Toward a Biologically Informed Psychology of Personality

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ABSTRACT This article describes nine ways in which biological approaches can inform issues of central and long-standing concern to personality psychologists These include (*a*) developing an adequate description of human nature, (*b*) providing several solutions to the puzzle of within-species genetic variability, (*c*) identifying the most important ways in which individuals differ, (*d*) giving precision to the concepts of adaptation and adjustment, (*e*) identifying the origins of personality dispositions, (*f*) providing insight into personality development and the life course, (*g*) providing conceptual and evidential standards for invoking personality types as opposed to personality dimensions, (*h*) addressing the psychophysiology of personality, and (*i*) focusing attention on psychological mechanisms as evolved dispositional strategies

Biologists define biology as the study of life In that broad sense, all of psychology is subsumed by biology Within the field of psychology, however, biological approaches represent particular modes of analyzing psychological and behavioral phenomena Three such modes are highlighted in this special issue evolutionary approaches, behavioral genetic approaches, and psychophysiological approaches In the past decade, advances in knowledge, theoretical sophistication, and methodological precision have occurred in each of these subfields This issue brings together and elucidates some of the most important of these advances

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Many misunderstandings surround the biological study of personality One is that there is "a" biological perspective—a single, unified, monolithic approach This view errs for two reasons (*a*) There are several distinct levels of biological analysis (e g , evolutionary, behavioral genetic, psychophysiological), each with distinct theoretical assumptions, content, and methods, and (*b*) within each level, there are often competing theories about the same set of observations Biological approaches to personality are many and varied, not singular in nature

A second common misunderstanding is that biological approaches are somehow at odds with approaches that are considered "environmental" or "social " Many biological approaches, particularly those that are evolutionary, focus precisely on how organisms deal with their environments As one biologist aptly put it "The whole reason for phenotypes' having evolved is that they provide flexibility in meeting environmental contingencies " (Alexander, 1979, p 14) Evolutionary approaches are not opposed to environmental approaches, they describe how, through a long history of natural selection, environments have shaped organisms to adapt strategically to their environments

There is an important sense in which *all* human behavior is the product of the environment But environments vary on a temporal dimension from distal to proximate The distal environment is the "environment of evolutionary adaptedness," the ancestral conditions that forged basic human adaptations A more proximate environment is that of ontogeny —the conditions encountered or created during development At the most proximate level are immediate environmental contingencies that, through organismic structures created over phylogeny and ontogeny, affect current behavior All personality phenomena are products of these environmental conditions Biological approaches are concerned with identifying the mechanisms created by previous environments and through which current environmental contingencies operate

Most personality research is conducted without being informed by biological perspectives Therefore, it is reasonable to ask What central issues in personality can be illuminated by these biological perspectives? This introduction highlights nine such issues The first lies at the core of nearly all grand theories of personality—the quest for understanding human nature

Human Nature

Personality psychology at least since Freud has been concerned with identifying human nature—the core human motives and psychologi-

cal mechanisms shared by all (or typical of most) members of our species To cite two examples, Freud posited core human instincts of sex and aggression, universal components of the psychic apparatus (id, ego, superego), and species-typical invariance in stage sequence (oral, anal, phallic, latency, genital) Maslow proposed the push toward self-actualization and the satisfaction of survival needs as the central driving forces of human motivation

Several articles in this special issue propose ways in which evolutionary biology can inform the study of human nature—conceptions consonant with what is known about the forces of natural selection that govern organic life Tooby and Cosmides provide a compelling argument that the core of human nature is to be found in *universal functional design* They argue that the human mind cannot be understood properly without articulating the adaptive problems that humans have faced in our evolutionary history—problems ultimately linked with survival and reproduction *Psychological mechanisms,* they argue, have evolved to solve these adaptive problems These species-typical psychological mechanisms, together with the adaptive problems toward which they are directed, comprise the core of human nature

Tooby and Cosmides illustrate this evolutionary approach with an impressive body of research They argue that in order for us to engage effectively in elaborate social exchange without being exploited, humans must have evolved psychological mechanisms to detect cheaters—those who benefit in a social exchange without reciprocating by paying a cost A psychological mechanism for detecting such cheaters, they argue, must be species-typical of humans, a part of human nature that solves one important adaptive problem

Tooby and Cosmides argue further that because humans have had to solve many, distinct adaptive problems, the psychological mechanisms that have evolved to solve these problems must similarly be numerous and specific (cf Symons, 1987) General, all-purpose psychological mechanisms such as "learn from your environment" or "maximize inclusive fitness" could not have evolved Such mechanisms would be analogous to programming a computer chess strategy with a single general instruction such as "win" or "make good moves " Such a program, like postulated general all-purpose psychological mechanisms, are too underdetermined to generate the complex, flexible, and specific contingent patterns of behavior that we observe Thus, in addition to illustrating one empirical method for studying the core of human nature, they present a compelling view that our species-typical psychological mechanisms are likely to be specific, numerous, and complex

This view implies that personality theories that posit only one or a few motives, and only a handful of psychological mechanisms, are almost sure to be wrong from the outset

Daly and Wilson use evolutionary reasoning to argue that Freud's postulation of a universal Oedipal complex is inconsistent with what is now known about evolutionary biology Using Trivers's (1974) now classic theory of parent-offspring conflict, they argue that Freud correctly noted the pervasiveness of conflict and ambivalence in parent-child relations But Freud failed to distinguish between two sorts of conflict—an early *nonsexual* father-son conflict over how a mother's reproductive efforts are to be expended, and a later potential rivalry that *is* sexual, but over possible mates and not the mother

Daly and Wilson review previous data and present new data showing that the central Freudian claim of a same-sex contingency in parent-offspring antagonism during the Oedipal phase is not supported They argue, like Tooby and Cosmides, that theories of human nature should be consistent with what is known about the principles that govern organic life generally, and the evolution of social interaction specifically Evolutionary theory, while not a theory of human nature, provides a powerful guide or metatheory for articulating a possible basis for human nature

The Enigma of Human Genetic Variability

Although once considered to be highly controversial, the major dimensions of personality are now known to show moderate heritability Roughly half of the observed variance in personality traits, traditionally conceived, has been shown to be due to genetic differences among individuals This general conclusion has emerged repeatedly over the past several decades from research using different methods (e g , twin, adoption, family) and different investigators, many of whom contributed to this special issue (Bouchard, Eysenck, Horn, Loehlin, McGue, Nesselroade, Plomin, Rushton, Willerman) Now that genetic variability within our species has been documented, scientists are turning to the next logical question Why is it there?

The question is not a trivial one, for it is known that natural selection tends to eliminate genetic variability Virtually all humans have two legs, two eyes, and five fingers on each hand—these are species-typical characteristics, and deviations from them are due mostly to environmental variance (e g , accidents) rather than to genetic vari-

ance (Loehlin & Nichols, 1976) Although there are forces that create and maintain genetic variability (e g , mutation, frequency-dependent selection, genetic drift), natural selection tends to move traits in a population toward fixation or species uniformity

Several contributors to this special issue attempt to solve the enigma of human genetic diversity, but differ sharply with one another in their proposed solutions Tooby and Cosmides offer the most general conceptual treatment by outlining the major possibilities Within-species genetic variance can be due to (*a*) frequency-dependent selection for alternative morphs or strategies (e g , white- and dark-colored moths exist within the same species due to frequency-dependent selection that operates against those that become too common), (*b*) "genetic noise" (e g , due to mutation) that is selectively neutral, and hence was not eliminated by natural selection, or (*c*) concomitants of parasite-driven frequency-dependent selection for biological individuality per se

Tooby and Cosmides outline the stringent standards of evidence required if genetic variability is to be considered to be of the first variety —alternative adaptive strategies They argue that these standards are unlikely to be met, given the constraints that sexual recombination and the complexity of adaptations impose on functional design Thus, the notion that different "personality types" represent genetically alternative adaptive strategies is seen as improbable by Tooby and Cosmides, although they acknowledge that future empirical evidence might eventually document this possibility

Gangestad and Simpson argue that at least some genetic differences represent frequency-dependent adaptive strategies They develop a model of female sociosexuality, with "restricted" as one type (those women who require more time, attachment, and commitment prior to entering into a sexual relationship) and "unrestricted" as the other (those women who require less time, attachment, and commitment) The model posits that these two types of females evolved and are maintained by frequency-dependent selection, with different reproductive benefits accruing to the two types Restricted females could have benefited by eliciting greater male parental investment in their offspring Unrestricted females, in contrast, could have benefited by increasing the quality of the genes passed on to their sons

Gangestad and Simpson test predictions from their model with several empirical studies They show, for example, that sociosexuality tends to be bimodally distributed (supporting the notion of two types) and that females genetically predisposed to be unrestricted tend to pro-

duce more sons than those predisposed to be restricted Although further tests of the theory are needed, their results provide encouraging support for the possibility that at least some genetic personality variability within our species represents alternative adaptive strategies The next decade of research will undoubtedly lead to continued progress in unraveling the mystery of the moderate heritability of personality characteristics

Identifying the Most Important Individual Differences

Personality psychologists have long been concerned with identifying the most important ways in which individuals differ From among the thousands of dimensions of difference, which ones should galvanize the attention of personality theorists and researchers? As Goldberg (1972) succinctly phrased the question Why measure *that* trait? Rationales for designating some individual differences as particularly important have come from folk psychology (Gough, 1968), factor analysis (Cattell, 1957), lexical analysis (Norman, 1963), and the act frequency approach (Buss & Craik, 1985), to name a few An important alternative rationale resides in biological criteria for importance (cf Buss, 1984)

Individual differences closely linked with the components of natural selection, sexual selection, and important life-history strategies are crucial when using an evolutionary rationale for designating importance Kenrick, Sadalla, Groth, and Trost demonstrate that personality characteristics such as dominance, friendliness, and emotional stability are intimately tied in with sexual selection in that they are central to mate choice (cf Buss, 1989) The possibility that these individual differences have previously been, and may currently be, linked with evolution by sexual selection grants them special importance from an evolutionary perspective, when contrasted with those individual differences not linked to evolution Gangestad and Simpson, arguing from a different perspective, propose that individual differences surrounding sociosexuality are especially important because they represent alternative adaptive strategies for achieving reproductive success Because they are so closely linked with reproductive success, these differences acquire special importance within an evolutionary framework

These two examples highlight the need to move to external criteria for evaluating the importance of dimensions of individual differences They suggest that individual differences take on a larger significance

to the extent that they play an integral role in important processes that govern organic life—those of evolution by natural selection

Adaptation and Adjustment

Concepts such as adaptation and adjustment have been central to nearly all frameworks of personality As typically used, these concepts signify an ability to deal effectively with the varied demands of everyday living The related dimensions of Neuroticism (Eysenck, 1953), Emotional Instability (Norman, 1963), and Trait Anxiety (Spielberger, 1972), which imply ineffective negotiation of life's tasks, are central to nearly every taxonomic system of personality These concepts represent a particular manner of coping, typically one with high levels of subjective distress, intrapsychic discomfort, large fluctuations of mood or affect, and a relative inability to terminate negative subjective states

The concept of adaptation is also central to evolutionary biology, although it is defined somewhat differently Adaptations in evolutionary biology refer to evolved solutions to problems posed by the complex tasks of survival and reproduction Not all features of behavior or morphology are considered to be adaptations, and the evidential standards for considering something an adaptation are complex and often difficult to meet (Williams, 1966) Nonetheless, the effectiveness with which reproductive problems are solved provides a biologically anchored meaning of "adjustment "

Perhaps the most important contribution of the articles in this issue to an understanding of adaptation and adjustment comes from the work of Draper and Belsky, Gangestad and Simpson, Rushton, and Zuckerman Draper and Belsky articulate an intriguing evolutionary theory of alternative reproductive strategies based on the *environments* that humans encounter in early childhood They propose that in environments and cultures where fathers are present during early childhood, the reproductive strategy tends to involve delayed puberty, delayed onset of sexual activity, stability of adult pair-bonds, and a set of concomitant personality characteristics that facilitate this strategy such as low self-monitoring and high cooperativeness In environments and cultures where fathers tend to be relatively absent, an alternative personality constellation and reproductive strategy is followed—one involving early onset of puberty and sexual activity, instability of adult pair-bonds, low parental investment, high self-monitoring, and high aggressiveness

What is intriguing about this theory is that it posits that *both* strate-

gies are part of our species-typical repertoire—we all have the capacity to follow either strategy But which one we do follow depends on the environment that we encounter while growing up Draper and Belsky emphasize that it is possible to rear children successfully under both regimes, and that neither strategy is inherently superior or inferior to the other—they are both "adaptive" in the environmental contexts in which they occur This implies that conceptual clarity might be achieved from anchoring definitions of "adjustment" and "adaptation" in the effectiveness with which reproductive problems are solved in particular environments The definition of adjustment would shift from the *content* of the strategy (i e , it is not necessarily maladjusted to be impulsive or aggressive) to the *success* of the strategy in a specific environment

An analogous shift in the meaning of adjustment and maladjustment is implied in the articles by Gangestad and Simpson, Rushton, and Zuckerman But rather than positing a universal species-typical repertoire of strategies that are differentially evoked by environments, they posit genetically alternative strategies that were forged during our ancestral environments It would be inappropriate to consider one strategy (e g , the "unrestricted sociosexuality" proposed by Gangestad and Simpson the high sensation seeker proposed by Zuckerman, or the r-strategy proposed by Rushton) as either inferior or superior to the alternative strategies

In sum, evolutionary thinking has implications for how personality psychologists might conceptualize adaptation and adjustment It suggests that equating maladjustment with strategies that might appear distasteful or repugnant (e g , those that are aggressive, impulsive, or wanton) is inappropriate These strategies may be functional in the particular environments in which they occur (e g , where resources are unstable or unpredictable) The effectiveness with which survival and reproductive problems are solved is one biological criterion by which the concepts of "adapted" and "adjusted" can be anchored

The Ontogenetic Origins of Personality Dispositions

Although the field of behavioral genetics is sometimes seen as preoccupied with estimating heritability, the articles in this special issue document the equally important use of behavioral genetic methods for illuminating the magnitude and nature of environmental influences on personality dispositions Two articles in this special issue, one by

Eysenck and the other by Bouchard and McGue, contribute to the understanding of environmental and genetic sources of variance underlying major dimensions of personality

Both articles come to similar conclusions, based on different sets of data Reviewing twin and family studies on Extraversion, Neuroticism, and Psychoticism, Eysenck concludes that roughly half of the variance on these dimensions is due to additive genetic variance Furthermore, there is little evidence for the importance of shared environmental influences (environmental features that are the same for siblings), which implicates unique, individual nonshared environmental influences as critical—a conclusion in line with most of the behavioral genetic evidence over the past decade (Plomin & Daniels, 1987)

Bouchard and McGue present findings on the California Psychological Inventory (CPI), using data from the Minnesota study of monozygotic and dizygotic twins reared apart From these unique data, they find that approximately half of the variance on CPI scale scores is heritable, that few scales show any evidence of common family environmental influences, and that rearing environment, at least as gauged by retrospective reports, explains little variance in adult personality, but does account for variance on a Consensuality factor that includes the CPI scales of Socialization and Communality Taken together, these articles represent the contribution that behavioral genetics has made toward identifying, in a broad sense, the parameters of the major classes of causal influence on basic dimensions of personality

Personality Development and Life-History Analysis

One of the most important new developments in behavioral genetic approaches to personality is a focus on personality change over time Two articles in this special issue treat this topic Plomin and Nesselroade provide a theoretical analysis and Loehlin, Horn, and Willerman empirically illustrate the behavioral genetic approach using data from the Texas Adoption Project

Plomin and Nesselroade consider several types of personality change —changes in heritability over ages, the relative contribution of genetic differences and environmental differences to personality change in childhood and adulthood, and genetic influences on short-term changes in personality (e g , days, hours, minutes) Based on a review of the empirical evidence, they come to some provocative conclusions Herit-

ability tends to increase, rather than decrease, when developmental changes in heritability are found Genetic involvement is substantial in personality change in childhood, but slight in personality change in adulthood Finally, behavioral genetic methods can be applied to examine intra-individual differences in general and short-term personality changes from situation to situation

In an important ongoing behavioral genetic study, Loehlin, Horn, and Willerman examine Extraversion, Socialization, and Emotional Stability over a 10-year interval They reach two important conclusions (*a*) The main source of *individual* change is based on individual experience and/or measurement error, a finding that is consistent with a now large body of evidence suggesting the importance of nonshared environmental influences (Plomin & Daniels, 1987), and (*b*) changes in *group* means of adopted and natural children on these personality variables indicate an average shift toward increased similarity with their genetic parents Both articles herald major new uses of behavioral genetic methods in the analysis of personality

Personality Types Versus Personality Dimensions

A long-standing debate in personality psychology is whether individual differences are best characterized by continuous dimensions or by discrete types Biological perspectives can inform this debate by articulating theoretical arguments for the plausibility or implausibility of types, offering new standards of evidence that could demonstrate the existence of distinct types if these standards are met, and providing empirical findings that bear on the theoretical arguments and standards of evidence

The contributors to this special issue diverge in their views of whether type concepts will be supported by the biological evidence Tooby and Cosmides argue that three criteria must be met for considering personality differences to be typological (*a*) Are personality differences best represented by single quantitative variables or by an entire range of variables that covary in an organized, coordinated fashion? (*b*) Do the variables covary in ways that fulfill criteria for adaptation? (*c*) Do the alternative types show evidence of frequency-dependent selection (i e , that the adaptive payoff of one type decreases when it increases in frequency in the population)?

Biological sex certainly meets these standards and is perhaps the

clearest case of a typology A host of traits covary with maleness and femaleness in an organized, coordinated fashion (Symons, 1979, Trivers, 1972, Williams, 1975), they do so in ways that fulfill criteria for adaptation (Buss, 1989, Symons, 1979), and the adaptive payoff of a given trait for each sex decreases as the members of that sex become more numerous (Fisher, 1930) Tooby and Cosmides argue that no existing personality typologies fulfill these criteria

Gangestad and Simpson, in contrast, are more optimistic about typological concepts in personality psychology They present evidence that restricted and unrestricted patterns of sociosexuality fulfill some of these criteria In addition to evidence of bimodality, they make a plausible case for the adaptive benefits of each suite of covarying characteristics The third criterion—that the types fit an analysis consistent with frequency-dependent selection—will probably be the most difficult to document empirically

The Psychophysiology of Personality

If studies in behavioral genetics have yielded evidence that personality traits are moderately heritable, they leave unanswered the critical question of what the genetic differences code for at the level of physiology Two important articles in this issue address this question Stelmack reviews the evidence on the psychophysiology of Extraversion concluding, contrary to Eysenck's (1967) original hypothesis, that there is little compelling evidence that introverts and extraverts differ in *basal* levels of physiological activity or arousal At the same time, there is excellent evidence that introverts show greater physiological *reactivity* or *sensitivity* to sensory stimulation than extraverts, as indicated by both electrodermal and electrocortical activity This finding helps explain why introverts tend to avoid certain classes of stimulation in social behavior, whereas extraverts seek those classes of stimulation

Zuckerman summarizes a large literature on the psychophysiology of sensation seeking He concludes that high sensation seekers show stronger orienting responses to novel stimuli of moderate intensity than do low sensation seekers The lows show heart-rate acceleration, suggesting defensive responses to novel stimulation At the cortical level, high sensation seekers show an augmented reaction to intense visual and auditory stimuli, whereas low sensation seekers tend to be unresponsive to variations in stimulus intensity

An intriguing feature of Zuckerman's analysis is that it provides

direct, although speculative, links with evolutionary biological approaches He proposes that sensation seeking and sensation avoidance represent two different strategies for adapting to a dangerous environment in which novelty can be rewarding or threatening to survival A trait of sensation seeking might provide an organism increased access to food and mates, but also entails an increased risk The sensation avoider, in contrast, avoids the risks, but only at the expense of losing the foraging and mating advantages that would be associated with approach The psychophysiological mechanisms summarized by Zuckerman are consistent with the patterns of information processing compatible with these respective strategies

In conclusion, although studies of the psychophysiology of personality historically have proceeded in relative isolation of other biological approaches to personality, they may be linked in two possible ways First, they illuminate the nature of the mechanisms associated with genetic differences found by behavioral geneticists And second, they can provide information about the reproductive strategies adopted by those who differ in personality dispositions

Psychological Mechanisms as Evolved Problem-Solving Strategies

Psychological mechanisms have long been central phenomena in the field of personality These range from the defense mechanisms and intrapsychic structures proposed by Freud to more recent concepts such as ego control (Block, 1971), species-typical emotions (e g , Plutchik, 1980), and defensive pessimism (e g , Cantor & Kihlstrom, 1987) Several articles in this issue view psychological mechanisms as the central phenomena of personality These mechanisms have a distinct biological status—they represent *strategic solutions* that have evolved because in our evolutionary past they successfully solved reproductive and survival problems

Kenrick and his colleagues, for example, present data showing that sex-differentiated mate preferences are evolved solutions to the somewhat different mating problems faced by men and women Zuckerman argues that the psychological and physiological mechanisms linked with sensation seeking and sensation avoidance may represent two distinct strategies for adapting to a dangerous environment in which new stimuli can be reproductively advantageous or reproductively damaging Rushton argues that epigenetic rules (routes from genes to behavior that in-

clude psychological mechanisms) have evolved to solve complex problems posed by social interaction

Tooby and Cosmides contend that evolved psychological mechanisms are likely to be highly specific rather than global or domain-general Male sexual jealousy, for example, may solve the specific reproductive problem of increasing paternity certainty (e g , by producing behavior that fends off intrasexual competitors or limits a mate's access to those competitors) But the psychological mechanism of jealousy contributes nothing toward solving a host of other reproductive problems such as finding a reproductively valuable mate or rearing offspring to reproductive age

A focus on psychological mechanisms as evolved strategies yields a unique perspective on the debate over personality consistency It suggests that consistency may not be found at the level of overt behavior because different adaptive problems are confronted over time and over situations, and each psychological mechanism can generate a host of phenotypically diverse acts (e g , jealousy could produce the acts of concealing one's mate or derogating one's competitors) This suggests that the appropriate level of analysis for searching for personality consistency resides with enduring psychological mechanisms rather than with overt behavior

The concept of psychological mechanism as evolved strategy, however, requires further theoretical and empirical elaboration At this inchoate stage, it is not clear (*a*) precisely how psychological mechanisms are to be described and demarcated from one another, (*b*) what standards of evidence should be required for invoking the concept of evolved psychological mechanism, and (*c*) whether a comprehensive taxonomy can be developed of the adaptive problems that humans have evolved to solve The next decade of work in evolutionary psychology will likely center on this unit of analysis in personality psychology

CONCLUSION

Biological approaches to personality psychology are not new They date at least back to the humoral theory of Galen that posited four bodily fluids as biological determinants of personality What is new is substantial progress in the accumulation of knowledge, in the precision of methodology, and in the sophistication of theoretical models With each advance, the biological approaches have confronted new frontiers

In the psychophysiology of Extraversion, for example, early theories

postulated individual differences in basal or tonic levels of physiological arousal It is now known that there is little evidence in support of the concept of "general arousal" across physiological subsystems This physiological theory has been replaced by one that is replicably documented—that introverts do show greater reactivity to sensory stimulation than do extraverts Although Eysenck's original hypothesis of differences in general arousal turned out to be wrong, it catalyzed research that eventually led to a better understanding of the psychophysiology of Extraversion

In previous decades, the field of behavioral genetics was centrally concerned with estimating the heritability of major personality dimensions such as Extraversion and Neuroticism It is now known that these major dimensions show moderate heritability—conclusions reached by independent investigators using different methods Attention has now turned to new issues such as the nature of environmental influence (shared versus nonshared), the ways in which genotypes and environments correlate and interact, and the use of behavioral genetic methods for studying personality change over the life course

Perhaps the most exciting developments in the biological analysis of personality have come from evolutionary theory Earlier evolutionary approaches, although valuable in their time, were mired in now outdated notions of biological determinism and intractability, in superficial and misleading analogies with other primate species, in incorrect analyses of adaptation and units of selection (e g , now discredited notions such as adaptations that exist for the "survival of the species"), in a lack of testable hypotheses, and in a virtual absence of empirical methodology

Evolutionary approaches have moved beyond these earlier limitations and are offering exciting contributions to the analysis of personality At a theoretical level, evolutionary biology informs central issues such as the definition of human nature, criteria for identifying important individual differences, the enigma of genetic variability, and conceptions of adaptation and adjustment Perhaps the most salutary sign is the development of specific evolutionary models of particular domains (e g , social exchange, mate selection, parent-child interactions) that generate testable empirical predictions

Beyond the exciting advances within all three biological approaches is the beginning of bridges between the levels Evidence on the heritability of personality dispositions, for example, suggests to psychophysiologists the personality dispositions that might be the most prom-

ising for an identifiable physiological substrate At a different level, the findings by Zuckerman on the psychophysiological proclivities of sensation seekers and sensation avoiders point to the possible evolution-based strategies that each may be following The within-species genetic variability documented by behavioral geneticists was long ignored by evolutionary biologists who studied human behavior Now the enigma of genetic variability is a major topic that evolutionists are confronting Although each of these three levels of biological analysis proceeds with its own models, assumptions, and methods, findings at one level are now informing the models developed at the other levels

This optimistic assessment of the advances made in the biological analysis of personality no doubt underrepresents the problems that face each approach Psychophysiological approaches are constrained by measurement techniques, the measurement samples required by many behavioral genetic designs are often prohibitively large, and the amount of hard empirical data needed to test specific evolutionary hypotheses, although increasing rapidly, is still far from optimal

The advances represented by the contributions to this special issue, however, presage a central role for biological approaches to the study of personality But biology will not cannibalize personality psychology Nor will it supplant the many approaches that have characterized the field since its inception Indeed, a strong case can be made for fertilization both ways Traditional personality research paradigms have generated basic findings that biological perspectives must confront and account for It no longer makes sense, however, for the field to ignore the biological foundations of its central phenomena These foundations include evolutionary biology, behavioral genetics, and psychophysiology All three levels of analysis contribute to a biologically informed psychology of personality

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