

MIDLIFE COGNITION

*The Association of Personality With
Cognition and Risk of Cognitive Impairment*

SHERRY L. WILLIS AND JULIE BLASKEWICZ BORON

A major distinction among life span psychological theories is their differing position on stability versus change in midlife (Lachman, 2004). Trait theories such as those concerned with personality (Costa & McCrae, 1980) or intelligence (Schaie, 2005) have depicted midlife as a period of stability, at least when studied at the aggregate level. By the fourth decade of life, there appears to be considerable stability in personality traits (Costa, Herbst, McCrae, & Siegler, 2000). Caspi and Roberts (2001) concluded that personality consistency increases with age and is more common than change in midlife and old age.

As Costa and McCrae (1999) noted, historically, personality and cognition have been isolated and separated from one another. Reviews of the literature have concluded that there are weak associations between personality and ability (Ackerman & Rolfhus, 1999). Costa and McCrae (1999) went so far as to suggest that intelligence should be conceptualized as a sixth factor in addition to the five personality factors assessed by the NEO Personality Inventory (NEO-PI). However, few longitudinal studies have included adequate measurement of both

personality and abilities such that concurrent and antecedent-consequence relationships could be examined in samples of sufficient size and across lengthy periods of the life span.

If personality traits reach a higher level of consistency in midlife and intellectual abilities also are more stable, then examining the association between personality and intelligence may be of particular interest in midlife. Moreover, research examining early antecedents of cognitive risk in old age have indicated that certain personality dimensions may directly or indirectly have an influence on onset of chronic disease or on neurodegeneration that contribute to cognitive impairment. Specifically, personality characteristics associated with proneness to psychological distress have been reported to be associated with increased cognitive risk (Crowe, Andel, Pedersen, Fratiglioni, & Gatz, 2006). In addition, personality characteristics have been associated with health behaviors associated with chronic diseases (e.g., cardiovascular disease) that are known to impact cognitive functioning (Roberts & Bogg, 2004).

The aim of this chapter is to examine the literature on the association between personality

traits and cognitive functioning in midlife and the research findings on the role of certain personality traits in increasing or diminishing the individual's risk of cognitive impairment. Gender differences in association between personality and cognition have been noted in some studies and will be briefly discussed (Feingold, 1994). A criticism of the trait approach to the study of personality has been the lack of theory articulating the mechanisms or processes underlying development and change in personality traits (Endler, 2000). Cognitive or learning styles have been suggested as possible mechanisms underlying the relationship between personality and cognition and thus will be briefly reviewed. The stability of personality traits across the life span is an important issue, because the assumption of long-term disposition to personal distress is critical to the personality-cognitive impairment hypothesis. I briefly review the findings on stability of personality in midlife and the possible mechanisms that maintain continuity in personality in adulthood.

PERSONALITY TRAITS IN ADULTHOOD

There is considerable consensus that the structure of the personality traits can be encompassed by the Big Five superordinate dimensions of Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness (Costa & McCrae, 1980). The NEO-PI (Costa & McCrae, 1985) assesses the big five traits and generates facet scores for six facets for each of the five factors. The same basic factor structure has emerged from a broad range of personality assessment derived from a variety of instruments and methodologies (Caspi & Roberts, 2001; Endler, 2000). Considerable convergence between self-reported trait ratings and ratings of others who know the individual have been found; in addition, there is convergence between observer ratings of spouses and peers. Although Costa and McCrae's big five appears to be the prevailing current trait model of personality, a considerable amount of research has used the California Psychological Inventory (CPI) of 20 facets of personality (Jones, Livson, & Peskin, 2003). The CPI facets were designed to measure aspects of personality meaningful to the average

person (Gough & Bradley, 1996). The CPI and NEO-PI differ not only in the domains of personality studied but also in the level of analysis (facets, factors) and the manner in which the domains were derived. CPI facets represent dispositions selected for their importance in social life, whereas the NEO-PI measures traits abstracted through factor analysis (Helson, Jones, & Kwan, 2002).

Neuroticism measures emotional instability versus stability (Costa & McCrae, 1985). Individuals who score higher on Neuroticism are characterized as being more anxious, depressed, and emotionally labile (Eysenck & Eysenck, 1985). Extraversion measures the need for stimulation and activity and sociability, as opposed to introversion (reserved, quiet; Costa & McCrae, 1985). Individuals who score high on Extraversion are characterized as being more sociable, lively, active, and venturesome (Eysenck & Eysenck, 1985). Openness to Experience measures curiosity, creativity, and imagination at one pole as opposed to conventionality and not being analytical at the other pole (Costa & McCrae, 1985). Agreeableness measures the quality of a person's interpersonal focus, ranging from being good natured, forgiving, and trusting at one pole to being cynical, uncooperative, and ruthless at the other pole. Conscientiousness measures a person's degree of organization and persistence at one pole and aimlessness, unreliability, and carelessness at the other pole.

ASSOCIATION OF PERSONALITY TRAITS AND MENTAL ABILITIES IN ADULTHOOD

Given the voluminous literature on personality traits and on mental abilities, studies examining the relationship between these two trait approaches have been remarkably limited. As Costa and McCrae (1999) noted, historically, personality and cognition have been isolated and separated from one another, and the early studies suggested only weak associations between the two trait approaches. Costa and McCrae (1999) argued that the limited associations between personality and ability may in part be due to differing time dimensions assessed in personality and some cognitive measures. For example, they reported nonsignificant

relationships between conscientiousness and choice reaction times were found related to memory (Costa & McCrae, 1999).

Few longitudinal adequate measures of mental abilities. Like the personality traits, the periods of the life span and antecedent events should be examined. Moreover, several studies of personality in adulthood have had methodological limitations that are limiting the strength of the associations (Costa & McCrae, 2003) examining the relationships between personality traits and Primary Mental Abilities (PMA) & Thurstone, 1954) in late adulthood. The Study of Adult Development (SADS) and four studies of personality in young adulthood (Costa & McCrae, 1999) found no association in personality traits in midlife may be due to the use of both personality traits and cognitive measures. Moreover, in many studies, the sample sizes are not large enough to detect associations between personality traits and mental abilities (Borson, 2003).

Costa and McCrae (2003; Schaie, 1996) concluded that there is a relationship between Openness to Experience and cognitive abilities. Their findings regarding the relationship between personality traits and mental abilities in older adults.

Neuroticism

Neuroticism is the most consistently associated with various cognitive abilities. Participants in the Study of Adult Development who scored high on Neuroticism had lower information-processing

ley, 1996). The CPI and y in the domains of per- s in the level of analysis he manner in which the

CPI facets represent dis- their importance in social IEO-PI measures traits actor analysis (Helson,

ires emotional instability i & McCrae, 1985). Indi- gher on Neuroticism are ore anxious, depressed, le (Eysenck & Eysenck, easures the need for stimu- nd sociability, as opposed ed, quiet; Costa & McCrae, o score high on Extraversion eing more sociable, lively, me (Eysenck & Eysenck, xperience measures curios- magination at one pole as nality and not being analyti- (Costa & McCrae, 1985). res the quality of a person's ranging from being good nd trusting at one pole to peroperative, and ruthless at scientiousness measures a ganization and persistence at nness, unreliability, and care- pole.

PERSONALITY TRAITS ABILITIES IN ADULTHOOD

ous literature on personality abilities, studies examining between these two trait een remarkably limited. As (1999) noted, historically, gnition have been isolated one another, and the early only weak associations trait approaches. Costa and ued that the limited associa- onality and ability may in differing time dimensions lity and some cognitive mea- they reported nonsignificant

relationships between personality traits such as conscientiousness and cognitive states, such as choice reaction time; somewhat higher correlations were found when personality traits were related to more complex forms of cognition (Costa & McCrae, 1999).

Few longitudinal studies have included adequate measurement of both personality traits and abilities. Likewise, few studies have examined the personality-ability relationship over lengthy periods of the life span, such that concurrent and antecedent-consequence relationships could be examined in sufficiently large samples. Moreover, several of the studies that have examined personality-cognition relationships in adulthood have had predominately male samples, limiting the study of gender differences in the associations (Mroczek & Spiro, 2003). Boron (2003) examined the relation of the NEO-PI factors and Primary Mental Ability (PMA; Thurstone & Thurstone, 1949) scores in young, middle, and late adulthood in the Seattle Longitudinal Study (SLS) and found more consistent and significant relationships in middle and late adulthood, than in young adulthood. Greater consistency and significance in personality-cognition relationships in midlife may be due to an increase in consistency in both personality and cognition during midlife. Moreover, in research within the SLS with adequate samples of men and women, almost four times as many significant personality-cognition relationships were found for midlife women as for men (Boron, 2003).

Costa and McCrae (1999) and others (Boron, 2003; Schaie, Willis, & Caskie, 2004) have concluded that the most meaningful relation is between Openness to Experience and various cognitive abilities. Below, I briefly summarize findings regarding the association of personality traits and mental abilities for middle-age and older adults.

Neuroticism

Neuroticism is the personality trait that most consistently exhibits negative relationships with various cognitive processes and mental abilities. Participants from the Normative Aging Study who were high in anxiety (a facet of Neuroticism) were found to score lower on information-processing ability, manual dexterity,

and pattern analysis capability (Costa, Fozard, McCrae, & Bosse, 1976). In a more recent study with the Normative Aging Study participants, memory complaints predicted the level, but not the rate, of change in both Neuroticism and Extraversion (Mroczek & Spiro, 2003). Men who complained of memory problems had lower Extraversion and higher Neuroticism. Negative relationships between Neuroticism and creativity have also been found (McCrae, 1987).

Boron (2003) examined personality-ability relationships for early (36-49 years) and later (50-63 years) middle-age adults. For early midlife women, Neuroticism was significantly negatively related to performance on inductive reasoning, spatial orientation, verbal ability, and speed; no significant relationships with Neuroticism were found for early midlife men. Education accounted for additional variance on reason and verbal abilities for women. For late midlife women, Neuroticism was significantly negatively related only to verbal ability; however, for late midlife men, Neuroticism was significantly negatively related to reason; in both cases, education accounted for additional variance. In the total SLS sample from young adulthood to old age, Neuroticism was significantly negatively related only to verbal ability (Schaie et al., 2004).

Extraversion

For participants in the Baltimore Longitudinal Aging Study, a positive relationship was reported between creativity and Extraversion (McCrae, 1987). In a recent study with the Normative Aging Study participants, memory complaints predicted the level, but not the rate, of change in both Neuroticism and Extraversion (Mroczek & Spiro, 2003). Boron (2003) found that for early midlife women (36-49 years), Extraversion was negatively related to performance on spatial orientation and verbal ability; no significant relationships were found for early midlife men. Education accounted for additional variance on verbal ability for women. For late midlife women (50-63 years), Extraversion was significantly positively related only to number; however, for late midlife men, Extraversion was significantly negatively related to verbal ability; in both cases, education accounted for additional variance. In the total SLS sample,

Extraversion was related to verbal ability (Schaie et al., 2004)

Openness to Experience

Studies have found Openness to Experience to be the most consistent trait to correlate with cognitive abilities and to have the highest relationships. Costa et al. (1976) suggested that this association may be due in part to the significant relationship among Openness to Experience, education, and socioeconomic status; in addition, cognitive style (i.e., greater tolerance for novel experiences) as a mediator has been hypothesized. Participants from the Normative Aging Study who were high on Openness to Experience and high on Extraversion performed better on some cognitive processes (Costa et al., 1976). A positive relationship among divergent thinking, creativity, and Openness to Experience was found for participants in the Baltimore Longitudinal Aging Study (McCrae, 1987). For middle-age adults, a positive relation of Openness and knowledge of humanities and civics was found (Ackerman & Rolhus, 1999). Boron (2003) reported that for early midlife women, Openness was positively related to performance on verbal memory, inductive reasoning, spatial orientation, and verbal ability (with the largest effect noted for verbal ability); the only significant relation for early midlife men was verbal ability. Education accounted for additional variance on reason and verbal ability for women. For late midlife women, Openness was positively related to verbal ability; additional variance was accounted for by education. For late midlife men, Openness was positively related to memory, and verbal ability; additional variance was accounted for by education. In the total SLS sample, Openness was related to inductive reasoning, spatial orientation, perceptual speed, verbal ability, and verbal memory (Schaie et al., 2004).

Conscientiousness

Given their more recent addition to the NEO assessment battery, less research has included the factors of Conscientiousness and Agreeableness. For participants in the Baltimore Longitudinal Aging Study, a positive relationship between creativity and Conscientiousness

was found (McCrae, 1987). Boron (2003) found no significant associations for early midlife women and men with Agreeableness or Conscientiousness. For late midlife women, a negative relationship of Conscientiousness with reason and verbal ability was reported; education accounted for additional variance. No significant relationships were found for late midlife men. In the total SLS sample, Conscientiousness was related to verbal ability (Schaie et al., 2004).

Agreeableness

Boron (2003) reported a modest positive relationship for late midlife women of Agreeableness with reason and speed ability; additional variance was accounted for by education. No significant relation was observed for late midlife men. In the total SLS sample, Agreeableness was negatively related to inductive reasoning and spatial orientation (Schaie et al., 2004).

Cognitive Style as a Mechanism Linking Personality and Ability

Given the relatively modest associations between personality and abilities, it has been suggested that cognitive or learning styles may be an important link in the cognition–personality relationship. Costa and McCrae (1999) have suggested that there may be stronger associations between personality and cognitive styles than directly with cognitive abilities. Likewise, Sternberg and Grigorenko (1997) suggested that styles may be a bridge between personality and cognition. *Cognitive style* has been defined as characteristic modes of perceiving, remembering, thinking, problem solving, or decision making. In a somewhat similar approach, Langston and Sykes (1997) suggested that individual beliefs and expectancies may be a proximal mechanism whereby personality traits influence behavior.

Neuroticism has been positively related to thinking styles characterized as more simplistic or norm favoring in young adults (Zhang & Huang, 2001). In contrast, reflective learning styles have been negatively associated with neuroticism in midlife adults (Furnham, 1996). Furnham (1996) found that an activist and pragmatic learning style related positively to Extraversion and Openness to Experience in midlife adults. Openness has also

been re
involv
adult
Consci
involv
(Zhang

CUMUL
IN PERS

Much of
ality trai
ative stal
McCrae,
The issu
recent fir
tive risk.
long-term
tress, rep.
neurotic:
viduals' i
In the fol
types of s
ality trait
contribute
larly in m

Caspi a
of person
course, co
tinuity an
empirical
consistenc
mon than
However,
ous types
eral types

Finding
the method
ies of cont
examine m
measures a
study bivar
whole. A li
variance a
overall patt
alizes to all
relational
between t
Meredith, J
(Jones & J

1987). Boron (2003) found correlations for early midlife with Agreeableness or for late midlife women, a correlation of Conscientiousness with Agreeableness was reported; education was related to variance. No significant correlation was found for late midlife men. In the study, Conscientiousness was related to Agreeableness (Schaie et al., 2004).

found a modest positive relationship between Agreeableness and cognitive abilities; additional variance in cognitive abilities was explained by education. No significant correlation was found for late midlife men. In the study, Agreeableness was negatively related to reasoning and spatial orientation (Schaie et al., 2004).

Mechanism and Ability

Given the relatively modest associations between personality and cognitive abilities, it has been suggested that learning styles may be an important mechanism in the cognition-personality relationship. McCrae (1999) and McCrae and Costa (1999) have suggested that there may be stronger associations between personality and cognitive styles than between personality and cognitive abilities. Likewise, Plomin and McCrae (1997) suggested that the relationship between personality and cognitive abilities has been defined as *style* has been defined as the ability of perceiving, remembering, and making decisions. In the present approach, Langston and McCrae (2003) suggested that individual beliefs about learning may be a proximal mechanism through which personality traits influence behavior. Agreeableness has been positively related to learning styles as more simplistic or rote learning styles in young adults (Zhang & Huang, 2001). Reflective learning styles have been associated with neuroticism in young adults (Furnham, 1996) and pragmatic learning style in young adults. Extraversion and Openness to Experience in young adults. Openness has also

been related to thinking styles characterized as involving creativity and complexity in young adult samples (Zhang & Huang, 2001). Conscientiousness was related to thinking styles involving a hierarchical approach in young adults. (Zhang & Huang, 2001).

CUMULATIVE CONTINUITY IN PERSONALITY TRAITS

Much of the recent life span research on personality traits has focused on a discussion of the relative stability of traits across adulthood (Costa & McCrae, 2006; Roberts & DelVecchio, 2000). The issue of stability is particularly relevant to recent findings regarding personality and cognitive risk. Wilson et al. (2003) argued that it is the long-term predisposition to psychological distress, represented by personality traits such as neuroticism, that may contribute to some individuals' increased risk of cognitive impairment. In the following section, we briefly review the types of stability of concern in studying personality traits and discuss mechanisms that may contribute to continuity in personality, particularly in midlife and old age.

Caspi and Roberts (2001), in their discussion of personality development across the life course, concluded that although there are continuity and discontinuity at all life stages, empirical evidence suggests that personality consistency increases with age and is more common than change in midlife and old age. However, it is important to understand the various types of continuity studied; we discuss several types of continuity below.

Findings on continuity are also impacted by the methods used to study stability. Earlier studies of continuity used a nomothetic approach to examine mean trends in the data via repeated measures analysis of variance procedures and to study bivariate correlations for the sample as a whole. A limiting assumption of the analysis of variance approach is the assumption that the overall pattern of change within a sample generalizes to all subjects. A limitation of simple correlational analysis is that the relationship between two variables is linear (Jones & Meredith, 1996). However, more recent studies (Jones & Meredith, 1996; Mroczek & Spiro,

2003; Small, Hertzog, Hulstsch, & Dixon, 2003) have taken an individual-differences approach, focusing on individuals' unique patterns of personality change. The relatively new statistical techniques of hierarchical linear modeling (Bryk & Raudenbush, 1987) and latent curve analysis (Meredith & Tisak, 1990) have been used. These procedures permit examination of nonlinear change and offer options for dealing with missing data.

Types of Continuity

Differential Stability

Rank order continuity indicates consistency in individual differences in a sample across time. This is the most common form of stability studied in personality. Costa et al. (2000) examined both rank order and intraindividual stability over a 6- to 9-year period in middle age; rank order stability in midlife approached retest reliability. Small et al. (2003) also reported uniformly high 6-year stability coefficients in a study involving the Victoria Longitudinal Study participants. In their meta-analysis, Roberts and DelVecchio (2000) concluded that rank order consistency in personality peaks in the 50s. Moreover, there is little variability across different personality domains in rank order consistency.

Absolute Stability

A second type of consistency focuses on intraindividual stability or constancy in amount of an attribute over time. Thus, the argument for stability claims not that personality scores do not vary over time but that individuals retain the same rank order across time. Costa et al. (2000) reported small intraindividual decreases in levels of Neuroticism, Extraversion, Openness to Experience, and Conscientiousness within the 6 to 9 years studied in midlife; decline was more evident for women than for men. Age-related changes were considered modest and over a 10-year period were on the order of less than 0.20 standard deviation units. Women were found to decline on all facets of Neuroticism except anxiety and to decline also on Extraversion.

Many of the more recent studies of personality continuity have focused on the question of

absolute stability using hierarchical linear modeling or latent curve analyses (Jones & Meredith, 1996; Mroczek & Spiro, 2003; Small et al., 2003). These longitudinal studies have found reliable individual differences in rates of personality change, although the magnitude of variance was small relative to the total variance between individuals (Helson et al., 2002). Using repeated measures multivariate analyses of variance, Small et al. (2003) reported only a significant decline for Openness over the 6-year interval. However, with latent change analyses, significant individual differences in change were found for all five NEO-PI factors; individuals who were initially lower on the personality dimension exhibited greater increases 6 years later. Likewise, Mroczek and Spiro (2003) found significant variability over a 12-year interval in both level and rate of change for Neuroticism and Extraversion for men in the Normative Aging Study. However, these studies also acknowledge that many participants are well characterized by the overall trajectory for a given trait.

Schaie et al. (2004) estimated age-related changes in the NEO-PI traits from young adulthood to old age; of interest is that middle age marked a shift in trajectories for several of the NEO-PI traits; a plateau or stability beginning in midlife was noted for Neuroticism, Openness, and Conscientiousness. For Neuroticism, there was an increase from young adulthood to midlife, with stability after middle age. Openness showed a modest increase until age 46, a plateau until the late 60s, and a decline thereafter. Extraversion was highest in young adulthood and showed a decline from the 40s. Conscientiousness was highest in young adulthood with a decline until the 50s, followed by a plateau.

Gender Differences

Gender differences in level of personality traits and in rate of change have received relatively little attention (Feingold, 1994). Across studies of gender differences in level of personality traits, the largest gender differences have been found for Neuroticism and Openness, with women scoring higher than men (Costa, Terracciano, & McCrae, 2001; Feingold, 1994;

Small et al., 2003). Gender differences may vary by facet within a domain. In a meta-analysis, Feingold (1994) reported that men scored higher than women on assertiveness, from the Extraversion domain, whereas women scored higher on the Extraversion facet of gregariousness. Women scored higher than men on tender-mindedness and trust, from the Agreeableness domain, and on the anxiety facet of the Neuroticism domain. Most studies have examined gender differences only in level of the trait. Small et al. (2003) reported gender differences in rate of change over a 6-year period with an initial age range of 55 to 85 years; women showed greater declines in Neuroticism, but greater increases in Agreeableness.

Structural and Ipsative Continuity

Two additional forms of continuity focus on the interrelationship among traits and have received less attention in the literature. *Structural continuity* refers to the persistence of correlational patterns among a set of variables across time. Some developmental psychologists argue that structural invariance should be established before other kinds of stability are examined (Baltes, Reese, & Nesselroade, 1977). Costa and McCrae (1992) concluded that there do not appear to be qualitative structural shifts beyond adolescence in the NEO personality traits. However, several studies using confirmatory analytic techniques have reported that facets from the NEO-PI do not always adhere to a simple factor structure, with each facet corresponding to one and only one factor (Church & Burke, 1994; Small et al., 2003). Small et al. (2003) chose to reduce the number of facets to examine structural stability over time; considerable structural stability was found for the reduced model.

Ipsative continuity focuses on individual rather than group-level continuity and denotes continuity in the configuration of variables within an individual across time. Very little longitudinal research within the NEO approach has been conducted using the ipsative view. However, Eysenck (1967) suggested that differing configurations of neuroticism and extraversion within an individual are related to neural systems.

MECHANISMS OF CONTINUITY

The finding of at least some continuity in personality over time is a question of wh... continuity. One approach has been to focus on the mechanism of development and change in a trait as an effort to account for the variability, other than the trait itself (Sykes (1997) n... ality seems to be a good starting point for investigating w... exclusion of other factors. Early in the question, Bandura (1999) "an integrated model of classified beha... nants and the mechanisms they operate an... ones can be fostered (p. 166). Caspi... mechanisms de... for the maintenance of the trait. The mechanism of continuity may be personality continuity.

Environmental Influences Environmental influences may show continuity. Bandura (1999) reported that... show remarkable stability in adulthood. Longitudinal studies are of a similar nature as longitudinal studies. However, there is a need to examine the differences between personality and environment are assumed that stability in personality. However, stable personality or producing con...

Genetic Influences Personality continuity

MECHANISMS FOR MAINTAINING CONTINUITY IN PERSONALITY

The finding of relative stability in personality at least from middle age into old age leads to the question of which mechanisms may contribute to continuity. One of the criticisms of a trait approach has been the relatively limited consideration within theory or research in understanding the mechanisms or processes underlying development and change in a trait. The definition of a trait as an enduring disposition may in part account for the limited interest in explanatory variables, other than genetic ones. Langston and Sykes (1997) noted that "the trait area of personality seems to have become stuck in the rut of investigating which traits are fundamental to the exclusion of other important questions, particularly the question, how do traits work" (p. 142). Bandura (1999) observed that what is needed is "an integrated conceptual scheme that not only classified behaviors but specifies their determinants and the key mechanisms through which they operate and the modes by which desired ones can be fostered and undesired ones altered." (p. 166). Caspi and Roberts (2001) proposed the mechanisms described in the following section for the maintenance of continuity in personality. The mechanisms related to stability in environment may be particularly relevant to the personality continuity seen in midlife and old age.

Environmental Influences. Personality characteristics may show continuity because the environment is stable. Warren and Hauser (1997) reported that socioenvironmental conditions show remarkable intragenerational persistence in adulthood. Longitudinal environmental correlations are of approximately the same magnitude as longitudinal personality correlations. However, there has been insufficient research to examine the directionality of the relationship between personality and environment. It is assumed that stable and enduring features of the environment are fostering continuity in personality. However, stable, enduring, and partially heritable personality traits may lead to seeking out or producing consistency in one's environment.

Genetic Influences. Genetic influences on personality continuity have been explored in twin

studies. McGue, Bacon, and Lykken (1993) examined in adulthood the genetic and environmental etiology of age-to-age continuity in twins. Monozygotic cross-twin correlations were consistently and significantly larger than the dizygotic cross-twin correlations. The authors estimated that approximately 80% of phenotypic stability may be associated with genetic factors. Although genetic factors may influence continuity, there is the question of the mechanisms by which continuity is maintained. Kagan (1997) suggested that inherited variations in threshold of arousal may contribute to longitudinal consistencies. Alternatively, genetic factors may exert their influence through gene-environment correlations.

Person-Environment Interactions. Three types of person-environment interactions may foster continuity in personality. First, *reactive transactions* occur when different individuals exposed to the same environment experience it, interpret it, and react to it differently. Each person extracts a subjective psychological environment from the objective surroundings, and it is that subjective environment that shapes subsequent personality. Once psychological constructs of the self are well organized, as in midlife, these constructions make individuals selectively responsive to information that is congruent with their expectations and self views (Fiske & Taylor, 1991)

Second, *evocative transactions* occur when individuals evoke distinctive reactions from others on the basis of their personality characteristics. The person acts, the environment reacts, and the person reacts back in a mutually interlocking evocative transaction. Such transactions continue across the life span and promote continuity. Facial expressions of emotion are especially important in evocative person-environment transactional processes; they convey information to others about what the individual is feeling and how the individual is likely to act. Personality traits have been found to be registered in facial expressions and thus may influence continuity by evoking congruent and reciprocal responses from other persons (Keltner, 1996).

Third and last, *proactive transactions* may account for the age-related increase in magnitude of stability coefficients across the life span. The most consequential environments for

personality development are interpersonal environments, in particular, friendship and mate selection. Friends and partners tend to resemble each other; empirical studies indicate that members of peer groups are similar because individuals selectively choose to affiliate with similar others. Affiliations with similar others tend to consolidate behavioral patterns over time. Demands of the social environment remain relatively stable over time. Consistency in social network relations may contribute to continuity in how one views and defines oneself. Assortative mating may influence personality continuity because similarities between spouses create an environment that reinforces initial tendencies (Buss, 1984). Caspi and Herbener (1990) found that persons who married a partner similar to themselves were subsequently more likely to show personality continuity over time.

PERSONALITY AND RISK OF COGNITIVE IMPAIRMENT

Personality Traits, Stress, and Neural Impairment

There is increasing evidence that psychological distress may have biological consequences that influence cognitive functioning. Experiencing stress, depression, and anxiety are associated with hormonal and immune system changes; these associations have been implicated in theories of neural degeneration and the development of cognitive impairment (Sapolsky, 1996, 2001). Stress is associated with activation of the hypothalamic-pituitary-adrenal (HPA) axis. Activation of the HPA axis results in the release of glucocorticoid hormones; long-term exposure to these hormones has been found to result in neurodegeneration. Long-term exposure to glucocorticoids appears to have a negative effect on the hippocampus, the brain area associated with memory and learning, in both animals and humans. Higher levels of cortisol, a human glucocorticoid, are often present in depression; people with a history of depression have been found to have less hippocampal volume than matched control participants (Sheline, Wang, Gado, Csernansky, & Vannier, 1996). In addition,

HPA hyperactivity has been found in Alzheimer's disease (AD) patients, who also experience hippocampal damage (Busciglio et al., 1998)

In addition, psychological distress as represented in depression and anxiety has been found to be associated with greater production of proinflammatory cytokine interleukin-6 (IL-6; Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). IL-6 appears to promote inflammatory neuronal damage, as evidenced in beta-amyloid plaques seen in AD (Papassotiropoulos, Hock, & Nitsch, 2001).

It is the long-term exposure to psychological distress and the associated long-term exposure to glucocorticoids and IL-6 that appear to be likely to lead to neurological damage resulting in risk to cognitive functioning. One approach to studying long-term psychological distress is to study individuals' proneness to psychological distress, as represented by personality traits that have been shown to remain relative stable over much of the adult life span. Neuroticism and, to a lesser extent, extraversion, are the personality traits that have been implicated as predisposing individuals to long-term psychological distress.

Higher levels and more frequent experiences of psychological distress have been found for individuals high in neuroticism. Individuals with higher neuroticism scores report greater distress in response to major life events (Parkes, 1990) and to daily stressful events (Marco & Suls, 1993). Reactivity to stress may be even greater in older adults as compared to younger adults (Mroczek & Almeida, 2004). In addition, people high in neuroticism may have greater exposure to stressors. Study participants high in neuroticism have reported more interpersonal stressors, had more negative appraisals of stressful events, and used less adaptive coping strategies compared with those low in neuroticism (Gunther, Armeli, & Cohen, 1999).

Although the theory and findings regarding neuroticism and stress have been fairly consistent, findings on the association of extraversion, stress, and neural functioning have been mixed. Eysenck (1967) theorized that extraversion was related to cortical arousal and possible cognitive functioning. In his model, cognitive function may be negatively affected by people high in extraversion or high in introversion. Moderate extraversion reflecting moderate arousal was

hypothesizing, functioning, mixed and related to rodegene

Studies generally (Robinson theory, the cism and independ version is cortical a represent Activatio heightens influence tem. On Neurotic the asso arousal (these asso alternativ of anxiet tion of Extravers runs fro version Neurotic anxiety). High Ne (high in Extravers that a co Extravers cognitive from fin and with higher or compare Francis,

Research Extraver

Sever support f ity traits increased et al. (20

has been found in Alzheimer's
 patients, who also experience hip-
 Busciglio et al., 1998)

Psychological distress as repre-
 sented by depression and anxiety has been found
 with greater production of
 cytokine interleukin-6 (IL-6;
 McGuire, Robles, & Glaser,
 2003). Efforts to promote inflammatory
 responses as evidenced in beta-amyloid
 protein (A β) (Papassotiropoulos, Hock,

2003). Chronic exposure to psychological
 stress is associated with long-term exposure
 to cortisol and IL-6 that appear to be
 associated with neurological damage resulting
 in cognitive dysfunctioning. One approach to
 reduce psychological distress is to
 address the proneness to psychological
 distress by personality traits that
 tend to remain relatively stable over
 the life span. Neuroticism and, to
 a lesser extent, extraversion, are the personality
 traits most often implicated as predisposing
 to long-term psychological distress.
 Individuals with more frequent experiences
 of psychological distress have been found
 to score higher in neuroticism. Individuals
 with high neuroticism scores report greater
 distress due to major life events (Parkes,
 1981). Highly stressful events (Marco &
 Almeida, 2004). In addition,
 neuroticism may have greater
 effects on stressors. Study participants high in
 neuroticism reported more interpersonal
 conflict and negative appraisals of stressors
 compared to those low in neuroticism
 (Cohen & Cohen, 1999).

Theory and findings regarding
 the association of extraversion,
 neuroticism, and cognitive functioning have been mixed.
 It has been theorized that extraversion was
 associated with lower arousal and possible cognitive
 dysfunctioning. This model,
 however, is not supported by people high in
 neuroticism and low in introversion. Moderate
 to high neuroticism and low extraversion
 are associated with moderate arousal was

hypothesized to be optimal for cognitive func-
 tioning. Findings regarding higher cognitive
 functioning in moderate extraverts have been
 mixed and the hypothesis of high extraversion
 related to risk of cognitive impairment or neu-
 rodegeneration has not been adequately tested.

Studies of neuroticism and extraversion have
 generally examined these two traits separately
 (Robinson, 2001). However, in Eysenck's (1967)
 theory, the neuronal systems underlying neuroti-
 cism and extraversion are not assumed to be
 independent. The cortical arousal linked to extra-
 version is considered a function of the reticulo-
 cortical activating system, whereas neuroticism
 represents the activation of the limbic system.
 Activation of the limbic system indirectly
 heightens cortical arousal through its activating
 influences on the reticulocortical activating sys-
 tem. On the basis of these assumptions,
 Neuroticism would be considered a moderator of
 the association between Extraversion and
 arousal (Robinson, 2001). In part on the basis of
 these assumptions, Gray (1981) proposed an
 alternative theory that focused on the dimensions
 of anxiety and impulsivity that result from rota-
 tion of Eysenck's (1967) Neuroticism and
 Extraversion factors. The dimension of anxiety
 runs from the High Neuroticism/Low Extra-
 version quadrant (high anxiety) to the Low
 Neuroticism/High Extraversion quadrant (low
 anxiety). The impulsivity dimension runs from
 High Neuroticism/High Extraversion quadrant
 (high impulsivity) to Low Neuroticism/Low
 Extraversion (low impulsivity). It would follow
 that a combination of high Neuroticism and low
 Extraversion would be related to greater risk of
 cognitive impairment. Partial support comes
 from findings that people with anxiety disorders
 and with generalized anxiety disorder score
 higher on Neuroticism and lower on Extraversion
 compared with control respondents (Gomez &
 Francis, 2003; Trull & Sher, 1994).

Research on Neuroticism, Extraversion, and Cognitive Risk

Several recent studies have provided some
 support for an association between the personal-
 ity traits of Neuroticism and Extraversion and
 increased risk of cognitive impairment. Crowe
 et al. (2006) examined the relationship between

personality and cognitive impairment in members
 of the Swedish Twin Registry. Neuroticism and
 Extraversion scores were obtained in midlife,
 and cognitive impairment was assessed 25 years
 later, in old age. Greater Neuroticism was associ-
 ated with higher risk of cognitive impairment.
 Moderate Extraversion, as hypothesized by
 Eysenck (1967), was associated with lower risk
 of cognitive impairment, as compared to high
 Extraversion or introversion. The combination of
 high Neuroticism and low Extraversion was associ-
 ated with increased risk of impairment, sup-
 porting Gray's (1981) hypothesis regarding the
 effects of anxiety on cognition. An unexpected
 additional finding was that high Neuroticism/
 high Extraversion was also associated with
 cognitive impairment; high Neuroticism/high
 Extraversion would correspond with high impul-
 sivity in Gray's framework.

Wilson and colleagues have published sev-
 eral articles linking Neuroticism and risk of
 dementia (Wilson, Barnes, et al., 2005). Wilson
 et al. (2003) examined the association of dis-
 tress proneness with incident AD and cognitive
 decline in the Religious Orders Study. During
 a 5-year follow-up, participants who were high
 on distress proneness (90th percentile on
 Neuroticism) had twice the risk of develop-
 ing AD of those who were low on distress
 proneness (10th percentile on Neuroticism).
 Neuroticism was related to decline in episodic
 memory but not in other cognitive domains with
 a greater than tenfold increase in memory
 decline in participants high on neuroticism.
 However, Neuroticism was not related to com-
 mon measures of AD pathology at autopsy. In a
 second study, Wilson et al. (2006) tested the
 hypothesis of the association of distress prone-
 ness to increased risk of AD in the Rush
 Memory and Aging Project. Older individuals
 without dementia completed a neuroticism mea-
 sure and were followed over 3 years. Persons
 with high level of distress proneness (90th per-
 centile on Neuroticism) were 2.7 times as likely
 to develop AD than those not prone to distress
 (10th percentile on Neuroticism). Neuroticism
 was associated with more rapid cognitive
 decline also. In a third study, Wilson, Krueger,
 et al. (2005) examined the association of
 Neuroticism and Extraversion in a geographi-
 cally defined urban sample of elders. In a 6-year

follow-up after personality assessment, a high level of Neuroticism was associated with a 33% increase in risk of death compared with a low Neuroticism score. A high level of Extraversion was associated with a 21% decrease in risk of death compared with a low score. The association of Neuroticism and Extraversion with mortality was not substantially changed by taking into account disease conditions, substance use, or body mass. However, adjustment for cognitive, social, and physical activity did reduce the association of both traits with mortality.

PERSONALITY AND HEALTH BEHAVIORS

The preceding section focused on research that has examined the role of a long-term proneness to psychological distress on neurodegeneration and risk of cognitive impairment. An alternative way personality traits may have an indirect effect on health and on cognitive functioning is by their association with health behaviors. Several studies have reported an association between personality traits and health behaviors; these health behaviors have been related to chronic diseases (e.g., cardiovascular disease, diabetes) with onset in midlife and that have been found to be associated with cognitive impairment. Although Neuroticism was the personality trait of primary interest in studying the effect of stress on cognitive functioning, Conscientiousness appears to be an important trait in examining health behaviors (Roberts & Bogg, 2004). *Conscientiousness* refers to individual variability in propensity to follow socially prescribed norms for impulse control, to be task and goal directed, to be planful, to delay gratification, and to follow norms and rules. A number of studies have found an association among Conscientiousness, health, and longevity, in part through the effect of Conscientiousness on health behaviors as well as through its effect on social-environmental factors that contribute to health, such as work, family structure, and socioeconomic status (Roberts, Walton, & Bogg, 2005).

Brummett et al. (2006) examined personality traits as predictors of body mass index (BMI) over 14 years in midlife. Openness and Agreeableness were negatively related to BMI.

Neuroticism was positively related to BMI in women only. Extraversion was positively related to BMI in men. Conscientiousness was negatively related to BMI in both men and women, with a higher negative association in women. Conscientiousness also predicted change in BMI during midlife such that participants lower in Conscientiousness tended to show larger gains in BMI with age.

Most studies that have examined the association of Conscientiousness and health behaviors have been unidirectional, assuming that Conscientiousness was a predictor of subsequent health behaviors. Roberts and Bogg (2004) examined both Conscientiousness as a predictor of health behaviors and the impact of socioenvironmental and substance use behaviors on changes in Conscientiousness over time, within the Mills Longitudinal Study sample of women. Social responsibility, a facet of Conscientiousness, as measured in young adulthood, was negatively related to substance use (tobacco, marijuana) in midlife but positively related to alcohol consumption in midlife. In addition, marijuana consumption at age 43 was negatively related to changes in social responsibility at age 52. Women who admitted to smoking marijuana at age 43 were more likely to decrease in social responsibility between 43 and 52.

Roberts and Bogg (2004) conducted a meta-analysis of the relationship between Conscientiousness-related traits and health behaviors. Conscientiousness was found to predict nine health behaviors: (1) alcohol use, (2) disordered eating habits (including obesity), (3) drug use, (4) physical inactivity, (5) risky sexual practices, (6) risky driving practices, (7) tobacco use, (8) suicide, and (9) violence (Roberts et al., 2005). The Conscientiousness facet with the strongest and most consistent relationship to health behaviors was conventionality. Individuals with a propensity to adhere to society's norms were less likely to engage in unhealthy behaviors. Other facets of Conscientiousness related to health behaviors were impulse control and reliability.

CONCLUSION

In this chapter, we have reviewed the literature on the cumulative consistency of personality that

peaks in midlife and the association between personality and cognitive abilities in midlife. We have suggested that the greater stability in personality in midlife may have important implications for studying the association between personality and abilities in the second half of the life span. The limited research available suggests that the relationships between personality and abilities in midlife are stronger than earlier in the life span and that midlife personality traits, such as Neuroticism, may be important predictors of cognitive risk in later adulthood.

Examination of the relationship between personality and ability in the latter half of the life span has been limited by the lack of longitudinal studies that include adequate measurement of both personality and ability measures and that cover long periods in adulthood. Several of the longitudinal studies that have reported associations between personality and ability in adulthood have unfortunately had limited numbers of women in their samples. There is evidence that women may show earlier decline on key personality traits beginning in midlife and that the strength of the association between personality and ability may vary by gender. Hence, further research on the role of gender in personality-ability relationships is a high priority.

During the past 5 years, there has been increasing support for the finding that individuals who score higher on personality traits such as Neuroticism may be at increased risk for cognitive impairment. These findings have been reported in the Swedish Twin Registry and in several diverse samples in the United States. Most of these studies have measured personality only over a limited time period, and thus the significance of personality as a long-term risk factor needs further study. Particularly notable are the findings from the Swedish Twin Registry, which found that personality in midlife predicted cognitive risk some 30 years later. Unfortunately, none of these studies have included biomarkers of stress or neural imaging, as well as personality and cognitive risk measures; hence, the directionality and pathways among personality, stress, and cognition have not been adequately examined.

Research findings suggest that a second way in which personality may be associated with risk of cognitive impairment may be indirectly,

through the health behaviors. Siegler and others (Brummett et al., 2006) have reported significant relationships between personality and a diverse set of health variables. These health variables, such as BMI, have been shown to be important precursors of onset of chronic disease, such as cardiovascular disease, which is known to impact cognitive functioning. Studies examining the role of health and disease in relation to cognition should consider inclusion of personality traits in their models.

Personality traits have traditionally been examined at the level of the individual trait rather than as configurations. Costa and McCrae (1980, 1995) in their studies of traits have indicated that there is considerable stability in configurations. However, Eysenck's (1967) early theoretical work suggests that configurations of several traits may be of interest in studying the association between personality and neurodegeneration. For example, Eysenck hypothesized that high Neuroticism and low Extraversion would increase one's risk for neurodegeneration, and the Swedish Twin Registry study found support for this hypothesis. Cognitive aging has benefited from the joint study of various abilities, such as fluid and crystallized intelligence. It appears that further exploration of various configurations of personality traits and their joint change would be profitable, particularly in midlife with increased consistency in personality.

Given the strong focus on stability of personality traits, most studies have examined personality in a unidirectional manner, as a predictor. There has been limited study of reciprocal relationships, in which personality has been examined in a bidirectional approach. Roberts and Bogg (2004), however, showed that although Conscientiousness impacts lifestyle and health behaviors, these lifestyles may impact future levels of Conscientiousness. Further study of reciprocal relationships involving personality are thus merited.

As Costa and McCrae (1999; Costa et al., 1976) noted, personality and cognition have traditionally been studied in relative isolation. However, during the past 5 years a number of studies in midlife and old age have suggested the need for further exploration of the association between personality and ability in the latter half of the life span. Both the personality and

related to BMI in
was positively
Conscientiousness was
in both men and
ve association in
also predicted
such that partici-
Conscientiousness tended to
an age.
Examined the associa-
and health behav-
al, assuming that
predictor of subsequent
Bogg (2004) exam-
as a predictor of
effect of socioenviron-
mentors on changes in
, within the Mills
of women. Social
Conscientiousness, as
mod, was negatively
assoc, marijuana) in
to alcohol consump-
marijuana consump-
y related to changes
age 52. Women who
ana at age 43 were
social responsibility

conducted a meta-
between Conscien-
and health behaviors.
and to predict nine
al use, (2) disordered
esity), (3) drug use,
risky sexual practices,
s, (7) tobacco use,
(Roberts et al., 2005).
et with the strongest
ship to health behav-
Individuals with a
ety's norms were less
thy behaviors. Other
ess related to health
ontrol and reliability.

reviewed the literature
ency of personality that

cognitive literatures would profit from mutual exploration of these domains. An important outcome would be a more integrated understanding of adults in midlife and old age.

REFERENCES

- Ackerman, P. L., & Rolhus, E. L. (1999). The locus of adult intelligence: Knowledge, abilities, and nonability traits. *Psychology and Aging, 14*, 314-330.
- Baltes, P. B., Reese, H., & Nesselroade, J. R. (1977). *Lifespan developmental psychology: Introduction to research methods*. Monterey, CA: Brooks/Cole.
- Bandura, A. (1999). Social cognitive theory of personality. In L. A. Pervin & O. P. John (Eds.), *Handbook of personality: Theory and research* (2nd ed., pp. 154-196). New York: Guilford Press.
- Boron, J. (2003). *Effects of personality on cognitive ability, training gains, and strategy use in an adult sample: Seattle Longitudinal Study*. Unpublished master's thesis, Pennsylvania State University, University Park, PA.
- Brummett, B. H., Babyak, M. A., Williams, R. B., Barefoot, J. C., Costa, P. T., & Siegler, I. C. (2006). NEO personality domains and gender predict levels and trends in body mass index over 14 years during midlife. *Journal of Research in Personality, 40*, 222-236.
- Bryk, A. S., & Raudenbush, S. L. (1987). Application of hierarchical linear models to assessing change. *Psychological Bulletin, 101*, 147-158.
- Busciglio, J., Andersen, J. K., Schipper, H. M., Gilad, G. M., McCarty, R., & Marzatico, F., et al. (1998). In P. Csermely (Ed.), *Annals of the New York Academy of Sciences: Vol. 851. Stress, aging and neurodegenerative disorders: Molecular mechanisms* (pp. 429-443). New York: New York Academy of Sciences.
- Buss, D. M. (1984). Toward a psychology of person-environment correspondence: The role of spouse selection. *Journal of Personality and Social Psychology, 53*, 1214-1221.
- Caspi, A., & Herbener, E. S. (1990). Continuity and change: Assortative marriage and the consistency of personality in adulthood. *Journal of Personality and Social Psychology, 58*, 250-258.
- Caspi, A., & Roberts, B. W. (2001). Personality development across the life course: The argument for change and continuity. *Psychological Inquiry, 12*, 49-66.
- Church, A. T., & Burke, P. J. (1994). Exploratory and confirmatory tests of the big five and Tellegen's three- and four-dimensional models. *Journal of Personality and Social Psychology, 66*, 93-114.
- Costa, P. T., Jr., Fozard, J. L., McCrae, R. R., & Bosse, R. (1976). Relations of age and personality dimensions to cognitive ability factors. *Journal of Gerontology, 31*, 663-669.
- Costa, P. T., Herbst, J. H., McCrae, R. R., & Siegler, I. C. (2000). Personality at midlife: Stability, intrinsic maturation, and response to life events. *Assessment, 7*, 365-378.
- Costa, P. T., Jr., & McCrae, R. R. (1980). Still stable after all these years: Personality as a key to some issues in adulthood and old age. In P. B. Baltes & O. G. Brim, Jr. (Eds.), *Life span development and behavior* (Vol. 3, pp. 65-102). New York: Academic Press.
- Costa, P. T., Jr., & McCrae, R. R. (1985). *The NEO Personality Inventory manual*. Odessa, FL: Psychological Assessment Resources.
- Costa, P. T., Jr., & McCrae, R. R. (1992). Four ways five factors are basic. *Personality and Individual Differences, 13*, 653-665.
- Costa, P. T., & McCrae, R. R. (1995). Primary traits of Eysenck's P-E-N System: Three- and five-factor solutions. *Journal of Personality and Social Psychology, 69*, 308-317.
- Costa, P. T., Jr., & McCrae, R. R. (1999). *Cautions and considerations for the links between cognition and personality*. Paper presented at the 9th Biennial Meeting of the International Society for the Study of Individual Differences, Vancouver, British Columbia, Canada.
- Costa, P. T., & McCrae, R. R. (2006). Age changes in personality and their origins: Comment on Roberts, Walton & Viechtbauer (2006). *Psychological Bulletin, 132*, 26-28.
- Costa, P. T., Jr., Terracciano, A., & McCrae, R. R. (2001). Gender differences in personality traits across cultures: Robust and surprising findings. *Journal of Personality and Social Psychology, 81*, 322-331.
- Crowe, M., Andel, R., Pedersen, N. L., Fratiglioni, L., & Gatz, M. (2006). Personality and risk of cognitive impairment 25 years later. *Psychology and Aging, 21*, 573-580.
- Endler, N. S. (2000). The interface between personality and cognition. *European Journal of Personality, 14*, 377-389.

Eysenck
ality
Eysenck
and
app
Feingold
ity:
116,
Fiske, S.
New
Furnham
Que
Jour
285-
Gomez, I
anxi
Gray
Indiv
Gough, F
(3rd
logis
Gray, J. A
perso
of p
Sprin
Gunther,
The
copin
Psych
Helson, R
Perso
Hiera
longit
Socia
Jones, C.
Longi
ses of
from
and c
Perso
Jones, C. J
sonali
and A
Kagan, J. (C
& N.
cholog
Wiley.
Keicolt-Gla
Glaser
psycho
Psycho

- and continuity. *Psychological*
- P. J. (1994). Exploratory and of the big five and Tellegen's dimensional models. *Journal of Social Psychology, 66*, 93-114.
- d, J. L., McCrae, R. R., & relations of age and personal- cognitive ability factors. *Psychology, 31*, 663-669.
- , McCrae, R. R., & Siegler, I. C. at midlife: Stability, intrinsic response to life events. *Psychology, 31*, 371-378.
- McCrae, R. R. (1980). Still stable s: Personality as a key to some d and old age. In P. B. Baltes (Eds.), *Life span development* (Vol. 3, pp. 65-102). New York: Springer-Verlag.
- McCrae, R. R. (1985). *The NEO Inventory manual*. Odessa, FL: Psychological Assessment Resources.
- McCrae, R. R. (1992). Four ways sive. *Personality and Individual Differences, 13*, 653-665.
- McCrae, R. R. (1995). Primary traits of the Big Five: Three- and five-factor models. *Journal of Personality and Social Psychology, 69*, 308-317.
- McCrae, R. R. (1999). *Cautions for the links between cognitive ability and personality*. Paper presented at the 9th Annual Meeting of the International Society for Personality and Individual Differences, Vancouver, British Columbia, Canada.
- McCrae, R. R. (2006). Age changes in personality: Their origins: Comment on Roberts & Viechtbauer (2006). *Psychology of Women Quarterly, 30*, 26-28.
- McCrae, R. R., & McCrae, R. R. (2001). Stability in personality traits across cultures: Surprising findings. *Journal of Personality and Social Psychology, 81*, 322-331.
- McCrae, R. R., & Pedersen, N. L., Fratiglioni, L., & Pedersen, N. L. (2006). Personality and risk of cognitive decline 25 years later. *Psychology and Aging, 21*, 870-880.
- The interface between personality and aging. *European Journal of Personality, 20*, 1-15.
- Eysenck, H. J. (1967). *The biological basis of personality*. Springfield, IL: Charles C Thomas.
- Eysenck, H. J., & Eysenck, M. W. (1985). *Personality and individual differences: A natural science approach*. New York: Plenum Press.
- Feingold, A. (1994). Gender differences in personality: A meta-analysis. *Psychological Bulletin, 116*, 429-456.
- Fiske, S. T., & Taylor, S. (1991). *Social cognition*. New York: McGraw-Hill.
- Furnham, A. (1996). The FIRO-B, the Learning Style Questionnaire, and the five-factor model. *Journal of Social Behavior and Personality, 11*, 285-299.
- Gomez, R., & Francis, L. M. (2003). Generalized anxiety disorder: Relationships with Eysenck's, Gray's and Newman's theories. *Personality and Individual Differences, 34*, 3-17.
- Gough, H. G., & Bradley, P. (1996). *CPI manual* (3rd ed.). Palo Alto, CA: Consulting Psychologists Press.
- Gray, J. A. (1981). A critique of Eysenck's theory of personality. In H. Eysenck (Ed.), *A model of personality* (pp. 246-276). New York: Springer-Verlag.
- Gunther, K. C., Armeli, S., & Cohen, L. H. (1999). The role of neuroticism in daily stress and coping. *Journal of Personality and Social Psychology, 77*, 1087-1100.
- Helson, R., Jones C. J., & Kwan, S. Y. (2002). Personality change over 40 years of adulthood: Hierarchical linear modeling analyses of two longitudinal samples. *Journal of Personality and Social Psychology, 83*, 752-766.
- Jones, C. J., Livson, N., & Peskin, H. (2003). Longitudinal hierarchical linear modeling analyses of California Psychological Inventory data from age 33 to 75: An examination of stability and change in adult personality. *Journal of Personality Assessment, 80*, 294-308.
- Jones, C. J., & Meredith, W. (1996). Patterns of personality change across the life-span. *Psychology and Aging, 11*, 57-65.
- Kagan, J. (1997). Biology and the child. In W. Damon & N. Eisenberg (Eds.), *Handbook of child psychology* (Vol. 13, pp. 221-241). New York: Wiley.
- Keicolt-Glaser, J. K., McGuire, L., Robles, R. F., & Glaser, R. (2002). Psychoneuroimmunology and psychosomatic medicine: Back to the future. *Psychosomatic Medicine, 64*, 15-28.
- Keltner, D. (1996). Facial expressions of emotion and personality. In C. Magai & S. H. McFadden (Eds.), *Handbook of emotion adult development and aging* (pp. 385-401). San Diego, CA: Academic Press.
- Lachman, M. E. (2004). Development in midlife. *Annual Review of Psychology, 55*, 305-331.
- Langston, C. A., & Sykes, W. E. (1997). Beliefs and the Big Five: Cognitive bases of broad individual differences in personality. *Journal of Research in Personality, 31*, 141-165.
- Marco, C. A., & Suls, J. (1993). Daily stress and the trajectory of mood: Spillover, response assimilation, contrast, and chronic negative affectivity. *Journal of Personality and Social Psychology, 64*, 1053-1063.
- McCrae, R. R. (1987). Creativity, divergent thinking and openness to experience. *Journal of Personality and Social Psychology, 52*, 1258-1265.
- McGue, M., Bacon, S., & Lykken, D. T. (1993). Personality stability and change in early adulthood: A behavioral genetic analysis. *Developmental Psychology, 29*, 96-109.
- Meredith, W., & Tisak, J. (1990). Latent curve analysis. *Psychometrika, 55*, 107-122.
- Mroczek, D. K., & Almeida, D. M. (2004). The effects of daily stress, personality and age on daily negative affect. *Journal of Personality, 72*, 355-378.
- Mroczek, D. K., & Spiro, A. (2003). Modeling intraindividual change in personality traits: Findings from the Normative Aging Study. *Journal of Gerontology: Psychological Sciences, 58B*, 153-165.
- Papassotiropoulos, A., Hock, C., & Nitsch, R. M. (2001). Genetics of interleukin 6: Implications for Alzheimer's disease. *Neurobiology of Aging, 22*, 863-871.
- Parkes, K. R. (1990). Coping, negative affectivity, and the work environment: Additive and interactive predictors of mental health. *Journal of Applied Psychology, 75*, 399-409.
- Roberts, B. W., & Bogg, T. (2004). A longitudinal study of the relationships between conscientiousness and the social-environmental factors and substance-use behaviors that influence health. *Journal of Personality, 72*, 325-353.
- Roberts, B. W., & DelVecchio, W. F. (2000). The rank-order consistency of personality from childhood to old age: A quantitative review of longitudinal studies. *Psychological Bulletin, 126*, 3-25.

- Roberts, B. W., Walton, K. E., & Bogg, T. (2005). Conscientiousness and health across the life course. *Review of General Psychology, 9*, 156-168.
- Robinson, D. L. (2001). How brain arousal systems determine different temperament types and the major dimensions of personality. *Personality and Individual Differences, 31*, 1233-1259.
- Sapolsky, R. M. (1996, August 9). Why stress is bad for your brain. *Science, 273*, 749-750.
- Sapolsky, R. M. (2001). Depression, antidepressants, and the shrinking hippocampus. *Proceedings of the National Academy of Sciences, USA, 98*, 12320-12322.
- Schaie, K. W. (2005). *Developmental influences on adult intellectual development: The Seattle Longitudinal Study*. New York: Oxford University Press.
- Schaie, K. W., Willis, S. L., & Caskie, G. (2004). The Seattle Longitudinal Study: Relationship between personality and cognition. *Aging, Neuropsychology and Cognition, 11*, 304-324.
- Sheline, Y. I., Wang, P. W., Gado, M. H., Csernansky, J. G., & Vannier, M. W. (1996). Hippocampal atrophy in recurrent major depression. *Proceedings of the National Academy of Sciences, USA, 93*, 3908-3913.
- Small, B. J., Hertzog, C., Hultsch, D. F., & Dixon, R. A. (2003). Stability and change in adult personality over 6 years: Findings from the Victoria Longitudinal Study. *Journals of Gerontology Series B: Psychological Sciences and Social Sciences, 58B*, 166-176.
- Sternberg, R. J., & Grigorenko, E. L. (1997). Are cognitive styles in style? *American Psychologist, 52*, 700-712.
- Thurstone, L. L., & Thurstone, T. G. (1949). *Examiner manual for the SRA Primary Mental Abilities Test (Form 10-14)*. Chicago: Science Research Associates.
- Trull, T. J., & Sher, K. J. (1994). Relationship between the five-factor model of personality and Axis I disorders in a nonclinical sample. *Journal of Abnormal Psychology, 103*, 350-360.
- Warren, J. R., & Hauser, R. M. (1997). Social stratification across three generations: New evidence from the Wisconsin Longitudinal Study. *American Sociological Review, 62*, 561-572.
- Wilson, R. S., Arnold, S. E., Schneider, J. A., Kelly, J. F., Tang, Y., & Bennett, D. A. (2006). Chronic psychological distress and risk of Alzheimer's disease in old age. *Neuroepidemiology, 27*, 143-153.
- Wilson, R. S., Barnes, L. L., Bennett, D. A., Li, Y., Bienias, J. L., Mendes de Leon, C. F., et al. (2005). Proneness to psychological distress and risk of Alzheimer disease in a biracial community. *Neurology, 64*, 380-382.
- Wilson, R. S., Evans, D. A., Bienias, J. L., Mendes de Leon, C. F., Schneider, J. A., & Bennett, D. A. (2003). Proneness to psychological distress is associated with risk of Alzheimer's disease. *Neurology, 61*, 1479-1485.
- Wilson, R. S., Krueger, K. R., Gu, L., Bienias, J. L., Mendes de Leon, C. F., & Evans, D. A. (2005). Neuroticism, extraversion, and mortality in a defined population of older persons. *Psychosomatic Medicine, 67*, 841-845.
- Zhang, L. F., & Huang, J. (2001). Thinking styles and the five-factor model of personality. *European Journal of Personality, 15*, 465-476.