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Beyond Nature\Nurture Buddhism and Biology on Interdependence

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We are but whirlpools in a river of ever-flowing water. We are not stuff that abides, but patterns that perpetuate themselves. Norbert Wiener (1950, 96)

There have been many famous, and sometimes fruitful, comparisons between quantum physics and Eastern thought, but only recently has a fruitful dialogue emerged between biology and Buddhist thought. This paper engages this dialogue by examining and comparing core principles from evolutionary biology and early Buddhist thought, which taken together elucidate a more fully embodied view of our minds and selves as inseparable from the natural world. We shall first present the basic Buddhist notion of dependent arising (*pratitya-samutpada*) - that all conditioned phenomenon arise in dependence upon other phenomena - and examine its implications for understanding the development of species and the functioning of organisms. We shall then explore and elaborate some basic congruities between dependent arising and evolutionary biology for an ontogeny of mind. Rather than diminishing our significance as creative, spiritual beings, the radical interdependence articulated by both Buddhism and biology may actually serve to ameliorate our alienation from the natural world, and ultimately from ourselves. To the extent that they forge a view of embodied interdependence and deep belonging in the universe, they may suggest a path beyond the stale dichotomy of spirit and matter that underlies so much of this alienation.

This dialogue is possible only because there has been a fortuitous convergence in the latter half of the twentieth century between early Buddhist concepts and more recent developments in Western thought. This convergence suggests the sense that we may actually understand ourselves

and our world more fully and deeply if we conceive of phenomena in terms of their interconnected patterns of relationships rather than as reified entities existing independently from their developmental histories, their environmental dependencies, or their internally differentiated processes. There is, in short, a growing consensus in many fields that thinking in terms of timeless essences, substantive entities or unchanging identities obscures rather than elucidates the phenomenal world and our place within it.

Although expressed differently in different fields, these common themes have been articulated clearly and comprehensively in classical Buddhist philosophy: 1) that all conditioned phenomena are radically interdependent and hence lack any kind of fixed or unchanging 'essence' (*svabhava*); 2) that 'things' in the world are dynamic yet wholly conditioned constructs (*samskara*) carved out of this fluid, ever-changing interdependence; 3) that ignorance of this interdependence, and our ensuing assumptions of having fixed 'natures' or being absolutely autonomous agents, underlies alienated human condition; and 4) that this alienation can be overcome by profound insight into our deeply contingent and conditioned reality. While these basic concepts of essencelessness, interdependence and ultimate identitylessness seem simple enough, it requires considerable elaboration to fully appreciate how profoundly they implicate the 'nature' of human nature.

Since the famous yet faulty dichotomy between nature and nurture that still governs much of our discussion of human life obscures this organic interdependence, we shall examine these thorny issues after first briefly presenting the Buddhist understanding of the role of mind and mental activities in the conditioned arising of life forms and the fundamental similarities that this understanding shares with evolutionary theory. We shall see that from the perspective of both Buddhist thought and biology, the nature\nurture debate is built upon faulty premises, utilizes unfounded assumptions, and leads to more confusion than clarity. Moreover, we will apply

Buddhist analyses of causation to one conception of genetic determinism.

But we cannot simply jettison antiquated perspectives. We must suggest constructive alternatives. We will therefore attempt to articulate a Middle Path - between the extremes of absolute determinism and absolute autonomy - by articulating human evolution as a self-organizing, feedback process in which action and experience condition the construction of organismic forms and patterns, which themselves form the basis for new behaviors and experience, and so on, eventually giving rise to new emergent structures at each stage of development.

I. EVOLUTION AND THE BUDDHIST THEORY OF INTERDEPENDENCE

Analogous to theories of evolutionary development, Buddhist thought envisions a deep interdependence, a feedback cycle between the long-term processes that brought about the human species, our individual embodiment endowed with its species-specific behavioral patterns, and the ongoing activities that are enabled and conditioned by these first two, corresponding, roughly, to phylogeny, ontogeny, and psychology, respectively. Though for analysis' sake, we must discuss these sequentially, we should not lose sight of their fundamental interdependence. For ultimately, in both the Buddhist and evolutionary biological perspectives, it is the discrete actions of living beings in interaction with their environment that, over the long term, underlie evolutionary change.¹ We shall first trace the development and activity of mind in the Buddhist world view and then examine analogous conceptions within evolutionary biology, presenting both as succinctly as intelligibility allows.

Buddhist Interdependence

In Buddhist terms, our human world developed through the aggregate activities (*karma*) of sentient beings instigated by specific mental afflictions (*klesha*, *anusaya*). This was succinctly

expressed by the great fifth-century Indian Buddhist, Vasubandhu (AKBh ad V 1a.), who stated:

The world in its variety arises from action (*karma*). Actions accumulate by the power of the latent afflictions (*anusaya*), because without the latent afflictions [they] are incapable of giving rise to a new existence. Consequently, the latent afflictions are the root of existence.²

That is, in the classical Indian Buddhist view our entire sentient world, including the specific structures and capacities of our embodied existence, are the cumulative result of the prior activities (*karma*) of living beings instigated by the *three poisons* - ignorance, craving and aggression - and their associated mental afflictions (*anusaya*). These actions, moreover, are informed by a sense of permanent identity, thought of as a unitary, autonomous entity, independent of and isolated from the dynamic and interdependent world around us.³ What we commonly think of as an essential or fixed 'nature' is, in this view, a complex construct (*samskara*) generated by misunderstanding, forged by emotional attachments, and secured by endless assertive activities: grasping to self-identity, desiring sensual pleasure and averting threats to either.⁴ Our human 'nature' is constructed, in other words, by actions motivated by the 'three poisons' of ignorance, craving and aggression.⁵ Our bodies and all of their faculties, the Buddha declared, "should be regarded as [the results of] former action (*karma*) that have been constructed and intended and now to be experienced."⁶

Amongst these results, we are endowed at birth with the latent proclivities or dispositions (*anusaya*) toward actions that are motivated by ignorance, craving and aggression - the very actions that were instrumental in bringing about these kind of bodies in the first place. These dispositions remain latent, however, awaiting their fuller development with growth and maturation.⁷ Thereafter, and for as long as they persist, these latent dispositions (together with the *view of self-existence*⁸) are 'activated' by nearly all of our moment-to-moment experiences,⁹ informing their consequent actions and making them karmically effective. This constitutes the crucial link in the recursive feedback cycle known as *samsara*: Actions lead to results, which in turn typically activate the latent

afflictions; those latent afflictions in turn give rise to further activities that lead to more results, and so on.¹⁰ Vasubandhu describes this classic account of cyclic causality in terms of one's 'mind stream': "the mind stream (*santana*) increases gradually by the mental afflictions (*klesa*) and by actions (*karma*), and goes again to the next world. In this way the circle of existence is without beginning."¹¹

As indicated above, the mental afflictions play such a crucial role in the formation and development of sentient life that Vasubandhu called them "the roots of existence."¹² Being so deeply implicated in our ongoing activities, it is nearly impossible to evade their influences. And as long as they persist, the Buddha asserts, it is "impossible" to ever truly be free of the misguided actions they instigate.¹³ Eradicating these afflictions, therefore, becomes a *sine qua non* of Buddhist liberation,¹⁴ for which one must understand their conditioned arising, the conditioned nature of 'self-identity',¹⁵ and the interdependent nature of all phenomena. Overcoming our sense of being truly separate and alienated from the larger universe around us is thus an integral part of the Buddhist path to liberation.

It is difficult to envision how such seemingly 'psychological' processes as the afflictions could be so instrumental in bringing about the forms of life on this planet, how 'mind' and mental afflictions could so strongly influence the development of sentient existence. We shall therefore examine one widely accepted account of how such behavioral patterns have built up, and are built into, our mental and physical structures: the view of evolutionary biology. Here too we shall be as brief as intelligibility allows.

The Interdependence of Evolution, Experience and Action

In the perspective of evolutionary biology, we have all descended through the extended processes of evolution from those creatures whose successive transformations produced successful

biological organisms. This occurred through what biologists call differential reproductive success, the simple fact that creatures who reproduce more prolifically pass on more of their heritable characteristics than those who reproduce less. The theory of evolution includes a positive feedback process wherein those behavioral patterns that lead to greater reproductive success are also steadily reinforced over extended periods of time. That is to say, the heritable characteristics we embody today largely result from behaviors that have successfully furthered their own reproduction in the past.

What living beings are, in other words, are assemblages of dynamic yet historically conditioned structures (*samskara*) forged from the crucible of past experience, the structures that "have been constructed and intended and are now to be experienced." Chief among these structures are the physical and mental capabilities that allow us to acquire food and shelter, and the cognitive and emotional wherewithal necessary for reproducing and raising offspring. In other words, the *drive* to preserve personal existence, a *desire* for those activities that lead to reproduction, and sufficient *attachment* to the people and things necessary to achieve those objectives, are all essential characteristics for producing, preserving and re-producing human life. That these drives, this thirst for life, are *constitutive* of the very form of existence we embody right here and now follows from the simple yet profound postulate at the heart of evolutionary theory: what has been more (re)productive in the past is more plentiful in the present.¹⁶

As biological creatures, we all therefore embody the cumulative results of whichever behaviors facilitated more reproductively successful interactions between our forebears and their natural and social environments.¹⁷ Accordingly, these results are expressed in our proclivities or dispositions to certain behaviors, whose basic physiological structures are either present at birth or mature within critical periods of development. These structures, and their associated behavioral patterns, thereafter promote and facilitate our various life activities, whose results in turn - in the

long-term and in the aggregate - are indispensable components in the evolutionary processes whereby reproductively consequential capacities become stronger and more complex.¹⁸ Actions thus constitute an indispensable link in a positive feedback cycle: our inherited capacities (which *result* from previous actions) facilitate our current *activities* (based upon inherited capacities) which in turn *condition* future evolutionary developments.¹⁹

We therefore find basic agreement between early Buddhist thought and evolutionary biology²⁰ regarding the important influences that certain drives and behavioral patterns impart over vastly extended periods of time, in their persistence as heritable emotional and cognitive capacities, and as dispositions activated in our moment-to-moment psychological processes - that is, their roles in evolution, embodiment and enaction, respectively. The radical implications of evolutionary biology is that the very forms and structures of human life reflect the accumulative results of past activities of innumerable beings over countless generations.²¹ They are, as the Buddha said, the results of "former action (*karma*) that have been constructed... and now to be experienced." In this perspective, we are contingent and historical creatures through and through, lacking any unchanging 'species-essence' or fixed 'human nature,' a point we shall return to shortly.

Creating Complexity: the Co-evolution of Biology and Culture

It is easy to underestimate the implications of this important relationship between the past actions of our ancestors and the particulars of our present species, since they so radically implicate our unique human capacities, our special modes of knowing, feeling and thinking, within the constructive processes of the past. Nowhere, perhaps, is this more true than in our social and cultural spheres.

Our world of interaction with others, society, and the shared, symbolic means we have of expressing, communicating and transmitting that world, culture, are never exclusively 'social' or

'cultural' as opposed to 'natural.' They exist in an interdependent or dialectical relationship. While it is widely perceived that our biological capacities undergird much of our social and cultural lives, from sexuality to language, it is much less appreciated how much our cultural and social lives have indelibly configured our physiology. By most accounts, our unique human brain structures evolved roughly simultaneously with the development of culture, which was itself dependent upon the social and cognitive capacities this evolving brain facilitated.²² For human beings, then, culture and human biology are inseparable, interdependent, 'co-evolutionary' phenomena. Culture is not something *added on* or extraneous to human life: insofar as it has been (and is) inseparable from behavior affecting differential reproductive success, it is fundamentally *constitutive* of human existence. There is thus an interdependence between the social and cultural environments that early humans created and inhabited and the dynamics and direction of further evolutionary development. After a certain stage, our social and cultural lives became predominant, self-perpetuating evolutionary forces in their own right.²³

This immensely complicates our attempts to delineate the originating conditions of human life and behavior, for we can no longer rely upon any straightforward calculus of genetic inheritance, selection pressures, and external behavior.²⁴ The previous categories of nature and nature are simply inadequate for describing these complex, co-evolutionary processes. Rather, evolutionary thought requires new models of circular causality which can take into account the complex interdependence between our genetic and social and cultural inheritances.

On 'Nature' and 'Nurture' and Human 'Nature'

In the attempt to understand the causes and conditions of our complex, variegated behavior, however, many have found it useful to distinguish those traits that seem to be inborn or innate from those that seem to be acquired after birth, attributing fixed and unchanging rigidity to the former and

responsive flexibility to the latter. People's views are often classified according to the relative strength they accord 'nature' or 'nurture', the hard-nosed 'realists' on the one side, pessimistic about ever fully eradicating "man's inhumanity to man", pitted against the enlightened 'progressives' on the other side, optimistic about the prospects of rectifying once and for all the problems our troubled species continually creates for itself. One reason this debate takes the form it does is that it fails to incorporate the radical implications of the evolutionary view of life, of the complex and circular causality that implicates the very forms and capacities of our embodied existence in a deep interdependence between living beings, their interactions with their social and 'natural' environments, and the emergent results these interactions lead to. It is this radical interdependence that undermines common notions of biological determinism, on the one hand, and qualifies any absolute autonomy claimed by the *tabula-rasa* camp on the other.²⁵

We therefore need to interrogate the dubious dichotomy between nature and nurture that informs this debate, for it enfeebles rather than enables further understanding of the human condition. If we are not clear about the 'nature' of species, we cannot be clear about the causes and conditions that bring them about. We cannot begin to have an historical science of the human species. And it is only by better understanding the causal conditions, the dependent arising if you will, of our species as a whole that we can understand the heritable behavioral dispositions which constitute our present embodiment - how our bodies and their faculties are the results of "former actions (*karma*) that have been constructed and intended and now to be experienced."

What do we mean by 'nature'? The 'nature' of something, its dictionary meaning suggests, is its essence, its unchanging, intrinsic characteristic that definitively sets it off from other such entities or essences. But when we take into account the origination, persistence and extinction of *species forms*, as we currently understand these processes, it is clear that the notion of a fixed 'species essence' has no place within the intricate and interwoven web of causal relations described in

evolutionary theory. "Darwinism... banished essentialism," historian of science Richards (1987, 4) declares, "the idea that species members instantiated immutable types." And if a species does not instantiate an immutable type or essence, it must have a series of causal conditions which led to its present, albeit provisional, form. This is why biologists insist on *historical* nature of biological science. As Ernst Mayr (1988, 15f) asserts:

The ability to make the switch from essentialist thinking to population thinking is what made the theory of evolution through natural selection possible.... The genotype (genetic program) is the product of a history that goes back to the origin of life, and thus it incorporates the 'experiences' of all ancestors.... It is this which makes organisms historical phenomena.

And if species do not instantiate immutable types or essences, but are profoundly historical phenomena, what then is the cogency of the 'nature' versus 'nurture' debate? Since it assumes a conception of nature or species essence which is no longer tenable in biological explanation, the nature\nurture controversy is based upon a false dichotomy: if there is no fixed 'nature' or 'species essence,' there can be no pure 'nurture' with which to contrast it.²⁶ Even though we often use the terms 'nature' or 'essence' as if they referred to something that is fixed and unchanging, in practice these are usually just convenient ways of talking about things that only provisionally endure, characteristics that only temporarily appear, and properties that only contingently cohere.²⁷ In other words, 'nature,' in the sense of biological inheritance, is an historically constructed phenomenon conditioned by previous actions (however remote some of those constructive influences may be from their present results); while 'nurture,' in the sense of the conditioning processes incumbent upon one's upbringing and environment, is already dependent upon innate abilities to grow and to learn (which are themselves highly developed capacities constructed through our evolutionary past). Susan Oyama (1985, 122) thus argues that "there is no intelligible distinction between inherited

(biological, genetically based) and acquired (environmentally mediated) characteristics."²⁸ 'Pure nurture' is as impossible as unconditioned 'nature' is unexampled. In short, nature\nurture question is exactly parallel with, and about as edifying as, the classic chicken and the egg question.

II. AN INTEGRATED CAUSAL THEORY

This brings us back to the questions about models of interdependent causality raised at the beginning of this paper, of which the nature\nurture question is just a subset. Models of causality are important because they influence how we conceive and carry out our aims and actions in life. Faulty causal models subvert these aims and pervert these actions. Buddhist thinkers insist we cannot be clear about causality as long as we think in terms of independent entities and autonomous agents, but that, conversely, understanding the interconnected and processual nature of reality sheds more light on our common human condition and gives us more effective conceptual resources to overcome its drawbacks and limitations. This is where biological thinking on causality closes ranks once again with the Buddhist ideas of dependent arising.

As we have seen, modern biological theory has also been engaged in overcoming essentialist ways of thinking, based upon the unchanging forms and essences of traditional Western philosophy, and gradually replacing them with models that consider organisms as dynamic energy-processing and structure-building networks, that is, as open, self-organizing²⁹ phenomena. These new models are as applicable to the origination, development and living processes of human beings as they are for other forms of life. And once we start thinking in terms of complex dynamic organizations operating in systematically patterned ways to build up and maintain their own structures, our older models of human beings as autonomous 'agents' unilaterally acting upon an independent, external and pre-existing world becomes limited or irrelevant at best and simply misleading at worst.

What seems more explanatorily productive in an increasing broad range of applications is a model of complex, dynamic interaction that is 1) based upon the notion that there are no singular entities or homunculi directing things within or controlling them from without - comparable to the Buddhist denial of a substantial self (*atman*) which is largely consonant with modern science; and 2) that assumes a causal syntax akin to the Buddhist notion of dependent arising - when X is, Y arises. That is, when a set of certain conditions (X) are present, a certain set of other conditions (Y) arise. This kind of causal syntax is found in scientific models, from economics to ecology to meteorology, in which important measurements and predictions are based upon the dynamic relations between yet other measurements. The power of these models comes from the idea that we can understand living processes better by understanding the conditions in which they arise and the patterned interaction between them, that is, their 'dependent arising,' than by thinking in terms of the singular actions of fixed entities or essences. Models of complex, interdependent causality, such as found in evolutionary biology, self-organization theory, and Indian Buddhist thought, therefore all couch causality in terms of *patterns of relationship* rather than in terms of fixed, independent entities.³⁰

In this last section, we shall examine these models of causality in two ways. We will first examine the way that one important evolutionary theorist, Richard Dawkins, seemingly embraces such a model, but then treats genes as the privileged player - the autonomous agent if you will - in evolutionary explanations of life. Conversely, we will argue that genes are an inseparable component in the complex interrelationships between organisms and environment. We will then briefly outline a model of causality commensurate with both Buddhism and self-organization theory that surmounts the nature-nurture dualism while simultaneously pointing toward a vision of unalienated embodiment. For reasons of space, I will leave implicit many of the extensive analogies and parallels with the Buddhist concepts previously described. They nevertheless provide the conceptual framework, and often the analytic strategies, for most of the following discussion.

Genes: The Last Refuge for Independent Agents

Old ways die hard. Despite the efforts of biologists such as those cited above, one of the lingering consequences of understanding species as immutable types is the tendency to consider 'genetic' influences, paramount and nearly absolute. This is reflected, as Tooby and Cosmides (1992, 81) note, in "folk biology, captured in the two dictionary definitions of *innate* as 'present from birth' and as 'intrinsic,'" as if innate features of human design or behavior were not simply inborn but rather *intrinsic* parts of human nature, like some "inexorable supernatural predestination." (*ibid.* 80). This misunderstanding rests, evolutionary theorist Dawkins argues, upon a fundamental confusion about the two levels at which genes operate: phylogenetically, they are reproduced exactly from one generation to the next (excepting mutations, of course), while ontogenetically they help guide the course of each individual's development from genotype to phenotype (its manifest expression in the body).³¹ Although famously accused of such biological determinism himself, Dawkins (1982, 11f) unequivocally rejects the notion - in ontogeny - on the grounds of sheer complexity:

The belief that genes are somehow super-deterministic, in comparison with environmental causes, is a myth of extraordinary tenacity... Genes may modify the effects of other genes, and may modify the effects of the environment. Environmental events, both internal and external, may modify the effects of genes, and may modify the effects of other environmental events... [The notion that] if it is in the genes 'it is written,' it is 'determined' and nothing can be done about it:... is pernicious rubbish on an almost astrological scale.

It is thus especially curious that this same complexity is ultimately rejected in his account of phylogeny, the evolution of species themselves, where privileged status is accorded to purely genetic influences. We will examine Dawkins' efforts, inspired by 'misinterpretations' of his 'Selfish

Gene' theory, explicate the implicit assumptions underlying his genetic explanations of behavior. These efforts are insightful, not only also because his formulations reflect a 'anthropomorphization' of evolutionary causation - as if evolution were actually 'for' something and genes unilateral agents of their own aims - but also because some of his formulations simultaneously point toward a more complex causal model that is largely commensurate with those described above. As we shall see, the attempt to isolate genes, either logically or theoretically, as unilateral causes of specific phenotypes breaks down as causal influences diffuse into, and from, the surrounding environments.

In the first place, Dawkins argues that natural selection only operates upon *differences* between members of a population that are actually expressed in the phenotype, in the body:

It is a fundamental truth, though it is not always realized, that *whenever* a geneticist studies a gene 'for' any phenotypic character, he is always referring to a *difference* between two alleles. (Dawkins, 1982, 92) [Emphasis in original.]³²

'Genes for' some trait can therefore never be specified *independently* of the differences between the characteristics they seem to produce and some other, contrasting characteristics, both as operated upon by natural selection and as distinctive factors carrying explanatory weight.

The 'genes for' a trait are, moreover, not only operationally and definitionally distinctive, but are also contingent upon environmental conditions: "the character of interest is a *difference*, and in both cases [a gene for tallness and for dyslexia] the difference only shows itself in some specified environment." (23) Thus, Dawkins (38) concludes

The phenotypic 'effect' of a gene is a concept that *has meaning only if the context of environmental influences is specified*, environment being understood to include all the other genes in the genome. A gene 'for' A in environment X may well turn out to be a gene for B in environment Y. *It is simply meaningless to speak of an absolute, context-free, phenotypic effect of a given gene.* [Emphasis added.]

That is, following Dawkins' own statements, this context-rich definition of the expression 'genes for a trait' cannot refer to anything specific *outside* of the inseparable complex of other mutually conditioning genetic material, its morphological or behavioral expression within specified environments, and its *distinctiveness* from other expressions upon which natural selection may work.

This contextual dependence is further extended to the phylogenetic interdependence between an organism and its environment. Since the phylogeny of an organism is a product of the history of its interactions with the environment, this subtly yet radically shifts the notion of what exactly the 'subject' or 'product' of evolution might be. Dawkins also recognizes this:

The genes that exist today reflect the set of environments that they have experienced in the past. This includes the internal environments provided by the bodies the genes have inhabited, and also external environments, desert, forest, seashore, predators, parasites, social companions, etc. This is, of course, not because the environments have imprinted their qualities on the genes - that would be Lamarckianism - but because the genes that exist today are a selected set, and the qualities that made them survive reflect the qualities of the environments in which they survived. (1982, 93f)

All of this is consonant with the theories of complex, circular causality outlined above. But this makes the following, all-too typical privileging of genes as *the* 'unit of selection' particularly puzzling:

The whole purpose of our search for a 'unit of selection' is to discover a suitable actor to play the leading role in our metaphors of purpose.... *since we must speak of adaptations as being for the good of something*, the correct something is the active, germ-like replicator. (*ibid.*, 91)

Why, we must ask, are adaptations 'for the good of' genes rather than, say, the organism, the

environment, or, as many others have suggested, not 'for' anything at all? And if it is "simply meaningless to speak of an absolute, context-free, phenotypic effect of a given gene", then why is it meaningful to speak of an absolute, context-free, *ontogenetic* purpose of a gene, other than to propose and fulfill metaphors of purpose? As I interpret Dawkins' passages cited earlier, talking about 'genes for' certain traits is a shorthand way of referring to this whole complex of interrelated conditions. He thus uses the term 'genes' as a synecdoche, using the name of a part of something to stand for the whole. This is fair enough, we often have to use such devices to communicate. But this use demonstrates how live metaphors can, through repetition and familiarity, turn into dead metaphors, that is, become substitutes for 'explanations.'

This critique might be clearer if we substituted the terms 'cause' and 'effect,' since this is effectively an argument about causal relationships. A cause 'for' an effect can only be identified by its recurrent relationship with some identifiable effect, otherwise we wouldn't know which effect it was a cause 'for.' But this definitional interdependence of cause and effect makes any identification of 'genes' as "absolute, context-free" causes 'for' their phenotypes extremely problematic. Take some trait, such as aggression or altruism, for example. Clearly identifying the 'cause' of aggression, say, is dependent upon clearly identifying the behavior itself and establishing a plausible link between the two. But such categories are complex and contested, even amongst professional psychologists. They are more a matter of convention, of agreeing to draw distinctions here rather than there. So how can we find the cause (genotype) for something whose effect (phenotype) we cannot absolutely delineate, that is, the exact parameters of aggression?

This is not to deny that there is behavior we 'call' aggression, but rather that we can't get to some *actual genetic cause* of it by means of which we could *explain* aggression without begging all the important question about their causal relationship. That is to say, there is no way to find an independent biological substratum that we could call the 'real cause' of aggression which exists

independently of the complex behavioral patterns (and their enabling conditions) that we *call* aggression for the simple reason that the cause (genotype) is explicitly defined in terms of the behavior (phenotype) it seeks to explain.³³ The 'search' for a 'cause' of any 'effect' entails this unavoidable circularity. And for the very reason that the cause is defined by its relationship with an effect, a cause cannot, *in and of itself, explain* an effect.³⁴ The cause (genotype) and effect (phenotype) should be seen, in short, as two parts of a single, mutually defining unit - a unit that is only discernable, moreover, insofar as it is related to phenotypes that are differentiated from other phenotypes.³⁵

So why prioritize only one part of this unit, the genes? Since, as Dawkins admits, the environment and organism play crucial roles in configuring the genome, it would make as much sense to say that the organism/environment created the genes as it does to say the genes created the organism.³⁶ This is a radical shift in focus that is obtained not only by explicitly recognizing the interdependence between genes, organism and environment, but also by defining an 'environment' as that which is relevant to any given organism,³⁷ both of which, together with the genes, could be considered the 'products of evolution'. It is "this *developmentally relevant environment*--the environment as interacted with by the organism--that, in a meaningful sense, can be said to be the product of evolution," evolutionary theorists Tooby and Cosmides (1992, 86) argue: "*both the genes and the developmentally relevant environment are the product of evolution...*" [Emphasis in original] From this point of view, the environment does not simply exist 'out there', independently of any particular organism, nor are organisms simply active agents working upon a passive world; rather they all co-evolve.³⁸

In this kind of evolutionary theory the very terms of analysis have shifted from that of entities to interactions. "What evolves," Maturana and Varela conclude, "is always a unit of interactions" (12), not the organism itself, and certainly not the environment alone, but rather the

organism-in-environment: "The evolution of the living systems is the evolution of the niches of the units of interaction." (*ibid.*, 12). In other words, just as with the Buddhist theory of dependent arising, it is *the patterns of interaction that evolve*.³⁹ This might be elaborated upon.

Modern Systems Theory, Dependent Arising, and Mind-World Non-duality

We have examined some of the ways in which biological thinking parallels that of the Buddhist ideas of interdependence and have also seen some basic similarities in their denial of entities or essences - whether as individuals or species - as separable explanatory categories. Furthermore, in our analysis even Dawkins admits that genes, in and of themselves, cannot be sufficient causal factors for understanding the processes of evolutionary development. In this closing section we will explore some fairly recent developments in biological thinking that builds upon many of the preceding perspectives and extrapolates from them into an admittedly speculative, nearly religious, mode.

We previously introduced the Buddhist theory of dependent arising as a recursively cyclic process between the constructed complexes (*samskara*), their experiential results, and the actions (*karma*) they both enable and elicit. One of the most important of these results is cognitive awareness (*vijnana*), usually translated as 'consciousness' or 'cognition.' In the traditional formula of dependent arising, cognitive awareness arises conditioned by the constructed complexes, which then gives rise to sensation (*sparsa*) and feeling (*vedana*) (also resultant conditions), which in turn elicit craving (*trnsa*) and grasping (*upadana*). These then provoke the further activities (*karma*; specifically, *kamma-bhava*) that help create and sustain the structures (*samskara*) that perpetuate cyclic existence. And for as long as these *samskaras* continue, they provide the ground, the precondition, for further cognitive and affective processes, and so on. This circular causality - (a

resultant) cognitive awareness, afflictive emotion (*klesa*), and the actions they elicit, resulting in further cognitive awareness, etc. - is at the center of the early Buddhist worldview.⁴⁰

This process is not only circular, however. It is also 'epigenetic' in that it describes how the specific structures and dispositions that have been 'built up'⁴¹ from past experience and activities, 'countless lifetimes' as the Buddhists put it, both enable and dispose us to have particular types of experience and particular kinds of cognitive awareness. As depicted in traditional formulas of dependent arising, cognitive awareness arises based upon two conditions: on the one hand, sensory stimuli occurring within its cognitive domain, and, on the other hand, the *specific physiological and psychological structures (samskara conditions vijnana)*,⁴² that have been built up by previous karmic activities. *Samskaras* here refer to the various physical, mental and emotional structures or complexes that constitute human life, and which function like templates that simultaneously condition experience while being continuously conditioned by experience.⁴³ The normal range of possible experiences and consciousness therefore reflects the well-worn paths that have been carved out, as it were, over the long-term history of the 'mental stream' through its own interactions with the world and based upon the continuously accumulating results of these actions - much like a river and riverbed have symbiotically come into being through the accumulated effects of nothing but the stream of water itself.⁴⁴ The accumulated effects of cyclic existence - our bodies and mind (*namarupa*) - thus reflect recurrent *patterns of interaction*, rather than the unilateral development of singular entities. *Samskaras* condition *vijnana* (cognitive awareness), which gives rise to further actions (*karma*) that produce or reinforce *samskaras*, that condition further *vijnana*, and so on.

Much like this celebrated Buddhist Middle Path between the extremes of substantive entities beyond all change and the total absence of causal effect whatsoever, modern biology conceives of a living organism as a "stable organization of matter and energy through which both matter and energy flow." (Kauffman, 1995, 20f). There is no unchanging identity in organisms, since all the

actual molecules of one's body are continuously being exchanged, but neither is there absolute discontinuity, since the *pattern* of organization persists *by means of, not in spite of*, these continual flows of matter and energy. Organisms achieve this organized state through accumulative interactions with their environments and they maintain homeostasis by remaining energetically open, allowing for the natural processes of assimilation and decay.⁴⁵ Embodying structures that have developed in relation to complex environments, living organisms continue to be modified through further interactions, resulting in continuous structural changes. In other words, "the product of their functioning is the same functioning organization that produces them." (Maturana and Varela, 9)⁴⁶ Capra describes this constructive circularity:

As it keeps interacting with its environment, a living organism will undergo a sequence of structural changes... an organism's structure at any point in its development is a record of its previous structural changes and... each structural change influences the organism's future behavior. (220)

In Buddhist terms, this describes the dynamic circumstances through which one's *samskaras* are built up over time, as *conditioned* constructs, yet also continuously *condition* the kinds of experience that are normally possible. This constructive process includes the very organs and faculties (*indriya*) that facilitate the arising of cognitive awareness (*vijnana*), so that it is the constructs (*samskara*) themselves, the results of previous 'structural changes', that determine the range of possible objects of consciousness, of cognitive awareness. In other words, it is the organism that determines which aspects of the 'world' it responds to and that constitute its effective 'environment.'

Biological philosophers Maturana and Varela take this 'organism's eye-view' and argue that "perception should not be viewed as a grasping of an external reality, but rather as the specification of one." (1980, xv)⁴⁷ That is, what *counts* as the 'world' or 'environment' for any given organism

depends upon the specifics of its cognitive structures,⁴⁸ for these specify its 'cognitive domain.'⁴⁹ Biologically speaking, then, there is no independent, objective world that we, as organisms, have access to,⁵⁰ because "the domain of classes of interactions into which an organism can enter *constitute its entire cognitive reality.*" (10f) [Emphasis added]⁵¹ To even speak of a 'world' therefore is to speak of a cognizing, that is, an interacting organism. In this sense, and consonant with the view of dependent arising, Varela (1972) argues that "world and perceiver specify each other."

This represents a change of focus with profound implications. Just as we saw how the simple dichotomy between 'genes' and their effects broke down through an analysis of their interdependence in evolutionary history, forcing (some of) us to think of "genes-effect-environment" as an inseparable unit, so here too the simple dichotomy between cognition and environment breaks down through an analysis of the radically *interactive nature* of cognition, forcing us to think in terms of "cognition-organism-environment" as an inseparable, mutually-defining complex.⁵²

And since an organism "interacts with the environment by continually modulating its structure," cognition, Capra (1985, 267) concludes

is not a representation of an independently existing world, but rather a continual *bringing forth of a world* through the process of living. The interactions of a living system with its environment are cognitive interactions, and the process of living itself is a process of cognition.⁵³

Not only can't we separate subject from object in any ultimate sense, according to the analyses above, but we can't ultimately separate the structures of sentient beings from the total history of their interaction with their environments. This means that mind, as the process of 'bringing forth a world' through cognition, cannot simply be seen as a function of the individual subject, the human genome or the brain, but is rather a process that arises from and is informed by the sum total of interactions,

past and present. In other words, mind is the product of the entire history of interactions between organisms and environments. Where then does 'mind' reside? Capra (1996, 172) suggests that,

mind is not a thing, but a process, the process of cognition, which is identified with the process of life. In other words, the organizing activity of living systems, at all levels of life, is mental activity. The interactions of a living organism... with its environment are cognitive, or mental interactions. Thus life and cognition become inseparably connected. Mind - or, more accurately, mental process - is immanent in matter at all levels of life.

In this perspective, all absolute distinctions and dichotomies between 'external' world and 'isolated' organism have been dissolved. If we - our genes, our bodies, our cognitive and affective structures, our consciousness itself - are indeed primarily comprised of emergent capacities constructed by past (both phylogenetic and ontogenetic) interactions with our environment, then our minds and selves are not simply *analogous* to but are *fundamentally inseparable* from the natural world. Biologists Tooby and Cosmides (1982, 72) do not shrink from the implications that can be drawn from this, which express an understanding of life and mind consonant with mystical traditions around the world:

There has been the evolution of a mesh between the principles of the mind and the regularities of the world, such that our minds reflect many properties of the world... *The stuff of the mind is the stuff of the world.*

One could just as well say that world has organized mind as that mind has organized the world. Or, as the Christian mystic Meister Eckhart suggested: "The eye with which I see God is the eye with which God sees me." (Forman, 147). The Buddhist parallels to this biological 'Mind-Only' theory, *mutatis mutandis*, are legion.

SOTERIOLOGICAL IMPLICATIONS

In the end, all these points toward the displacement, demotion, if not dethroning, of the dogmatic notion of "the genome as the central directing agency that commands the molecular dance." (Kauffman 1994, 69) They point toward a vision of evolutionary development in which not only are organisms inseparably intertwined with their surrounding environments, but the attempts to separate certain dimensions from others - whether nature\nurture, the cause and effect relationship between genotype and phenotype, or between organisms and environment themselves - seems an artificial exercise that obscures as much as it edifies. Focusing on the relations between parts rather than on the parts themselves seems at least as promising a perspective with which to understand our place in the universe.

A full recognition of this radical interdependence, this inseparability between mind and world, genes and environment, individual and society, arguably helps ameliorate rather than exacerbate our sense of alienation or separation from the 'natural' world. In most Buddhist traditions, it is held that such an understanding of the interdependence of our minds and 'selves' helps liberate us from alienated existence fostered by the false belief in inalienable individuality.⁵⁴ This is the radical message right at the beginning of Buddhism: that the recognition of dependent arising is liberating.⁵⁵ This Buddhist perspective on the interdependence between our constructed 'nature' and the 'natural' world draws out dimensions of evolutionary biology that have heretofore remained mostly implicit. Perhaps even Darwinian evolutionary theory can lead beyond the false dichotomy of mind versus matter to a view of our radically embodied interdependence and deep belonging in the universe.

But we must acknowledge that the early Buddhist world view raises many of the same qualms as the theory of evolution: if the forms of earthly life have no outside agency controlling and directing them, since evolution itself is a seemingly directionless process, then are we not just contingent, accidental beings lacking any ultimate purpose or meaning? What room is there for

human agency and responsibility in a world couched in the impersonal, passive-voice of dependent arising? A world without either divine or human narrative agency is suspect to a world without accountability, a world of moral, social and political, not to mention religious, chaos, threatening immanent meaninglessness and nihilism. Although the debate between biological determinism versus cultural or spiritual freedom is largely a caricature of biology as a science, it nevertheless reflects vital issues about human community that cannot be shelved simply by labeling it 'unscientific.'

Couching causality in terms of agency is unquestionably crucial for most narrative accounts of who are and what we are doing. But there is a disjunction between the success of impersonal models of causality in science and our more traditional, not to say sentimental, notions of human agency. This disjunction is not only exacerbated by each new reach of the sciences and social sciences, but is informing the humanities as well. And if this post-modern loss of agency has in fact precipitated a crisis of culpability, having drowned it in the endless ocean of contingent conditions, on what groundless ground does accountability stand, if at all? Is this entire model of causality, productive as it may be, a spiritual dead-end street? And would science stop even if it were?

These are questions that only our collective history will answer. We can take heart, however, from the historical precedent of Buddhism civilization(s) that have been able to successfully graft a narrative view of human life, with all of its attendant ethical norms, onto the trunk of a world view couched almost wholly in the impersonal causality of dependent arising. As Nagarjuna put it XXIV 40 of his famous Verses: "Whoever sees dependent arising also sees suffering and its arising and its cessation as well as the path." Insight entails ethical consequences. If we are radically interdependent in the way the Buddhists and (some) biologists suggest, then consequences of our actions persist in the very forms of life we live. If the human nervous system "interacts with the environment by continually modulating its structure", then all our actions

influence the kind of persons we are, the kind of world we make, the kind of species we become. In this view, the loss of agency mentioned above is not at all absolute, and it neither entails an inability to act nor a denial of the consequences of our actions - quite to the contrary. It does point to the complexity of the grounds or conditions for our activity in the world, to be sure, but without undermining the dimension of responsibility for that world. Rather, by clearing away the false dichotomies and useless debates over unchanging natures, entities and essences, Buddhist and biological views on the groundlessness of life highlight an immediate vision of ethical responsibility - *just because* it emphasizes our radically constructed and interdependent nature. If we end up becoming what we do, we live *out*, not just *with*, the consequences of our actions.

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1. This is not to overlook the crucial role that genetic mutations play by providing the raw material of evolving life forms for natural selection to work upon.

2. Abhidharmakosa, Poussin, p.1; Shastri, p.760. "*karmajam lokavaicitrayam*" ityuktam / tani ca *karmanyanusayavasadopacayam gacchanti, antarena canusayan bhavabhinirvartane na samarthani bhavanti / ato veditavyah mulam bhavasyanusayah.*

3. *Sabbasava-sutta*, Nanamoli, 1995, 92f. The sense of such an 'alienated' self is described in a discourse in the Pali Canon (M I 8), attributed to the Buddha: "It is this self of mine that speaks and feels which experiences here and there the result of good and bad actions; but this self of mine is permanent, everlasting, eternal, not subject to change, and it will endure as long as eternity."

The psychologist, Ernest Wolf (1991, 169) describes the same universal "conviction that I am the person who was born in a certain place at a certain time as the son of the parents whom I knew and that I am the person who has had a history in which I can identify the 'I' of yesteryear as the 'I' of yesterday and, hopefully, of tomorrow."

4. In the very first sermon given after his awakening, Turning the Wheel of the Dharma (*Dhammacakka-ppavattana-sutta*, S II 56, Rahula, 92) the Buddha described the Origin of Suffering, the second Noble Truth: "It is this thirst (craving) which produces re-existence and re-becoming, bound up with passionate greed. It finds fresh delight now here and now there, namely, thirst for sense-pleasures, thirst for existence and becoming; and thirst for non-existence (self-annihilation)."

5. The 'three poisons' ('greed, hatred, delusion' are variant terms) effectively epitomize a much larger range of human emotion and behavior, itemized more specifically as follows:

"Greed: liking, wishing, longing, fondness, affection, attachment, lust, cupidity, craving, passion, self-indulgence, possessiveness, avarice; desire for the five sense objects; desire for wealth, offspring, fame, etc.

Hatred: dislike, disgust, revulsion, resentment, grudge, ill-humour, vexation, irritability, antagonism, aversion, anger, wrath, vengefulness.

Delusion: stupidity, dullness, confusion, ignorance of essentials (e.g. the Four Noble Truths), prejudice, ideological dogmatism, fanaticism, wrong views, conceit." (Nyanaponika 1986, 99)

6. S II 64. *Nayam... kayo tumhakam na 'pi annesam. puranam idam kammam abhisankhatam abhisancetayitam vediniyam dathabbam.* Translated in Johansson (1979, 148).

7. In one famous discourse, the Buddha explains that even though an innocent baby boy lying on the grass lacks a developed view of self-identity, a notion of sensual pleasure, or aggressiveness toward others, nevertheless, the child still has the dispositions "toward a view of self-identity", "to desire sensual pleasure", and "to aggressiveness to others", etc. The *Malunkya-sutta* M I 433. Nanamoli, (1995, 537f) "For a young tender infant lying prone does not even have the notion 'personality' [*sakk*ya, or 'self-identity'], so how could personality view arise in him? Yet the underlying tendency (*anusaya*) to personality view lies within him. A young tender infant lying prone does not even have the notion 'teachings,' so how could doubt about teachings arise in him? Yet the underlying tendency to doubt lies within him. A young tender infant lying prone does not even have the notion 'rule,' so how could adherence to rules and observances arise in him? Yet the underlying tendency to adhere to rules and observances lies within him. A young tender infant lying prone does not even have the notion 'sensual pleasures,' so how could sensual desire arise in him? Yet the underlying tendency to sensual lust lies within him. A young tender infant lying prone does not even have the notion 'being,' so how could ill will towards beings arise in him? Yet the underlying tendency to ill will lies within him."

8. We tend to *identify* with all our bodily feelings, sense objects, psychological processes, etc.: "Now, monks, this is the way leading to the origination of personality (*sakkaya*, or 'self-identity'). One regards the eye thus: 'This is mine, this I

am, this is my self.' One regards [bodily] form and so on [i.e. all the sensory and mental processes comprising human life] thus: 'This is mine, this I am, this is my self.'" (M III 285. Nanamoli, 1995, 1133.)

9. In a passage that could well have been drawn from a psychology textbook, one discourse of the Buddha depicts how the latent dispositions to the three poisons are instigated by everyday perceptual experience, using vision as the prototypical example: "Dependent on the eye and forms, eye-consciousness arises; the meeting of the three is contact; with contact as condition there arises [a feeling] felt as pleasant or painful or neither-painful-nor-pleasant. When one is touched by a pleasant feeling, if one delights in it, welcomes it, and remains holding to it, then the underlying tendency to lust lies with one. When one is touched by a painful feeling, if one sorrows, grieves and laments, weeps beating one's breast and becomes distraught, then the underlying tendency to aversion lies with one. When one is touched by a neither-painful-nor-pleasant feeling, if one does not understand as it actually is the origination, the disappearance, the gratification, the danger and the escape in regard to that feeling, the underlying tendency to ignorance lies within one." (M III 285, Nanamoli, 1995, 1134)

10. Buddhist analysis of the arising of the afflictions is more nuanced than this. Abhidharma traditions, for example, analyze the relationship between a latent disposition and the particular objects by which it is triggered in ways that closely resemble psychoanalytic conceptions of 'invested' or 'cathected' (*besetzen*) objects. 1) First, each type of affliction is 'bound up' and attached to certain objects and reacts to them in certain conditioned ways. 2) Then, whenever the appropriate object appears in its respective sense-field, it evokes an 'outburst' of that affliction. So, for example, sensual desire arises whenever an object (*dharma*) that 'provokes an outburst of sensual desire' (*kamaragaparyavasthaniya-dharma*) appears in the sense fields and one has not abandoned or correctly understood the latent disposition toward it (*raganusaya*). 3) This latter condition explains why ignorance is said to be the root of them all. (1) AKBh ad V 22; Shastri, 801; Poussin, 48. *yasya pudgalasya yo 'nusayo yasmin alambane 'nusete sa tena tasmin samprayuktah*. AKBh ad V 18c-d. Shastri, 793; Poussin, 39. *yena yah samprayuktas tu sa tasmin sampravogatah //... te canusayah samprayogato 'nusayirannalambanatah*; 2) AKBh ad V 34; Shastri, 829; Poussin, 72f; *tat yatha raganusayo 'prahino bhavati aparijnatah kamaragaparyavasthaniyas ca dharma abhasagata bhavanti. tatra ca ayoniso manaskara evam kamaraga utpadyate*; 3) AKBh ad V 36c-d; Shastri, 831; Poussin, 74; *sarvesm tesm mulam avidya*.)

As dispositions, they are, of course, not absolute determinants ("if one delights in it... if one sorrows... if one does not understand"), nor do they by themselves entail consequences unless or until they instigate intentional actions (*karma*). If this were not the case, the theory of *karma* would amount to a narrow determinism and thus contradict the very possibility of liberation through religious practice. But the Buddhist theory of causality depicts neither the absolute inescapability of consequences nor a strict determinism. Rather, karmic activities set into motion patterns of energies that *conduce* to effects consonant with the motivations that instigated them, which in turn *tend* to instigate further actions. Otherwise, the Buddha warned, there would be no way out of the vicious cycle and hence no point in religious practice: "If anyone should say: 'just as this man performs an action, just so will he experience the consequence' - if this were correct, there would be no pure life and no opportunity would be known for the stopping of suffering. A I 249. (*Yo... evam vadeyya - yatha yathayam puriso kamman karoti tatha tatha tam patisamvediyatiti - evam santam... brahmacariyavaso na hoti okaso na pannayati samma dukkhassa antakiriyaya*.) (Johansson 1979, 146). Such a disheartening interpretation, the Buddha warned, would lead to an ill-advised passivity, a fatalistic and defeatist attitude that was the antithesis of the Buddha's exhortation to work toward one's own liberation: "for those who fall back on the former deed as the essential reason (*sarato paccagacchatam*) [for their present actions], there is neither desire to do, nor effort to do, nor necessity to do this deed or abstain from that deed. So then, the necessity for action or inaction not being found to exist in truth and verity [for you].... you live in a state of bewilderment with faculties unwarded." (A I 174) PTS translation.

11. (AKBh III 19a-d. Poussin, 57-59; Shastri, 433-4. *yathakseparam kramad vrddhah santanah klesakarmabhih / paralokam punaryati... ity anadibhavacakrakam*.)

12. One Pⁱⁱli sutta (S II 65) states: "If one does not will, O Monks, does not intend, yet [a disposition] lies latent, this becomes an object for the persistence of consciousness. There being an object, there comes to be a support of consciousness. Consciousness being supported and growing, there comes to be the descent of name-and-form; conditioned by name-and-form, the six sense-spheres arises, etc.... Such is the arising of this entire mass of suffering."

13. "That one shall here and now make an end of suffering without abandoning the underlying tendency (*anusaya*) to lust for pleasant feeling, without abolishing the underlying tendency to aversion towards painful feeling, without extirpating the underlying tendency to ignorance in regard to neither-painful-nor-pleasant feeling, without abandoning ignorance and arousing true knowledge - this is impossible." (M III 285f; Nanamoli, 1995, 1134).

14. M I 47 (Nanamoli, 1995, 133), "When a noble disciple has thus understood the unwholesome and the root of the unwholesome, he entirely abandons the underlying tendency to lust, he abolishes the underlying tendency to aversion, he extirpates the underlying tendency to the view and the conceit 'I am,' and by abandoning ignorance and arousing true knowledge he here and now makes an end of suffering."

15. The congruencies between Buddhist and scientific ideas of the dependent arising of 'self-identity' and its consequences has been explored, along similar lines but at much greater length, in my 'Common Ground, Common Cause: Buddhism and Science on the Travails of Self-Identity,' forthcoming in *Breaking New Ground: Essays in Tibetan Buddhism and the Natural Sciences*. B. Alan Wallace (ed.). Univ. of California Press.

16. These include as well, of course, our acute social sensitivities, our abilities to think, feel and empathize, to wonder and to worry, to love and to hate, to compete and to cooperate; none of these are wholly outside the broad scope of the extended, interdependent and self-reinforcing conditioning processes known as evolution. The narrow focus of this paper precludes any comprehensive account of human psychology, which would have to give all these behaviors their due consideration. Current biological thinking, for example, is at quite the opposite pole from 19th century Social Darwinism: "Life is much less a competitive struggle for survival than a triumph of cooperation and creativity. Indeed, since the creation of the first nucleated cells, evolution has proceeded through ever more intricate arrangements of cooperation and coevolution." (Capra, 1996, 243).

17. As evolutionary biologist Barash explains: "If evolution by natural selection is the source of our mind's *a priori* structures, then in a sense these structures also derive from experience--not the immediate, short-term experience of any single developing organism, but rather the long-term experience of an evolving population.... Evolution, then, is the result of innumerable experiences, accumulated through an almost unimaginable length of time. The *a priori* human mind, seemingly preprogrammed and at least somewhat independent of personal experience, *is* actually nothing more than the embodiment of experience itself." (1979, 203)

Evolutionary biology thus suggests a way to reconcile the rationalists' focus upon the given capacities of mind, and the *a priori* categories of mental processing which they express, with the empiricists' concern with observable processes of cognition. The empiricists, for example, have a hard time accounting for the actual facts of cognitive bias, of the tendency to perceive and conceive the world in certain ways. The evolved structures of mind that presently underlay the capacity for all mental processes developed in the way that they did *only* because they are the product of endless experiences interacting with the empirical world over countless generations of human beings and the lineage of beings from which we evolved. In other words, the capacities of mind which the rationalists focus on--the specific inborn structures and tendencies to perceive and process information in certain specific ways--are themselves only the products of specific previous experience due, most importantly, to the differential reproductive success that such structures gave them in the drawn-out processes of natural selection. In short, it is only through long processes of empirical experience that such *a priori* structures of mind could have evolved in the first place. But given such development, once they are dedicated (predisposed) to process certain kinds of information in certain, fairly specific ways, these ways are not completely open to utter and radical conditioning in this particular lifetime *no matter* how they are conditioned.

18. Nichols (1974, 264): "Natural selection and genetic change depend upon the way in which an animal behaves since its behaviour, in particular everything leading up to the act of reproduction and later the protection of offspring, determines the direction of evolution as a result of differential breeding rates."

19. The link between merely *conducting* to certain behaviors and wholly *determining* them is paralleled by the relatively indirect causal connection between what *brings about* the dispositions and the way they in turn *conduce* to specific behaviors, i.e. they are all important factors within a multifaceted set of interdependent links, no single one of which is capable of unilaterally determining behavior. Barkow (1989, 74) emphasizes this important distinction: "It will surprise

no one that we are capable of selfishness, deceit, and other such behaviours. It should not be surprising that the capacity to act in such ways is a product of natural selection. Whether or how such behavior can be moderated or even eliminated depends on the nature of the mechanisms that produce it - our psychology - and not on the selection pressures that produced the psychology. This distinction, between our evolved behavioural mechanisms - our social psychology, our human nature - and the selection pressures that have generated them, is crucial.... Human psychology is a product of natural selection, but human behavior hardly reduces to a calculus of selection pressures."

20. There are some major caveats here. Buddhists do not hold a materialist world view, that beings are *nothing but* living bodies. Most Buddhist traditions hold that there is some aspect of an individual's 'mind-stream' that passes from one life to the next (usually *vijnana*) and whose 'entrance' and 'exit' from the body defines the span of a single lifetime. Mind (*vijnana*) in Buddhist theory is therefore not simply an emergent property arising out of the organization of molecules or neurons, but must rather have preceding moments of mind as its necessary cause. This does not vitiate, I believe, a comparison between evolution and Buddhism as explanatory theories about the dependent origination of species brought about through the collective activities of sentient beings, the focus of our comparison here. There are, however, major divergences between Buddhism and biology concerning exactly how the effects of these activities may be transmitted from one generation to the next. On this and other accounts, Buddhist perspectives may well be incommensurate with current scientific assumptions.

21. I am not suggesting that they are comparable in all respects, but only that it may be mutually edifying to compare their conceptions of long-term causal or conditioning influences. Evolutionary biology typically considers these questions in terms of gene pools and populations while Buddhist thinking largely speaks in terms of the trajectories of individual 'mind-streams' coursing through multiple lifetimes.

22. "As our central nervous system - and most particularly its crowning curse and glory, the neocortex - grew up in great part in interaction with culture, it is incapable of directing our behaviour or organizing our experience without the guidance provided by systems of significant symbols.... To supply the additional information necessary to be able to act, we were forced, in turn, to rely more and more heavily on cultural sources - the accumulated fund of significant symbols. Such symbols are thus not mere expressions, instrumentalities, or correlates of our biological, psychological, and social existence; they are prerequisites of it. Without men, no culture, certainly; but equally, and more significantly, without culture, no men." (49) Geertz, 'The Impact of the Concept of Culture on the Concept of Man.' *The Interpretation of Cultures*. 1973. New York: Basic Books.

"The evolution of language took place neither inside nor outside brains, but at the interface where cultural evolutionary processes affect biological evolutionary processes. The evolution of symbolic communication... created a mode of extrabiological inheritance [that]... has played such a major role in shaping human brains and mind. It is simply not possible to understand human anatomy, human neurobiology, or human psychology without recognizing that they have all been shaped by something that could best be described as an idea: the idea of symbolic reference. Though symbolic thinking can be entirely personal and private, symbolic reference itself is intrinsically social." (Deacon, 409f)

23. As Carrithers (1992, 49) explains: "The notion of an evolutionary ratchet is consonant with the idea of co-evolution, which suggests that organisms may produce changes in the environment, changes which redound on themselves, creating a circle of positive feedback. The only peculiarity in human evolution was that human social arrangements and their unintended consequences became a selective force in themselves... And with the appearance of these forms there appeared the forms of causation associated with them: not just ecological causation... but now distinctly human social, political, and economic causation. These animals were, so to speak, released into history."

24. "The point is... that *evolutionary processes are inseparable from the behaviour and social organization of animal species*.... Ethological theory has quite strictly supported the neo-Darwinian view of the interdependence of genetic and behavioral evolution.... this is not to argue for 'instinctive determinism', but to pose a more complex model in which genetic disposition, critical learning, and social environment all interact, even in the simplest and most stereotyped of species." Nichols (1974, 265f). [Emphasis in original].

25. Barkow, Cosmides, Tooby (1992, 36f): "Thus, the debate on the role of biology in human life has been consistently

framed as being between optimistic environmentalists who plan for human betterment and sorrowful, but realistic nativists who lament the unwelcome inevitability of such things as aggression, or who defend the status quo as inevitable and natural.... This morality play... has been through innumerable incarnations... (rationalism versus empiricism, heredity versus environment, instinct versus learning, nature versus nurture, human universals versus cultural relativism, human nature versus human culture, innate behavior versus acquired behavior, Chomsky versus Piaget, biological determinism versus social determinism, essentialism versus social construction, modularity versus domain-generality, and so on). It is perennial because it is inherent in how the issues have been defined in the Standard Social Science Model itself, which even governs how the dissidents frame the nature of their dissent."

26. Tooby and Cosmides (1992, 83f) thus critique the fundamental assumptions underlying this whole debate: "In this dualistic conception, the genes are 'biological' and evolved, while the 'environment' - including the social environment - is nonbiological and nonevolved.... Despite the routine use of such dualistic concepts and terms by large numbers of researchers throughout the social and biological sciences, *there is nothing in the real world that actually corresponds to such concepts as 'genetic determination' or 'environmental determination.'*" [Emphasis added.]

27. The alternative to this is to assert that the human species is not a conditioned phenomenon, but rather has unchanging, uncaused characteristics, a real 'human nature.' We would then have the absurd consequence, as the Buddhists put it, that the species has no historical cause. This would open the door to capricious or acausal causality, making it outside the purview of scientific or empirical investigation. This implication will of course be more dissatisfactory for some than for others.

28. An assessment with which Stephen Jay Gould agrees: "When I argue that the behavior of a particular mammal can't be explained by its genes, or even as the simple sum of its genes plus its environment of [or?] upbringing, I am not saying that behavior can't be approached or understood scientifically. I am merely pointing out that any full understanding must consider the organism at its own level, as a product of massively nonlinear interaction among its genes and environments. (When you grasp this principle, you will immediately understand why such pseudosophisticated statements as the following are not even wrong, but merely nonsensical: 'I'm not a naïve biological determinist. I know that intelligence represents an interaction of genes and environment - and I hear that the relative weights are about 40 percent genes and 60 percent environment.')" 'In Gratuitous Battle.' *Civilization. The Magazine of the Library of Congress*. Oct\Nov. 1998. p.87.

29. Buddhists would no doubt refrain from introducing the potentially misleading notion of 'self' into such an expression. In the Indian Buddhist context, this would imply that a single, unchanging essence has caused itself, independently of any supporting conditions. This is clearly not what this expression means in this context. Here 'self' has the sense of phenomenon that maintains itself through interactive processes governed largely by its own internally differentiated processes rather than through some unchanging agent, as for example, a thermostat is 'self-regulating.'

30. For example, in evolutionary thinking, the 'components' that influence evolutionary development are so deeply intertwined that it is rather their relationships that evolve: "the image of 'the environment' as a 'nonbiological' causal influence that diminishes the 'initial' evolved organization of humans rests on the failure to appreciate the role that the evolutionary process plays in organizing the *relationship* between our species-universal genetic endowment, our evolved developmental processes, and the recurring features of developmental environments." [Emphasis added.] Tooby and Cosmides (1992, 83f).

31. Dawkins (1982, 14) attempts to unpack the confusion that frequently arises from conflating these two distinct functions: "however inexorable and undeviating the genes may be as they march down the generations, the nature of their phenotypic effects on the bodies they flow through is by no means inexorable and undeviating.... So, of the two effects that genes have on the world - manufacturing copies of themselves, and influencing phenotypes - the first is inflexible apart from the rare possibility of mutation; the second may be exceedingly flexible. I think a confusion between evolution and development is, then, partly responsible for the myth of genetic determinism."

32. Alleles refers to alternative forms of a gene at the same region of the chromosome (*ibid*, 283).

33. This is classic Nagarjunian dialectic. See, for example, Garfield (1995).
34. Or, perhaps, we might define what we mean by 'explain' rather differently. One could argue the totality of relevant conditioning influences is so far beyond our immediate comprehension that we must, of necessity, narrow our scope of relevant information in assessing causal relations in any problem. In this light, all causal 'explanations' entail a certain degree of convention, based upon practicality if not also tradition, about what to consider relevant or irrelevant. In which case, 'causality' would be defined not only based on pragmatic criteria, contingent upon the problem being addressed, but in terms of the larger complex of interdependence relationships, such as Dawkins seems to be suggesting in the passage on phenotypes. This definition of causality is wholly consistent with the causal theories suggested by the Buddhist traditions and self-organization theory, i.e. it is pragmatic and nominalistic.
35. This same reasoning holds true even for more straightforward examples. (Dawkins, 1982, 20f): "Other than at the molecular level, where one gene is seen directly to produce one protein chain, geneticists never deal with units of phenotype as such. Rather, they always deal with *differences*. When a geneticist speaks of a gene 'for' red eyes... He is implicitly saying... other things being equal, a fly with this gene is more likely to have red eyes than a fly without the gene. That is all that we ever mean by a gene 'for' red eyes... A gene 'for' behavior X is a gene 'for' whatever morphological and physiological states tend to produce that behavior." [Emphasis in original]
36. This is why many scientists speak of the co-evolution of organism and environment. The geneticist, Richard Lewontin (1983), describes the fundamental interdependence between organism and environment, that the one defines the other: "The environment is not a structure imposed on living beings from the outside but is in fact a creation of those beings. The environment is not an autonomous process but a reflection of the biology of the species. Just as there is no organism without an environment, so there is no environment without an organism."
37. "An environment is something that surrounds or encircles, but for there to be a surrounding there must be something at the center to be surrounded. The environment or an organism is the penumbra of external conditions that are relevant to it because it has effective interactions with those aspects of the outer world." (Lewontin 2000, 48). The theme of the lectures collected in Lewontin, R. 2000 (*The Triple Helix: Gene, Organism, Environment*. Cambridge: Harvard University Press) is that it is this relationship, not organisms or genes, that is the unit of natural selection.
38. "Taken together, the relations of genes, organisms, and environments are reciprocal relations in which all three elements are both causes and effects. Genes and environment are both causes of organisms, which are, in turn, causes of environments, so that genes become causes of environments as mediated by the organisms.... the histories of both environment and organism are functions for both environment and organism... a coupled pair describing the *co-evolution* of organism and environment in which both are acting as both causes and effects." (Lewontin 2000, 100f)
39. "Evolutionary stable strategies within and between populations, whether or not they culminate in symbiogenesis, require that the 'unit of selection' now cease to be an individual genotype or even phenotype, and becomes instead a *relationship between* genotypes and/or phenotypes." [Emphasis in original.] Rose, Steven. 1997. *Lifelines: Biology Beyond Determinism*. New York: Oxford University Press.
40. And has its parallels in modern thinking. As Capra, (1975) describes it, Maturana's and Varela's "new concept of cognition, the process of knowing... involves perception, emotion, and action - the entire process of life."
41. Most of the important processes within the formula of dependent arising 'grow' and fluctuate according to the varying conditions of life. The perpetuation of cyclic samsaric existence indeed requires their increase:
It is with the sustenance or nourishment of *vijnana* that rebirth continues. "The *vinnana* [*vijnana*] sustenance (*vinnanaharo*) is a condition of renewed existence of rebirth in the future." S II 13. As with most samsaric processes, this is driven by craving (*tanhā*): if there is pleasure in, or passion or craving for the *vinnana* sustenance (or the other three nutriments), then "consciousness is *supported and grows*. When consciousness is supported and grows then name-and-form descends [into the mother's womb]. When name-and-form descends, then the *sankhara* (karmic formations) *increase*, when the *sankhara* increases, there ensues renewed existence in the future." (S II 101) "Consciousness (*vinnana*) being established and growing, there comes to be renewed existence in the future." (S II 65:

Tasmin patitthite vinnane virulhe ayatim punabbhavabhinibbati hoti.)

42. As Johansson points out (1979, 85), "if we did not have the power of experiencing, the power of forming mental images [*sanna*], then the object, seen through the eye, would not produce its conscious counterpart." Accordingly, Johansson (1979, 139) states that the *sankhara* are a "necessary condition for *vinnana* to function at all, because every act of consciousness is a *sankhara*."

43. Although *samskara* is one of the most important terms in Buddhist thought, is notoriously difficult to find a single satisfactory translation for it. *Samskara* has both an active sense, 'the act of forming' as well as a nominal sense, 'that which is formed,' 'karmic complex' or simply 'formation' come close to these. It also refers to what we would call 'structures,' or 'constructs' insofar as all phenomenon are compounded or put together.

Compounded of the prefix '*sam*', meaning 'with' or 'together with', and a form of the verbal root '*kr*' 'to do or make', it literally means 'put or made together' or simply 'formation.' In its widest sense, *samskara* refers to the entire phenomenal world, inasmuch as everything in it has been formed from various causes and conditions. In the psychological sense, *samskara* refers to the entirety of the volitions, dispositions and actions that make up the human person, both insofar as these are all *constructed* complexes formed from past actions and *constructive* and formative activities influencing in the present. Edgerton thus describes *samskara* as "predispositions, the effect of past deeds and experience as conditioning a new state," and as "conditionings, conditioned states." (BHSD, 542.) Collins (1982, 202) has also stressed that *sankhara* has a similar dual role as constructing and as constructed: "Both the activity which constructs temporal reality, and the temporal reality thus constructed, are *sankhara*."

44. As Lewontin (2000, 44) suggests, "in a curious sense the study of the organisms is really a study of the shape of the environmental space, the organisms themselves being nothing but the passive medium through which we see the shape of the external world."

45. Like all metabolic processes, organisms comprise "a set of relations among processes of production... [that] must continually regenerate themselves to maintain their organization.... Through their interaction with the environment living organisms continually maintain and renew themselves, using energy and resources from the environment for that purpose... [and] form new structures and new patterns of behavior.... it is structurally open, but organizationally closed. Matter continually flows through it, but the system maintains a stable form." (Capra, 1996, 168f)

46. They define living process similarly: "living systems.. transform matter into themselves in a manner such that the product of their operation is their own organization." Maturana and Varela (1982, 82)

47. Emphasis added. "The fundamental cognitive operation that an observer performs is the operation of distinction. By means of this operation the observer specifies a unity as an entity distinct from a background and a background as the domain in which an entity is distinguished." (xxii) Maturana, H. and Francisco Varela. 1980. *Autopoiesis and Cognition: The Realization of the Living*. Dordrecht, Holland: D. Reidel Pub.

48. Lewontin (2000, 63) "Organisms determine by their biology the actual physical nature of the signals from the outside. They transduce one physical signal into quite a different one... This transduction of one kind of signal into another is a consequence of the internal biology of the species, and different species are different in this respect."

49. "Living organisms respond to only a small fraction of the stimuli impinging on them... In this way each living system builds up its own distinctive world according to its own distinctive structure... The range of interactions a living system can have with its environment defines its 'cognitive domain'... one that is always dependent upon the organism's structure," Capra (269f)

50. "It is the biology, indeed, the genes, of an organism that determines its effective environment, by establishing the way in which external physical signals become incorporated into its reactions.... What ever the autonomous processes of the outer world may be, they cannot be perceived by the organism. Its life is determined by the shadows on the wall [of Plato's cave], passed through a transforming medium of its own creation." Lewontin, Richard. *The Triple Helix: Genes, organism, environment*. 2000. Cambridge: Harvard Univ. Press. (64)

There may well be, as most religious traditions postulate, nonbiological, that is nonevolved, spiritual faculties that can perceive spiritual or nonmaterial realities. And these may well be the most interesting, important, and ultimate facts about the ourselves and world. But, these have no obvious correlate with modern scientific thinking and so fall outside the scope of this essay.

51. "The idea that cognition is a *representation* of an independently existing world... [is] based on an erroneous analogy, of the more general idea that the world is pregiven and independent of the observer and that cognition involves mental representations of its objective features inside the cognitive system.... There are no objectively existing structures... the map making itself brings forth the features of the territory." (Capra (1996, 271)

52. Cognitive awareness arises with the concomitance of an appropriate stimulus, that is, an 'object', and its respective sense-faculty. Cognition is a function of these conditions together, none of them separately. Cognition is therefore not an agent, or even a faculty of an agent, that 'works' upon a world. Rather it is explicitly defined in terms of interactions between organism and environment. Although it is not often stated in its definition, one of the other conditions for the arising of cognitive awareness is a previous moment of mind; it does not arise from purely material conditions alone. This differentiates Buddhist theories of mind from many scientific theories which tend to assume some version of materialism.

53. Note that 'the bringing forth of a world' means roughly the same as the 'developmentally relevant environment' that has co-evolved or been co-created by the organism; both of these processes are here called 'cognitive interactions'.

54. Put in somewhat different terms, an understanding of our radical creatureness helps us to overcome the 'idolatry' of Self as an independent, self-subsistent entity, a belief in which constitutes alienation from the totality of what is, alienation, that is, from God.

55. (M I 191) "One who sees dependent origination sees the Dhamma; one who sees the Dhamma sees dependent origination." Also: (S II 41). "Now inasmuch, brethren, as the Ariyan disciple knows the causal relation thus, knows the uprising of the causal relation thus, knows the cessation of the causal relation thus, knows the way going to the cessation of the causal relation thus, he is what we call the Ariyan disciple who has won the view, who has won vision... who sees this good doctrine... who possesses the wisdom of the trained man, who has won to the stream of the Dharma, who has the Ariyan insight of revulsion, who stands knocking at the door of the deathless."