

tions because they lacked mediating psychological mechanisms capable of supporting more complete explanations. The cognitive revolution in psychology promised to provide this missing mechanism information. Skinnerians refused to participate in this effort and insisted that functional explanations were sufficient. They left the search for missing mechanism information to neuroscience and, unintentionally, to investigators who implement this information in connectionist models of behavior (e.g., Donahoe, 1997). Skinner's eclipse continues unabated primarily because his followers continue to insist that functional explanations based on natural selection (variation and reinforcement) provide sufficient explanations of behavior.

Paradoxically, several decades of cognitive psychology have almost exclusively yielded functional explanations in the form of box and arrow diagrams and/or structural equation models that interconnect psychological constructs in functional ways without providing mechanism information capable of explaining why and how the indicated functional relationships exist. Factor loadings and/or path and structural coefficients quantify the magnitude of functional relationships but do not explain why and/or how these effects exist. Dismantling studies can identify necessary and/or sufficient components of effective therapies but do not provide mechanism information capable of explaining why the identified components are necessary and/or sufficient for positive outcomes.

Kazdin (2007) clarified the meaning of mechanism as "the basis for the effect, i.e., the processes or events that are responsible for the change; the reasons why change occurred or how change came about" (p. 3). Kazdin (2007) formulated mechanism as a subset of cause when he stated that while cigarette smoking may cause cancer, the mutagenetic effects of benzo[*a*]pyrene appear to be the causal mechanism. Squire, Knowlton, and Musen (1993) argued, "Ultimately, one wants to understand cognition not just as an abstraction, or in terms that are simply plausible or internally consistent. Rather, one wants to know as specifically and concretely as possible how the job is actually done" (p. 454). In short, mechanisms consist of a sequence of causal steps that mediate functional relationships. On this view, functional explanations do not provide mechanism information. Cognitive neuroscience is beginning to provide mechanism information. Connectionist models bridge biology and psychology by providing computational models that simulate the emergence of cognition and behavior from basic neuro-

science principles, including experience-dependent plasticity, using mathematically stated learning rules. It is important to note that connectionism does for Skinner what population genetics did for Darwin; it provides mechanism information to explain and justify his selectionist explanations (cf. Donahoe, 1997).

The importance of the distinction I am making between functional explanations and mechanism information for the future of psychology is that efforts to advance psychological science by clarifying causal mechanisms must first understand how mechanism explanations differ from functional explanations. Our history has been to rightly criticize functional explanations of behavior for their lack of mechanism information but to wrongly accept functional explanations of cognition and affect as providing mechanism information. Perhaps cognitive neuroscience and connectionist models will produce the missing mechanism information.

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The Problem With a Darwinian View of Humanity

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In the special issue on Charles Darwin and psychology (Dewsbury, February–March 2009), the authors present evidence supporting the validity of Charles Darwin's theory of evolution and how generations of psychologists have viewed the natural world through its light, taking Darwinian theories for granted as being a literal interpretation of the origins of species and attempting to make human nature conform to the picture of evolution as Darwin conceived it. Certainly Darwin's considerable achievement in classifying the different species and in describing their struggle for survival is an entirely true and objective representation of the natural world. Indeed, evolutionary *theory* is so commonly held to be a scientific *law* in mainstream psychology that it seems heretical to even suggest that Darwin's theory and the "facts of evolution" may be little more than a working hypothesis or an unproven proposition open to serious challenge.

The Darwinian theory of *Homo sapiens*, nevertheless, poses several problems when it comes to explaining our species' origins and development. No one denies that development happens, that changes occur within species, or that survival is an important means (not an end in itself) to pursuing quality of life. The problem lies in the *mechanisms* by which species development is said to occur: (a) the "upward" transmutation of one species into another through the impersonal workings of a predatory, natural selection process; (b) the random, chance genetic mutations among offspring of a species that prove adaptive in a blind struggle for survival; (c) the idea that all species—human and nonhuman animals, plants, viruses, and bacteria—originated from a single primordial source that spontaneously came into being from protein or nucleic acid molecules, which emerged by pure chance out of "dead" nonliving matter and which subsequently demonstrated an ability to reproduce themselves on a single planet just once in a universe in which entropy eventually conquers all. It is somewhat ironic to imagine that such a vital consciousness as our own could even suppose itself and the magnificent workings of its physical body to be the end product of inert physical and chemical elements that are themselves lifeless but that somehow randomly managed to combine in such a way

that our species attained logic and imagination, thought and language, learning and memory, technologies and civilizations. It almost makes one believe in magic!

Evolutionary psychologists cannot conduct controlled experiments that vary the course of evolution; therefore, the theory cannot be experimentally verified. Many evolutionary tenets about possible mechanisms for human species development are proposed on a post hoc basis, accommodating virtually any disconfirming evidence by putting such data aside as an unexplained anomaly to be explained in the future or by making the adequate adjustments in the theory so that sometimes evolution can be gradual or sudden, convergent or divergent, depending on which geological/fossil record is being explained. Often circular reasoning is involved in that the theory of evolution is used to prove the theory of evolution. The geological/fossil record by now should have provided evolutionary biologists evidence in support of those supposed intermediate species that are presumed to link fish, reptiles, birds, cats, monkeys, and human beings together in the hypothetical evolutionary tree of life.

Because attributes such as precognitive abilities of the species violate basic tenets of evolutionary theory, especially the idea of linear time, no evidence of psi functioning is considered in evolutionist writings. Evolutionary psychology, despite its outward-appearing scientific face, still prefers to build its models along the lines of mechanistic Newtonian cause-and-effect theories of evolution to support its conclusions while ignoring those very scientific discoveries of modern physics that might give a theoretical basis for an alternative explanation of the origin and evolution of species. For example, consider the possibility that life “began” spontaneously in a given number of species at the same time. Suppose a unity of consciousness pervades all elements of the environment whether “alive” or “dead” and that there is a mutually cooperative, interactive, and intertwining evolutionary process going on such that the environment formed the species and the species formed the environment. Is it not possible that consciousness evolves form, and not the other way around?

In certain terms, Darwinian evolutionary theory, as conventionally held, has played an important negative role in present world conditions. How can we trust ourselves when we are tainted with selfish genes and violent impulses from our evolutionary past? How can we live lives of honor if we believe that our species has no intrinsic purpose other than a mindless determination to reproduce, as implied by some theories of evolution? How can people feel that individual actions matter when they believe they are victims of

an indifferent Nature that cares little for the individual but only for the group? How can we perceive our part in the great cooperative venture that is involved in nature when every individual is in natural competition with every other individual, with other species, and even with the earth itself in a desperate and even deadly struggle to survive? How can we expect moral and virtuous behavior from ourselves or from others if we take it for granted that we are a predatory, bloodthirsty species whose nature is amoral and that we live in a world where there are no standards of right or wrong because anything goes for survival's sake? How can we learn to cooperatively work together for a more humane world if we believe that competition is a grand ideal to be pursued and promoted at all levels of activity? There is no possibility of spiritual survival as far as evolutionary theory is concerned, because evolutionary Darwinian man and woman are not created with souls. All psychological activity is scaled down in between life and death. Death becomes an affront to life and comes to imply a certain kind of weakness, for is it not said that only the strong survive? Unfortunately, there are just not many good alternative theories to choose from. From the point of view of a transpersonal psychologist, however, Darwin's theory ignores too much.

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More on Evolution and Psychology

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The critiques of Tryon (2009a, this issue) and Cunningham (2009, this issue) provide an interesting contrast: one favoring greater reductionism and one favoring less. I consider each in turn.

On Tryon, Function, and Mechanism

Tryon (2009a) again has addressed the issue of mechanisms in these pages (cf. Tryon, 2009b). The concepts of function and mechanism are two of the most slippery in the

biological sciences. One approach to this problem is to suggest that one person's mechanism is another person's function. The real issue may be the level of reductionism that is appropriate for the issue at hand. The idea of the evolution of species was common at the time of Darwin's and Wallace's work, but the underlying mechanism (i.e., what processes were involved) was not understood. They provided that with the process of natural selection. As Tryon pointed out, however, this leaves open the question of the mechanisms underlying natural selection. A major contribution of the “modern synthesis” of the 1930s and 1940s was to bring together information from several biological disciplines, principally quantitative genetics, to provide a mechanism for natural selection. This was basically a mathematical model. But today's geneticists would regard such models as functional, not mechanistic. Mathematical models are not mechanisms in geneticists' sense of the word. Geneticists would look for changes in DNA and related biological chemicals as a mechanism to explain the function. Of course, biochemists and biophysicists would want to provide even more reductionistic explanations. The solution is to find the appropriate level for the work to be done.

Tryon (2009a) touted cognitive neuroscience as providing the mechanisms for psychological functions. But much of cognitive neuroscience provides what are basically mathematical models that, though extremely useful in some contexts, will not satisfy those neuroscientists who seek “wet” explanations—brain structures, synaptic changes, and the like. The point is that the level of reductionistic analysis required depends on the problems under study. The same process might be function at one level and mechanism at another. Each may have its uses.

Tryon (2009a) provided a classic non sequitur in arguing that the fact that the Division 25 membership is 1.5% of the American Psychological Association's (APA's) membership demonstrates that the vast majority of psychologists find functional explanations inadequate. These data, if accurate, show that most APA members choose not to belong to this division, perhaps because of the structure and function of the APA. The “Skinnerian” approach is, in fact, thriving, with, for example, a vibrant Association for Behavior Analysis International, which typically offers about 1,500 presentations and attracts about 4,000 people from 40 countries at its annual meetings. Behavior analysts have shown that their approach can be useful in some contexts. Whatever some might think of behavior analysis, it is doing well in some quarters. But, at the level of analysis