of the common assumption that historically — particularly with reference to the evolution of nonhuman animals — unconsciousness preceded consciousness. Corporeal matters of fact show this assumption to be unfounded. It has never in fact been shown that nonhuman animals do not think, or choose, or even deliberate with respect to movement,³⁹ or that they do not have a sense of speed, space, effort, and so on. On the contrary, if the above sensory-kinetic analysis of consciousness is correct, then the evolution of such

³⁸ Cf. Fields (1976), who explicitly draws a parallel between crustaceans and vertebrates with respect to the need for precise control of a multi-jointed, highly mobile body in changing circumstances — e.g., variable load, muscle fatigue, and the like. In particular, Fields draws attention to the fact that the muscle receptor organ of crustaceans is similar to the muscle spindle of vertebrates.

³⁹ “Animals may constantly be seen to pause, deliberate, and resolve” (Darwin, 1871/1981, p. 46).

corporeal capacities and awarenesses is coincident with the evolution of animate forms. Corporeal awareness is a built-in of animate life; as stated in the beginning, *know thyself* is incontrovertibly a fundamental biological built-in.

Second, there is in present-day western society a tendency to be mesmerized by brains, so mesmerized that the larger creaturely world of which humans are a part is forgotten, egregiously slighted, or arrogantly distorted. Cognitivist programmes of research in science and philosophy are at the forefront of this mesmerization. Should researchers in these disciplines find that the subject of nonhuman animals is in general not congenial to their interests, or that the foregoing evolutionary analysis of consciousness is in particular not exciting in the way that computerized study of their own brains is exciting, it may well be because they have lost touch with their own natural history. Indeed, compared with Aristotle's studious forays into the world of animals — human and nonhuman — cognitivists' knowledge of animals appears in many cases painfully limited. One is easily led to think, at least with respect to some of the creatures they write about — lobsters and scallops, for example — that their only encounter with them has been on a plate. Yet serious study of animate forms is required for understandings of consciousness. Included in this requisite study is a study of hominids themselves and for the following reason: any evolutionary understanding of human consciousness — any “naturalistic study of consciousness” (Flanagan, 1984, p. 307) — must acknowledge a historical fact recorded previously, namely, that while all humans are hominids, not all hominids are human. Accordingly, any evolutionary rendition of human consciousness must take into serious account artifactual evidence attesting incontrovertably to the intellectual acumen of nonhuman animals. Such an account can hardly be rendered in computational brainstate terms. It can, however, be rendered and in fact has been rendered in sensorykinetic terms demonstrating a corporeal consciousness (cf. Sheets-Johnstone, 1990).

The third implication is related to the second. We can hardly hope to understand consciousness if we make authoritative and self-serving evolutionary armchair pronouncements such as “Consciousness did not have to evolve.... Consciousness is not essential to highly evolved intelligent life.... However, from the fact that consciousness is inessential to highly evolved intelligent life, it does not follow that it is inessential to our particular type of intelligent life” (Flanagan, 1992, p. 129; the first sentence appears in his 1984, p. 344); or, if in the course of explaining how it is possible “that some living things are conscious” (Flanagan, 1984, p. 307; 1992, p. 1), we make claims about creatures whom we have not bothered to study but about whom we feel entitled to make judgments. To affirm, for example, that scallops “are conscious of nothing,” that they “get out of the way of potential predators without experiencing them as such, and when they fail to do so, they get eaten alive without (quite possibly) experiencing pain” (Flanagan, 1984, p. 344 f; 1992, p. 132), is to leap the bounds of rigorous scholarship into a maze of unwarranted assumptions, mistaking human ignorance for human knowledge. As a matter of fact, a well-known introductory biology text shows a picture of a scallop “sensing an approaching starfish,” and “leap[ing] to safety.” The same book, commenting on the complexity of a scallop's eyes,

elsewhere notes that although the lens of its eyes “cannot focus on images,” it detects “light and dark and movement” (Curtis, 1975, pp. 29, 387). Evolutionary understandings of consciousness on the basis of animate form are clearly a radical departure from materialist conceptions that, basically identifying consciousness and matter, eschew serious inquiry into the nature of animate life. It is thus not surprising that in offering their reductive programmes, materialists offer a metaphysics in advance of an epistemology and a natural history that support it. Their metaphysics is in advance of a supportive epistemology in that both experience and meticulous study belie theory. Proprioception in general and kinesthesia in particular advert to a knowing subject, a subject that, at minimum, knows when it is moving and knows when it is not. Consciousness can therefore be judged neither “inessential” nor essentially linguistic, a “center of narrative gravity.” Consultation of and reflection upon corporeal matters of fact testify to a corporeal consciousness that is epistemic in nature and that can be ignored only at the peril of a degenerate epistemology. Their metaphysics is in advance of a supportive natural history in that it ignores close knowledge of the literature on nonhuman animals, including, as suggested above, those nonhuman animals that were the direct hominid ancestors of modern-day humans. An evolutionary backbone is thus essentially lacking to their metaphysics, which is why it must be propped up by molecular definitions of life and why the life the metaphysics describes, being mere ongoing states of a brain, offers a portrait of life as if life were a series of stills. In sum, serious inquiry into the *nature* of consciousness perforce must take into account its natural history.

GLOSSARY

Although many terms used in the text are defined in the text, a listing is given here for convenience and added reference. (Note: Biological classification is in terms of kingdom, phylum, class, order, family, genus, species.)

Amoeba: A genus of protozoan organisms distinguished by their pseudopodia.

Annelida: a phylum of invertebrate animals that includes earthworms and marine worms, all of which have segmented bodies. (From Latin *anellus*, ring.)

Anthozoa: a class of coelenterates that includes sea anemones and corals. (From Greek *anthos*, flower + *zoion*, animal.)

Arthropoda: a phylum of hard-bodied invertebrate animals — the largest phylum in the animal kingdom — that includes lobsters, spiders, ants, and centipedes, all of which have an external skeleton and thus articulable body parts. (From Greek *arthro*, joint + *podos*, footed.)

buccal: pertaining to the cavity of the mouth.

campaniform sensilla: bell-shaped proprioceptive organs in insects that are sensitive to deformation.

chordotonal organs: internal proprioceptive organs of invertebrates.

cilium (pl. cilia): a hairlike structure that protrudes from the surface of a cell and is commonly found in rows; it has a characteristic 9+2 internal structure, i.e. nine pairs of microtubules surrounding two microtubules at the center.

Coelenterata: a phylum of invertebrate animals that includes polyps, jellyfish, sea anemones, and corals. (From Greek *koilos*, hollow + *enteron*, intestine.)

Crustacea: a class of arthropods that includes barnacles, prawns, crab, water fleas, and crayfish.

(From Latin *crusta*, the shell or hard surface of a body.)

decapod Crustacea: crustaceans such as lobsters and crab having five pairs of legs and belonging to the order Decapoda.

eukaryote: a cell that has an outer membrane that separates it from its environment and both a membrane-bound nucleus and membrane-bound organelles. (From Greek *eu*, good + *karyon*, nut, kernel.)

flagellum (pl. flagella): a hairlike structure that protrudes from the surface of a cell and that is instrumental in locomotion and feeding; it is longer than, but has an internal structure similar to, a cilium.

Gastropoda: A class of mollusks that comprises the largest number of species of mollusks (80,000). The class includes whelks, snails, limpets, conches, and abalones, which have either a univalve shell or no shell at all, and which are more mobile than bivalve mollusks such as the scallop. (From Greek *gastro*, stomach + *podos*, footed.)

Hydrozoa: a class of coelenterates which includes polyps and jellyfish and of which the polyp is the dominant form. (From Greek *hydor*, water + *zoion*, animal.)

Hymenoptera: an order of insects that includes bees, ants, and wasps. (From Greek *hymen*, membrane + *pteron*, wing.)

Mollusca: a phylum of soft-bodied invertebrate animals that includes snails, slugs, oysters, mussels, scallops, octopuses, and squid. (From Latin *molluscus*, soft.)

nauplius (pl. nauplii): a larval form of crustacean.

Paramecium: a genus of protozoan organisms distinguished by their cilia-mediated movement.

polyp: a coelenterate animal that is usually sessile and that has a vase-shaped or cylindrical body, the mouth of which is surrounded by tentacles.

prokaryote: a cell that has an outer membrane that separates it from its environment. (From Latin *pro*, before + Greek *karyon*, nut kernel.)

Protista: a kingdom of eukaryotic, unicellular organisms.

Protozoa: a phylum of organisms within the kingdom Protista. The animals are characteristically one-celled organisms that are invisible to the naked eye. They are classified according to their form of locomotion: movement by means of flagella, of cilia, or of pseudopodia. Some protozoa — the sporozoans — are nonmotile forms. (From Greek *protos*, first + *zoion*, animal.)

radula: a feeding organ by which gastropods rasp or scrape off bits of plant or animal tissue. (From Latin *radere*, to scrape.)

scolopidia: complex peg- or spike-like structures comprising the cellular units of chordotonal organs in invertebrates.

sensilla: external proprioceptive organs such as hairs, pegs, slits, and plates.

sessile: stationary, attached to a substrate, not freely moving. (From Latin *sedere*, to sit.)

Stentor: a genus of protozoan organisms distinguished by their cilia-mediated movement.

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