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Personality and Differences in Health and Longevity

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There are striking individual differences in health, well-being, and longevity. Some people are more likely to get sick, are less likely to recover when ill, and are less likely to live to a healthy old age. Although some of this variation is due to chance circumstances, there are systematic differences in disease proneness and longevity. The explanation for this variation is, however, much more complex than it first appears.

Modern scientific conceptions view personality as having biological, psychological, and social aspects. The individual is born with certain genetic predispositions and biologically influenced temperaments, is socialized to develop a self-identity and typical patterns of behavior, and lives in a social environment that encourages and elicits certain tendencies and reactions and discourages others. Personality is thus well-suited for studying modern conceptions of health that rely on a biopsychosocial model. That is, as it has become clearer that a full understanding of health, illness, and recovery requires adding psychosocial components to the biological ones, a biopsychosocial conception of personality is a natural conception to employ in sophisticated models and research.

History and Background

It has long been observed that emotional aspects of personality, such as being angry, anxious, or depressed, are associated with disease. For the ancient Greeks—Hippocrates, Galen, and their followers—so-called bodily humors were the explanation. They postulated that health arose from a balance across four known fluids—blood, black bile, yellow bile, and phlegm—and imbalance led to disease. If you were chronically sad, with a splenic melancholia, it was not surprising that early cancer might

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accompany your depression. Treatments thus often involved attempts to restore humoral balance through bloodletting, emetics, dietary changes, purging, diuretics, and so on. Although the humoral elements and their relations to health were without any scientific justification and proved to be incorrect, this concept of balance, or homeostasis, has become a cornerstone for modern ideas of emotional patterns and health.

Two millennia later, the psychophysiological models of the French physiologist Claude Bernard (1880) and of the "fight-or-flight" discoverer Walter Cannon (1932) developed the idea of biological homeostasis, successfully applying the concept of internal balance to nerves and hormones. The body consists of a series of systems that respond and adapt to continual strains and changes in the body. Most clearly, under stress, the sympathetic nervous system activates, and then is complemented by the parasympathetic system to restore balance. Processes of homeostasis involving the hypothalamic–pituitary–adrenal axis, the autonomic nervous system, and the cardiovascular, metabolic, and immune systems are core to today's understanding of health. But how are they linked to individual differences?

The dominance of psychoanalytic and neo-analytic theory as the field of psychiatry developed in the first half of the twentieth century led to many interesting observations and ideas in so-called psychosomatic medicine, but empirical validation was next to impossible. The psychoanalyst Alexander (1950) suggested that various diseases are caused by specific unconscious emotional conflicts. For example, ulcers and a dependent personality might be caused by oral conflicts—an unconscious desire to have basic infantile needs satisfied. However, neither the unconscious conflicts nor their supposed links to personality traits and disease states could be studied in a rigorous scientific manner.

In reaction to this imprecise and weak investigation, cardiologists proposed the Type A behavior pattern (Chesney & Rosenman, 1985). Type A people are those involved in a constant competitive struggle to do more and more things in less and less time, and are often quite aggressive in their efforts. They are hasty, hurried, impatient, impulsive, hyper-alert, and tense. The cardiologists intentionally eschewed psychological (especially psychodynamic) concepts, and explicitly aimed to objectify their concept by choosing a neutral term ("Type A"), defined as a medical syndrome of coronary proneness. Individuals who did not show Type A characteristics were called "Type B," rather than given some psychological or behavioral description. As research on this topic continued, it became apparent that the disease-relevant characteristics and patterns of individuals cannot be adequately explained in such a barren way. Research soon turned to trying to understand the trait correlates, the emotional components, the developmental bases, and the various consequences of Type A behavior. It became popular to use the term "Type A personality" even though the originators specifically tried to avoid a personality-type approach.

As research began to examine the health correlates of Type A behavior beyond coronary disease, it became apparent that, in a formulation where Type A behavior is defined as practically synonymous with coronary proneness ("the Type A coronary-prone personality"), the concept begs the question of whether this type of personality does indeed predict coronary disease. Inconsistencies across studies in how the construct was defined and measured, the use of simple correlations, and numerous

dead-end research programs only led to more confusion. After thousands of studies, research on Type A behavior nearly collapsed of its own dead weight. The missteps of the neo-analytic psychosomatic approaches and the atheoretical Type A syndrome approaches did, however, point the way to better concepts and better research designs.

Disease-Prone Personalities and Self-Healing Personalities

To address the deficiencies and to develop a more complete perspective, which relies on a full nomological net (Campbell & Fiske, 1959; Cronbach & Meehl, 1955), Friedman and Booth-Kewley (1987) meta-analyzed the correlations between emotional aspects of personality and certain chronic diseases (including heart disease) thought to be especially influenced by psychosomatic factors. A notably similar pattern of associations appeared between personality predictors and various disease outcomes. That is, the results failed to confirm the existence of a "coronary-prone personality," a distinct "ulcer-prone personality," and so on. Rather, it appeared that various negative traits such as hostility, anxiety, depression, and aggressiveness are markers of increased risk for various diseases, although not always to the same extent or for the same reasons (see Smith & Gallo, 2001; Suls & Bunde, 2005). This broader pattern was termed the *disease-prone personality* (Friedman & Booth-Kewley, 1987).

One implication of this emerging conception was that it would be necessary to employ multiple and valid personality predictors in the same study. The second implication was that it would be wise to employ multiple health outcomes in the same study. More than a half-century ago, the World Health Organization (1948) defined health as a multifaceted construct, comprised of physical, mental, social, cognitive, and functional components. Many of the best studies now do indeed employ multiple predictors and multiple health and well-being outcomes (Friedman, 2007; Friedman, Kern, & Reynolds, 2010; Smith & Gallo, 2001), but it is only recently that attention has extended beyond the physical dimension. Rather than simultaneously analyzing multiple health outcomes, too many approaches have relied instead on an uninformative "Type B" default formulation, in which you are seen as healthy if you are not ill.

Another key implication of this broader perspective is that more attention has been paid not only to risks and disease proneness, but also to analysis of the potential health-promoting effects of often salutary traits. Much research is now considering the role of optimism, sociability, hardiness, and conscientiousness. Complementing the disease-prone personality, Friedman (1991) proposed the notion of a *self-healing personality*—a personality with a multidimensional emotional style providing a match or adjustment between the individual and the environment, which maintains a physiological and psychosocial homeostasis, and through which good mental health promotes good physical health. Although the construct is characterized in part by traits such as hardiness (control, commitment, and challenge; Maddi & Kobasa, 1984) and sociability, its core is the fit between the person and the environment that will best maintain biopsychosocial balance. For example, a driven, successful business executive may be quite content with her fast-paced lifestyle and may become ill and depressed

if forced to slow down and take a long vacation. This inclusion of the socio-environmental context adds the "social" component to the biological and psychological elements, thus producing a true biopsychosocial approach.

Measuring Personality

Personality can be conceptualized and measured at different levels, including broad dimensions of positive and negative affect, dispositional traits, and life-story narratives (McAdams & Olson, 2010). Lower levels (narrow traits) are often better predictors of specific outcomes and may highlight processes connecting personality and health. For example, in two community samples, preventative behaviors were best predicted by the industriousness and orderliness facets of conscientiousness, whereas risky behaviors were best predicted by the impulse control and conventionality sub-scales (Sixkiller et al., 2010). Still, higher-order factors better generalize across multiple samples and link more reliably to key health outcomes, including longevity. In health psychology research, the five-factor model has been the focus of much of the recent literature linking personality and health, and it offers a framework for structuring and understanding personality–health relations (Smith & Williams, 1992).

Following a lexical approach, there essentially are two five-factor models, one stemming from work by Costa and McCrae and captured by the NEO–PI–R (Costa & McCrae, 1992), and the other stemming from work by other personality pioneers in the field (Goldberg, 1993). There is dispute over the exact definitions and the lower-order facets and traits comprising each factor, but the five main factors are typically labeled extraversion (social, active, dominant, positive affect), neuroticism (tendency to experience the world as distressful, proneness toward anxiety and depression, emotional instability), intellect/openness to experience (intellectual, imaginative, creative, artistic), agreeableness (cooperative, trusting, kind, generous), and conscientiousness (orderly, achievement motivated, responsible, planful).

Notably, the five-factor model allows multiple personality traits to be considered with multiple health outcomes, can easily be measured by commonly available instruments, and has been linked to health, longevity, occupational success, education, social relationships, marital stability, and productive contributions to society (Ozer & Benet-Martinez, 2006; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). At the same time, inconsistent findings point to the complexity of personality–health relations, simultaneously providing direction to our studies and challenging the field to look beyond overly simple causal models. Personality is behaviorally manifested within the context of situations; it influences and is influenced by the sociocultural context over time.

Measuring Health Outcomes

What does it mean to be healthy? In the traditional biomedical model, health is defined as a lack of disease and disability. The medical care system is mostly designed to treat disease symptoms to restore a state of "health." Yet many individuals live

long, fulfilling, and/or productive lives while managing one or more chronic conditions (Holstein & Minkler, 2003; Minkler & Fadem, 2002). For example, one study classified elderly participants as healthy if they lacked any disease or disability, maintained cognitive function, and were actively engaged in society (Strawbridge, Wallhagen, & Cohen, 2002). Less than 19 percent could be categorized as healthy by this definition, but over half of the participants declared themselves as healthy agers. With a growing percent of the population developing one or more chronic illness conditions, the biomedical model—which works well for acute disease that can be easily diagnosed and treated—fails to adequately address the mental, social, and functional problems that many chronic conditions bring.

In addition, there is the often-confused matter of subjective well-being. From a lay perspective, health means feeling good—yet this involves a considerable degree of subjectivity. For one individual, mild nausea, occasional dizziness, and regular muscle pain indicate severe problems that require medical intervention; for another, such symptoms are considered normal elements of everyday life. Although self-perceived health, typically assessed by a single self-reported item (e.g. "in general how is your health—very poor, poor, fair, good, very good?"), is often a good predictor of mortality risk (Idler & Kasl, 1991), people vary in how the question is interpreted. Some individuals focus solely on physical symptoms, whereas others view health in a more holistic sense, which incorporates maintaining balance across physical, mental, social, cognitive, environmental, and spiritual dimensions (Kern, Horton, Tung, Rajec, & Friedman, 2008). Personality can offer a lens through which physiological, emotional, and behavioral states and changes are perceived and interpreted. For example, extraverted individuals may focus more on social elements when evaluating their health; conscientious individuals may focus more on functional ability; intellectual individuals may focus on cognitive dimensions; and neurotic individuals may focus more on emotional elements.

Depending on the theoretical conception of health, the size of the sample, the resources available, and the goals of the study, different measures of health are used. Physical health can be measured through self-report of symptoms or pain, doctor reports, medical records, physiological signs (such as blood pressure or diagnostic test results), and definable clinical events (e.g. heart attack, stroke). Psychological or "mental" aspects (such as happiness, life satisfaction, lack of depression, subjective well-being) are usually assessed via self-reported questionnaires or interviews. Social aspects (e.g. how well a person interacts with others) are measured through self-report, friend report, observation, or social network size. Functional abilities (daily activities and what a person accomplishes and contributes to society) are often assessed through self-reports of daily activities and goals, reports by others, and records of personal accomplishments and achievements. Cognitive function (e.g. mental strength, alertness, and lack of cognitive dysfunction such as dementia and Alzheimer's) is usually assessed through various cognitive tests.

Note that a significant problem with many studies of personality and health is that they rely on measures that share method and definitional variance—with predictors and outcomes often both being self-reported measures of the individual's feelings, self-perceived symptoms, complaints, and perceptions of health and well-being. It is thus desirable, when possible, to include length of life as a very important outcome.

Longevity is a valid, reliable health outcome that temporally follows other variables. From a public health perspective, the largest economic benefit occurs through optimizing life expectancy (that is, increased length of life) while reducing physical, psychological, and social morbidity that may occur with advanced life (in other words, compressing morbidity into the shortest period before death; Fries, 1990). A valuable, outcome-focused approach thus measures health as a combination of length of life and quality-life years, defined through a combination of chronic conditions, perceived satisfaction, and functional ability (Kaplan, 2003).

Health is often measured as if it were relatively stable, and it is assessed through single time-point assessments; but health clearly can be influenced by fluctuating moods, cognitions, and physical and social conditions. A better alternative is to understand health within the context of an individual's lifelong trajectory (Schultz & Heckhausen, 1996; Smith & Spiro, 2002). In this sense, we can assess how the person functions physically, mentally, cognitively, socially, and productively at different ages and examine different trajectories. Are people following positive, healthy trajectories, or are they set on negative pathways leading toward illness, depression, and/or disability? From this perspective, health entails maintaining homeostasis by adjusting to changes that may occur, often using one area to compensate for loss in another area to maintain a general sense of competence and well-being (Baltes, Lindenberger, & Staudinger, 2006). We can then examine what influences these trajectories, personality being an important moderator across life domains. For example, an extraverted individual who suddenly loses his job or social network may have a low quality of life, even though he initially has few physical problems. Another individual may have experienced physical health problems early on in young adulthood, but learned to deal with the illness or disability, live a productive life, maintain a sense of independence and control, and be content with her accomplishments.

The Importance of Multiple Causal Linkages

A key reason for studying personality and health is to be able to design interventions to promote health and prevent disease. This usually will require a deep understanding of complex causes across time. In health studies, it is tempting to draw unfounded causal conclusions—equating correlations with causation. Even randomized control trials—the "true experiments" of health research—often cannot establish full and generalizable causality, as practical limitations (e.g. ethical considerations, sampling bias, non-adherence, attrition) arise. Personality and health links are therefore often best understood within a lifespan perspective. No single study answers all of our research questions, but when multiple short- and long-term studies, using different populations, measures, and methods, converge on similar answers, we build a valid understanding. Cross-sectional comparisons and short-term studies are helpful in uncovering what personality traits may link to what health outcomes, whereas long-term prospective studies allow us to consider the pathways involved, and often reveal relationships that otherwise are obscured by the methods and limitations of other studies.

In the past two decades, personality has been linked to multiple dimensions of health through multiple pathways. In curing acute disease, medicine aims to find a simple cause to treat, such as a virus, broken bone, or clogged artery, and it is tempting to look for such simple causal links between personality and health. Perhaps the most common model links personality and health through physiological dysregulation. This model postulates that emotional instability and negative affect lead to chronic high levels of stress, which wear down the physiological system, break down internal homeostasis, and eventually lead to illness. This model is evaluated by correlating levels of neuroticism and other negative traits with physiological markers of stress and subjective reports of poor health. Unfortunately, although such a model may be relatively easy to test statistically, multiple assumptions (often hidden) about simple causal pathways are made, leading to premature conclusions, mixed results, and greater confusion. A closer assessment suggests multiple pathways that function individually and synergistically.

Based on the concepts of homeostasis and allostasis, this distress and stress pathway involves a diathesis–stress process, in which personality characteristics influence stress, cause chronically elevated levels of stress and lack of regulation within different physiological systems, and lead to breakdown and disease. A growing body of literature is studying dysregulation at the physiological and neurological levels. For example, high levels of depression and hostility have been linked both to high levels of cortisol (an easily measured hormone that marks stress reactions) and to heart disease (Barefoot et al., 2000; Barefoot & Schroll, 1996; Ford et al., 1998; Januzzi, Stern, DeSanctis, & Pasternak, 2000; Rugulies, 2002; Suls & Bunde, 2005). Chronic stress predicts lowered resistance to infection (Cohen, Doyle, Turner, Alper, & Skoner, 2003). Levels and chronicity of stress can also moderate immunological parameters (Segerstrom & Miller, 2004). Still, although stress and dysregulation are linked to illness and mortality, studies have yet to test the entire process. Personality may both predict and moderate levels of stress, appraisals of circumstances, and coping responses. The field will benefit from examining biological, immunological, and neurological mechanisms within a causal model that links psychosocial influences on development to health outcomes (Friedman, 2008; Miller, Chen, & Cole, 2009).

A second prominent model links personality and health through behaviors—protective behaviors, such as eating a healthy diet, engaging in moderate exercise, getting sufficient sleep, flossing, wearing sunscreen, and sanitary practices, or risky behaviors, such as smoking, alcohol and drug abuse, promiscuous sex, and dangerous driving. In this model, personality characteristics influence the behaviors that people engage in, which subsequently lead to health or illness. Behaviors clearly affect risk for disease and many chronic conditions, accidents and injury, and early mortality. Smoking and tobacco use present the highest risk; their associated morbidity and mortality risk is higher than the effect of all other common health behaviors combined (Kassel, Stroud, & Paronis, 2003; Mokdad, Marks, Stroup, & Gerberding, 2004). To a lesser extent, other behaviors influence health outcomes. Personality may both predict and moderate health behaviors and subsequent health outcomes.

A third model links personality and health through a social pathway. In this model, personality influences the availability of social support, whom a person associates with,

the activities that people engage in, the reactions evoked in others, the quality of relationships, and the amount of conflict within relationships. A large body of literature confirms the importance of social support for health and well-being (cf. Taylor, 2007), although the types of support and the mechanisms involved remain unclear. Social relationships may fulfill a basic human need to relate to others (Ryan & Deci, 2000). Conversely, although relationships can add a positive element to life, they can also cause stress, conflict, and related poor health outcomes. For example, divorce and marital conflict increase risk of morbidity and mortality (Hughes & Waite, 2009; Tucker, Friedman, Wingard, & Schwartz, 1996). Social relationships also feed into the other pathways. In the physiological pathway, social support may buffer stressful experiences, change appraisals of life experiences, and help the person successfully cope with stressors to maintain a sense of balance and well-being. In the behavioral pathway, others influence the behaviors that people engage in, positively or negatively. Adherence to medical regimes is higher when supported by others, and good health habits promoted by some individuals can influence others within the group toward a healthy lifestyle. By contrast, the adage "bad company corrupts good character" remains: individuals (especially adolescents, who are particularly prone to peer influences) can be drawn into risky situations and influenced toward unhealthy behaviors. Personality affects the degree to which people influence and are influenced by others; it affects the quality and quantity of social relationships and it may moderate responses within different relationships.

A fourth model links personality and health through biological third variables, including genetics, early social environments, and neurological differences. To a certain extent, early experiences based both on genetic proclivities and on the early social environment predispose individuals to various conditions and provide biological set points across physical and mental domains. For example, the body has a general set point for body weight, and the body attempts to maintain that weight. As weight increases, hunger decreases and metabolism speeds up; as weight significantly declines, hunger increases and metabolism slows down. Similarly, research from positive psychology suggests a set point for happiness that is about 50 percent genetically driven (Lyubomirsky, Sheldon, & Schkade, 2005). Such set points can change over time, but it takes persistence and gradual change. Genetic and early environmental aspects may predispose individuals toward certain personality-type dispositions and toward various physiological reactions and related disease. People may have a tendency to respond in a certain way or to develop various conditions, but symptoms do not appear until stress triggers the condition. Two individuals under intense chronic stress may both become ill, but one develops heart disease and the other develops cancer, depending on which disease they are prone toward. Similarly, risky family characteristics can disrupt psychosocial functioning and biological regulation, increasing the risk of mental health problems, chronic disease, and early mortality (Repetti, Taylor, & Seeman, 2002). In such third-variable models, it may appear that personality influences disease, but an underlying biological factor influences both the individual characteristics and the health outcomes.

A fifth, but closely related model links personality and health through the situations that people select or are drawn toward and the resulting trajectories that lead toward health and resilience or toward decline and morbidity (Friedman, 2000). This

in turn feeds into the other pathways, by influencing the likelihood of stressful or non-stressful experiences, appraisal of stressors, coping strategies, behaviors that people engage in, and the social relationships that are developed (Carver & Connor-Smith, 2010; Vollrath, 2001). Studies in developmental psychology suggest that, although natural disasters and some major events cannot be controlled, most stressful life events do not occur randomly (Caspi & Roberts, 1999; Caspi, Roberts, & Shiner, 2005). Much of this is probably driven by genetics, early experiences, and the habitual response patterns that are developed fairly early in life.

A final model linking personality and health reverses the causal arrow. Certain medical conditions, mental illnesses, and various drugs and medications can cause radical personality changes. For example, in a four-year study that tracked individuals with hemiparkisonism, neural network changes were evident two years before motor signs appeared (Tang, Poston, Dhawan, & Eidelberg, 2010). Such neural changes may manifest as personality changes—an otherwise social, agreeable, conscientious individual may become hostile and impulsive—long before medical tests show the underlying cognitive decline. Similarly, many drugs, both legal and illegal, cause major changes in personality. Antidepressants, which mute emotional responses and impair cognitive functioning, are being prescribed at an alarming rate (Paulose-Ram, Safran, Jonas, Gu, & Orwig, 2007). Under the influence of alcohol, even conscientious individuals can become impulsive and irresponsible.

Each of these approaches offers a piece of the puzzle linking personality and health. These approaches are interrelated, and narrowly attributing relations to a specific part of the model only limits our understanding. Most likely, each of these plays a role some of the time for some people.

The Five-Factor Model and Health Outcomes

We now turn to a focus on multiple health outcomes and the personality traits of conscientiousness, extraversion, agreeableness, and neuroticism. We include sections on optimism and hostility. The fifth factor in the five-factor approaches to personality—intelligence or openness to experience—is also relevant to health and longevity, but is beyond the scope of this chapter (see Batty, Deary, & Gottfredson, 2007; Batty et al., 2009; Deary, Batty, Pattie, & Gale, 2008 for work in this area). We employ the conceptual framework sketched above to review key findings, and we include illustrations from our own empirical research.

Over the past 20 years, we have worked with the Terman Life Cycle Study, a longitudinal project begun in 1922 by Lewis M. Terman and his colleagues at Stanford University, focusing on gifted children (IQ 135 and above). Over 1,500 children were first assessed and rated across a broad array of personality, psychosocial, and physical variables. They were then followed throughout their lives, completing written assessments every 5 to 10 years. We have gathered death information for about 90 percent of the sample, and have worked to refine and validate items and scales to assess various psychosocial variables, including child and adult personality, health behaviors, social relationships, stressful life events, health and well-being in youth, adulthood, old age, and longevity.

Conscientiousness

A growing body of important literature not only illustrates how relevant conscientiousness is for health and longevity outcomes, but also underscores the limits of simple causal models of personality and health. In an initial study with the Terman sample, we examined childhood personality, rated by parents and teachers, and mortality risk across the lifespan (Friedman et al., 1993). Children who were rated high on conscientiousness were at a lower risk of dying at any given age across seven decades. This finding triggered multiple studies by others, with different samples and various measures of conscientiousness. For example, 174 patients with chronic renal insufficiency were assessed using the NEO–FFI; high conscientiousness predicted lower mortality risk over a four-year period (Christensen et al., 2002). Conscientiousness likewise predicted lower mortality risk in a sample of older clergy members followed for eight years (Wilson, Mendes de Leon, Bienias, Evans, & Bennett, 2004). In a sample of frail older individuals in the Medicare Demonstration Study, conscientiousness was protective over a 4- to 5-year period, with low impulsiveness and high self-discipline driving this relation (Weiss & Costa, 2005). Meta-analytically combining the results of 20 studies, we found that all studies reported a positive relation, and the overall effect was significant (Kern & Friedman, 2008). Subsequent studies have continued to find a health-protective effect of conscientiousness (Chapman, Fiscella, Kawachi, & Duberstein, 2010; Deary et al., 2008; Fry & Debats, 2009). Altogether, conscientiousness predicts up to a 2- to 4-year benefit in length of life.

Examining multiple health components is informative for understanding the potential pathways linking conscientiousness and health. In the Terman sample, we used adult personality, self-reported in early adulthood (average age 30), to predict multiple components of older age health 45 years later, when participants were in their 70s (Friedman et al., 2010). High conscientiousness predicted better physical health (including self-rated health and reports of disease), good social relationships, and productivity (active engagement in society), but was less relevant to subjective well-being. These findings point to several potential pathways: physiological resilience (suggesting a biological pathway), social resilience (suggesting a social pathway), and functional resilience (suggesting behavioral and situational pathways). Importantly, a growing body of research supports each of these pathways.

The most straightforward pathway is the behavioral one. Conscientious individuals are more likely to engage in protective behaviors and less likely to engage in risky behaviors (Bogg & Roberts, 2004). They are more adherent to treatment recommendations and structure their environments to be protective. However, although such healthy lifestyles are important, behavior alone is insufficient in explaining the health-protective effect. In the Terman study, the conscientiousness–longevity link was only partially mediated by health behaviors such as those related to smoking and alcohol use (Friedman et al., 1995). In the Hawaii Health and Personality Cohort Study, physical activity, education, healthy eating, not smoking, and moderate alcohol intake partially mediated a positive relationship between high conscientiousness (rated by teachers when the participants were children) and self-rated health (self-reported 40 years later; Hampson, Goldberg, Vogt, & Dubanoski, 2006, 2007).

In terms of an underlying third variable, genetic predispositions or early environments may lead both to a conscientious personality and to better health. Clear links with physical health and longevity (as compared to self-reports of well-being), including fewer reports of disease, are consistent with a biological pathway. For example, in a study of genetic polymorphic alleles, a variant in the gene sequence was related both to abnormal hypothalamic responses and to low conscientiousness (Wand et al., 2002). Higher levels of serotonin, a hormone important to regulation of sleeping and eating, have been linked with higher levels of conscientiousness (Carver & Miller, 2006, Evans & Rothbart, 2007; Kusumi et al., 2002; Manuck et al., 1998).

Conscientious individuals may experience fewer stressful events and may cope better with stress that does occur. In the males of the Terman study, conscientiousness attenuated the negative effects of an unsuccessful career (Kern, Friedman, Martin, Reynolds, & Luong, 2009). In a meta-analysis of 165 different samples, conscientious individuals appeared to be more likely to engage in problem-focused coping and cognitive restructuring, and less likely to cope by expressing negative emotion, using substances, and denying the problem (Connor-Smith & Flachsbart, 2007). Conscientious individuals may perceive daily life as less threatening; for example, conscientious students perceived fewer daily hassles and less academic pressure over a 3-year period (Vollrath, 2000). Conscientious individuals are also drawn toward circumstances that promote health, such as stable jobs and marriages. They are more likely to choose stable marriage partners and to maintain successful careers, which in turn can increase levels of conscientiousness and promote health. Thus, through both experiences and appraisals, conscientious individuals may better self-regulate and maintain homeostasis.

People high on conscientiousness are more likely to report active engagement in society. Self-determination theory suggests that people are driven by the needs of competence, relatedness, and autonomy (Ryan & Deci, 2000). Continued social engagement can help achieve these needs—active engagement maintains feelings of competence and provides a sense of meaning, social connections are developed and maintained, and the ability to complete daily tasks and contribute to society breeds a sense of control and independence. By fulfilling these needs in the right circumstances, physical and mental well-being improves.

All of these pathways are health-relevant and complementary, and together suggest that conscientiousness has far-reaching consequences. Is it possible to increase levels of conscientiousness, and, if so, would it always be beneficial? Although personality is considered a relatively stable part of the individual, it can and does change (Roberts & Del Vecchio, 2000). In a meta-analysis of 101 studies, conscientiousness showed little change from adolescence into college, but then it increased from age 20 to age 50 and from 60 to 70 (Roberts, Walton, & Viechtbauer, 2006), although there was much individual variation. Changes may also vary across lower-order facets; in two cross-sectional samples, industriousness increased early on, impulse control and reliability increased across the life course, and orderliness remained fairly stable (Jackson et al., 2009). In the Mills Longitudinal Study of Women, marital stability, increased work responsibility, and less substance use increased social responsibility over a 30-year period (Roberts & Bogg, 2004).

Potentially, by promoting psychological maturity, by discouraging unhealthy behavior patterns, and by structuring stable environments so as to develop a personal sense of responsibility, society can help individuals become more conscientious, with resulting health benefits. However, such a model has not been tested. To be successful, such an intervention must consider the multiple pathways through which conscientiousness and health may be linked. Interventions must carefully consider: (1) whether change is indeed possible; (2) which techniques work; (3) who would benefit from change; (4) what contextual factors are needed to support positive growth; (5) when it is appropriate to intervene; and perhaps most importantly, continually evaluate (6) whether changing levels of conscientiousness will translate into practical health benefits. Still, research findings from the past two decades evince hope that improvements in the psychological maturity and mental health of a population can have dramatic impacts on the physical health and longevity of that population.

Extraversion

Extraversion has been inconsistently linked to physical health (Cloninger, 2005; Roberts et al., 2007; Wilson et al., 2004; Wilson et al., 2005), and recent evidence suggests that relations between extraversion and life satisfaction are weaker than was previously assumed (Luhmann & Eid, 2009; Rammstedt, 2007). Extraversion has strong biological and interpersonal components, and links with health may depend on the facet of extraversion, the type of health outcome, and the context in which characteristics are manifested. The main facets of extraversion are dominance, sociability, activity, and positive emotions (Davies, Connelly, & Ones, 2010), and preliminary evidence suggests that these domains relate to health differentially.

The dominance facet of extraversion is predictive of positive job outcomes, but links to other aspects of health may depend on an individual's biologically influenced tendencies toward dominance (such as those dictated by testosterone, estrogen, and other hormones), the particular social environment in which the trait is expressed, combinations with other traits such as neuroticism and agreeableness, and ongoing appraisals and reactions to stress. Males tend to be more dominant than females, and dominance and aggressive tendencies predict heart disease in males, but not in females (Ferraro & Nuriddin, 2006; Rasul, Stansfeld, Hart, & Smith, 2005). But whether or not dominance and health are related may depend on the context. In stable environments, dominance may be adaptive, whereas in unstable environments, where dominance cannot be established, risk may accrue. In a series of studies with cynomolgus monkeys, dominant male monkeys within unstable social groups were much more likely to develop atherosclerosis than subordinate monkeys in unstable social groups and than dominant and subordinate monkeys in stable groups (Manuck, Kaplan, Adams, & Clarkson, 1988).

At times, dominant individuals may use less adaptive coping mechanisms and may create more stressful social relationships, which lead to chronically elevated levels of stress, increased wear on the physiological system, and increased susceptibility to illness. For example, in a study of over 300 older adult couples, spouse ratings of higher levels of dominance predicted coronary artery calcification, a marker of coronary artery disease (Smith et al., 2008). When combined with agreeableness and

positive affect, dominance can be an important component of effective leadership (Judge, Bono, Ilies, & Gerhardt, 2002); but, when combined with hostility, dominance may increase risk of heart disease and chronic illness, unstable social relationships, and poor mental health. This is another example of how personality—in this case dominance—is tied to the social context in which it is manifested.

The social aspects of extraversion are especially apparent in the sociability facet. High sociability generally is linked to good subjective and social health outcomes, but presents a mixed picture for objective physical health outcomes. In the Terman sample, extraversion predicted more social ties and high social competence 45 years later (Friedman et al., 2010), but it predicted physical health in women only. Extraverted individuals are more likely to use engagement coping strategies, including problem-solving (Connor-Smith & Flachsbart, 2007). In fact, sociability is characterized by an approach temperament, in which individuals pursue positive engagement with circumstances and people (Carver & Connor-Smith, 2010). In a study of personality and behaviors, extraverted individuals were more likely to expect positive outcomes from social interactions than introverted individuals were (Hensler & Wood, 2010). In a study of older adults, extraverted individuals were less likely to withdraw from social relationships, building more satisfying relationships and social support (Cukrowicz, Franzese, Thorp, Cheavens, & Lynch, 2008). In turn, social individuals may face fewer stressful experiences, appraise situations as less threatening, and have the ability to build and use resources to ameliorate stressful experiences (Fredrickson, 2001).

But here again, sociability can be a double-edged sword. Sociable individuals may be drawn toward positive environments with positive social relationships and healthy lifestyles, or they may be especially drawn toward social situations where alcohol or promiscuous sexual behavior is the norm, with subsequent negative outcomes. For example, extraverted college students are much more likely to smoke, consume alcohol and binge drink, get insufficient sleep, and have multiple sexual partners, increasing the risk of morbidity and mortality (Ploubidis & Grundy, 2009; Raynor & Levine, 2009).

The activity facet of extraversion is potentially beneficial across multiple dimensions of health outcomes. Extraversion has been linked to higher levels of physical activity (Kern, Reynolds, & Friedman, 2010; Rhodes & Smith, 2006), and it may be the activity facet of extraversion that drives this relation (Rhodes, Courneya, & Jones, 2002). Kaplan (1994) suggested that healthy aging can be defined as being alive and "doin' stuff" (p. 451)—that is, active engagement in life. In the Georgian Centenarian Study, extraverts lived a more engaged lifestyle, which in turn related to high mental status (Martin, Baenziger, MacDonald, Siegler, & Poon, 2009). Extraverts may have a biologically based drive for activity; when that need is filled, boosts in both positive affect and fitness levels occur. Extraverted individuals both objectively and subjectively engage in a greater quantity and quality of enjoyable activities, and experience greater positive arousal and energy from being physically active (Bolger & Zuckerman, 1995; Magnus, Diener, Fujita, & Payot, 1993; Miller & Krizan, 2010; Mroczek & Almeida, 2004; Roberts, Caspi, & Moffitt, 2003; Taylor, Repetti, & Seeman, 1997). In addition, physical activity can be an effective method for coping with stress, helping to restore balance to the physiological system.

The fourth facet of extraversion, positive affect, again presents a mixed picture. A growing literature suggests the importance for physical health of positive affect, life satisfaction, and happiness, although the degree to which positive affect influences physical health rather than subjective reports about health remains unclear (Pressman & Cohen, 2005; Salovey, Rothman, Detweiler, & Steward, 2000). A meta-analysis of over 300 studies found a small, positive correlation of trait levels of positive affect with subjective well-being, perceptions of health, symptom control, and survival in chronic disease conditions (Howell, Kern, & Lyubomirsky, 2007), but the causal links remain unspecified.

As with the other extraversion facets, there are multiple ways in which positive affect can be tied to health and disease. Biological differences may influence both the levels of positive affect and related health outcomes. Behaviorally, people are more likely to exercise and follow healthy habits when they are in a positive mood (Biddle, 2000). In terms of the stress pathway, positive affect may directly buffer the physiological system from stress by producing a muted response to stressors or by causing a faster return to baseline levels when stress occurs, thus preventing the accumulation of stress on the system (Pressman & Cohen, 2005); but this is not yet well established (Friedman, 2008). Positive affect relates to better social relationships (Lyubomirsky, King, & Diener, 2005) and may also affect perceptions of stressors, such that various experiences are viewed as challenging rather than threatening. Most likely, positive affect complements other traits. For example, in a population-based study in Nova Scotia, positive affect predicted lower incidence of heart disease across a 10-year period (Davidson, Mostofsky, & Whang, 2010), but positive affect was rated by nurses during an interview, making it unclear whether it was positive affect, social skills, or the many other unmeasured elements the interview, the person, and the situation that affected health outcomes.

Altogether, extraversion presents a mixed picture, which depends on the lifestyle that arises from social groups, appraisals of stress, and associated health behaviors. Most notably, positive emotionality will offer little physical benefit if it translates into dangerous activities or risky health behaviors.

Dispositional optimism

A related positive trait is dispositional optimism. Optimism includes elements of neuroticism and extraversion, and encompasses three beliefs: positive outcome expectancies (the general tendency to have positive expectations for the future), positive efficacy expectancies (belief in the ability to cope across various circumstances), and positive unrealistic thinking (a bias toward believing good things are more likely and negative things are less likely to happen to you than to others; Carver & Connor-Smith, 2010; Fournier, de Ridder, & Bensing, 2002; Marshall, Wortman, Kusulas, Hervig, Vickers, 1992). Optimism relates to positive outcomes, including psychological well-being and self-rated physical health (Segerstrom, 2007). In many cases, optimism predicts faster recovery from surgery, less illness, and lower mortality risk (e.g. Fry & Debats, 2009). However, evidence is mixed for other objective outcomes, including immunological parameters and disease outcomes (Segerstrom, 2005). And there is no solid evidence that staying positive can shrink tumors or open clogged arteries.

Optimistic individuals tend to be persistent in pursuing goals and display greater ability to continue despite setbacks or difficulties (Scheier & Carver, 1985). In a study of cardiac rehab patients, optimists engaged in fewer maladaptive behaviors to cope, which resulted in better post-treatment physical functioning (Shen, McCreary, & Myers, 2004). However, optimists may not see themselves as at risk, thus creating a barrier to healthy behavior. Many individuals across age, gender, educational level, and occupation have an optimistic bias that they are less susceptible than the average person to diseases and negative outcomes (Weinstein, 1987). In turn, people feel immune to risk and will engage in unhealthy behavior until it is too late. For example, in the Terman sample, children who were rated as optimistic and cheerful were at an increased risk of dying at any given age, which could be partly explained by engagement in risky behaviors in adulthood (Friedman et al., 1993; Martin et al., 2002). Optimistic individuals may perceive that they are more adherent and maintaining healthier behaviors than they actually are. For example, in a weight loss study, dispositional optimism related to confidence in ability to lose weight but did not translate into actual weight loss (Benyamini & Raz, 2007).

Evidence for the psychophysiology and social pathways has yet to be established. Optimists are more likely to use engagement coping strategies and less likely to use disengagement strategies (Carver & Connor-Smith, 2010; Solberg Nes & Segerstrom, 2006). Optimism relates to positive social relationships, which can build resources that buffer stressful experiences (Segerstrom, 2007). It remains unclear whether and when optimism acts as a true buffer from stress, changes perceptions such that stress is appraised as less threatening, makes a helpful combination of the two, or does neither.

Optimism is more cognitively based than the other traits, reflecting a dispositional manner of thinking about life experiences. Depending on the circumstances, a pessimistic style may at times be beneficial. For example, law students with a pessimistic explanatory style outperformed students with an optimistic style (O'Grady, 2006; Satterfield, Monahan, & Seligman, 1997). When faced with a health threat, if information is presented in terms of risk, an optimist may become defensive and build an unrealistic perception of low risk, whereas, if the information is presented as an opportunity for positive growth, an optimist may appropriately regulate his or her behavior and be successful in protecting his or her health (Schwarzer, 1999). In addition, combinations with other traits may be relevant. Optimism may be especially protective when combined with high conscientiousness, as a person is driven toward achievement and has a high degree of self-efficacy for achieving those goals, whereas optimism may be detrimental when combined with impulsivity, as unrealistic biases become particularly powerful. Future research should consider how optimism fits with the main five factors to impact various health outcomes.

Hostility and agreeableness

Much of the history of research on personality and health has been characterized by a focus on negative traits, especially depression and hostility. Although research on Type A behavior was often conceptually flawed, numerous studies have found that hostility, aggression, and anger predict heart disease, illness, and mortality risk (Booth-Kewley & Friedman, 1987; Matthews, 1988; Miller, Smith, Turner, Guijarro,

& Hallet, 1996; Ramsay, McDermott, & Bray, 2001; Suls & Bunde, 2005). Most explanations assume a physiological stress model, in which hostility chronically stresses the system and leads to disease (Smith & Ruiz, 2002; Vitaliano, Scanlan, Zhang, Savage, & Hirsch, 2002). However, health behaviors, biological third variables, and poor social relationships almost certainly play a role as well. In a meta-analysis of 27 studies, high hostility was associated with higher BMI, more alcohol consumption, smoking, and markers of heart disease, suggesting behavioral pathways (Bunde & Suls, 2006). Hostile individuals are also prone to poor social relationships. Rather than building a supportive social network, hostile individuals drive the others away, which leaves them with few resources in times of need.

Hostility has elements of both neuroticism (in the sense of being tense and discontented—considered in the section below) and agreeableness. Highly agreeable individuals are characterized by positive interpersonal traits—they are cooperative and trusting rather than cold and quarrelsome. Theoretically, they should have better social relationships and better health outcomes (Carver & Connor-Smith, 2010). Meta-analysis confirms that agreeableness does predict greater use of social support and more cognitive restructuring to cope with stress (Connor-Smith & Flachsbart, 2007). However, links with health outcomes are mixed, predicting subjective outcomes but inconsistently predicting objective physical health outcomes (Cloninger, 2005; Korotkov & Hannah, 2004; Roberts et al., 2007; Wilson et al., 2004, 2005). In the Terman sample, high agreeableness most strongly predicted social competence and subjective well-being, with mixed findings for physical health and longevity (Friedman et al., 2010). In a study of 100 elderly individuals, higher levels of trust related to functional health and longer life (Barefoot et al., 1998). In the MIDUS study, a nationally representative sample from the US, agreeableness predicted better self-perceived health and, in some cases, lower mortality risk (Goodwin & Endstrom, 2002; Weiss & Costa, 2005), but other studies have found no relation with mortality (Iwasa et al., 2008; Martin & Friedman, 2000; Wilson et al., 2004).

Although links between agreeableness and health may primarily occur through a social pathway, other pathways linking agreeableness and health are also relevant. Across cultures, women are more agreeable than men, a situation suggesting evolutionary biological underpinnings (Chapman, Duberstein, Sörensen, & Lyness, 2007; Costa, Terraciano, & McCrae, 2001; Jerram & Coleman, 1999), which in turn may influence health outcomes. Low agreeableness may be especially detrimental for women. For example, for many women in business, agreeable tendencies must be suppressed in order to gain the respect of male subordinates. This can create feelings of role conflict (known to be a significant workplace stressor), as women try to balance the desire to be friendly with a need to establish order and power.

Agreeableness may work in combination with other traits. In the MIDUS study, high agreeableness was protective for individuals high on conscientiousness, but it increased risk for individuals low on conscientiousness (Chapman et al., 2009). Individuals with a combination of self-disciplined behavior and friendly countenance may build good relationships and gain health benefits, by comparison with individuals who are driven but drive others away through hostility and selfish pursuit (i.e. have high conscientiousness, low agreeableness). Very agreeable individuals who lack self-discipline (i.e. have high agreeableness, low conscientiousness) may yield their own

desires to others, and in the process of maintaining harmony build internal stress, which results in poor health outcomes.

Altogether, very low levels of agreeableness are risky, whereas high levels depend on the social context and other traits. A moderate degree of agreeableness may turn out to be optimal for good health, as a balance is developed between amiable relationships with others and self-interests. This remains an open question.

Neuroticism

Neuroticism and negative emotionality are often seen as damaging traits that lead to ill-being, but the true picture is more complex. The strongest health links are evident between neuroticism and lower subjective well-being (DeNeve & Cooper, 1998). Neuroticism predicts increased susceptibility to pain, which may influence reports and experiences of poor health (Charles, Gatz, Kato, & Pedersen, 2008). Several reviews and meta-analyses indicate that negative emotionality, depression, and anxiety predict higher incidence of illness and coronary heart disease (Booth-Kewley & Friedman, 1987; Grippo & Johnson, 2002; Matthews, 1988; Miller et al., 1996; Rugulies, 2002; Smith & Gallo, 2001; Suls & Bunde, 2005; Wulsin & Singal, 2003). Across 19 studies, a meta-analysis found an increased mortality risk for emotional instability (Roberts et al., 2007). However, the evidence is mixed, as some studies report no relation or the reversed relation—neuroticism being health protective (e.g. Almada et al., 1991; Iwasa et al., 2008; Korten et al., 1999; Taga, Friedman, & Martin, 2009; Weiss & Costa, 2005). Neurotic tendencies, in light of social experiences and stresses, may have mixed effects.

Friedman (2000) suggested that there are two manifestations of individual neuroticism: one is a proneness toward pessimism, anxiety, depression, and resentment; the other is a "healthy neuroticism" that pays attention to all symptoms and so leads to a vigilance about taking care of one's health. The first can produce a negative trajectory toward depression, illness, and early mortality. The second may lead to reports of lower well-being, more psychosomatic symptoms, and more doctor's visits, but objectively lead to fewer diseases and longer life. In the Terman sample, higher levels of neuroticism predicted lower subjective well-being in older age for both men and women (Friedman et al., 2010). For women, neuroticism also predicted lower physical health and increased mortality risk. But, for men, neuroticism was less predictive of poor physical health, and it predicted *lower* mortality risk.

The effects of neuroticism may depend on other traits. For the Terman men, high neuroticism was protective when combined with high conscientiousness, whereas neuroticism conferred great risk at low levels of conscientiousness (Kern, Martin, & Friedman, 2010). That is, neurotic, conscientious men reported lower well-being, but were objectively healthier. In the MIDUS study, the mortality risk associated with high neuroticism depended on the combination of high or low agreeableness, conscientiousness, and socioeconomic status (Chapman et al., 2009). In the Vietnam Experience Study cohort, high neuroticism showed risk at low levels of cognitive ability, but not at high cognitive levels (Weiss, Gale, Batty, & Deary, 2009).

Neuroticism is partially biologically driven (Barker, Osmond, Forsén, Kajantie, & Eriksson, 2005; Bondy, 2007; McCaffery et al., 2006). For example, in a

population-based sample in Italy, high levels of neuroticism related to interleukin-6, an inflammatory response marker that is often elevated in frail or morbid conditions (Sutin, Terracciano, Deiana, Naitza et al., 2010). A study of 289 male twins suggested that major depressive disorder and microvascular dysfunction (an indicator of early atherosclerosis) share a genetic pathway (Vaccarino et al., 2009). Women on average are more neurotic than men, and underlying physiological differences may also impact health risks. For example, in a community-based Italian sample, depression related to lower levels of high-density cholesterol (HDL—good cholesterol) for women, but not for men (Sutin, Terracciano, Deiana, Uda et al., 2010). In a nationally representative sample in Great Britain, neuroticism both directly and indirectly increased mortality risk for women, whereas for men risk was indirect, depending on levels of psychological distress and on smoking (Ploubidis & Grundy, 2009).

It is important to note, however, that such relations do not necessarily translate into disease. Cross-sectional relations can identify individuals potentially at risk for disease, but longitudinal studies tracing the same people over time are necessary to see if disease actually develops. Although there is evidence that inflammatory markers increase the risk of heart disease (Rodondi et al., 2010), other core factors, such as social relationships and health behaviors, are also relevant. In the Italian sample (Sutin, Terracciano, Deiana, Naitza et al., 2010), individuals with higher levels of IL-6 were also more likely to smoke and be overweight. In a Canadian study of over 700 community members, emotionally stable individuals were more likely to engage in healthy behavioral practices under stressful conditions, whereas neurotic individuals were less likely to engage in healthy behaviors (Korotkov, 2008). Many relationships between neuroticism and morbidity or mortality are significantly reduced or mediated when smoking, alcohol use, and other risky health behaviors are controlled. Other relations are biologically based and will not be fully altered by attempts to stop worrying or to reduce anxiety.

Neuroticism and health links influence and are influenced by the perception and occurrence of stressful experiences. Anxious individuals may interpret normal everyday circumstances as more negative and stressful, and report more daily hassles (cf. Vollrath, 2001). Neurotic individuals are more reactive to negative events and stressful experiences, and in turn tend to experience higher levels of negative affect and more cognitive difficulties when stress occurs (Bolger & Schilling, 1991; Gunthert, Cohen, & Armeli, 1999; Neupert, Mroczek, & Spiro, 2008). For example, in a large representative sample in Germany, neurotic individuals who experienced unemployment or repeated divorce reported stronger negative reactions than less neurotic individuals (Luhmann & Eid, 2009). Further, such individuals are less likely to use adaptive mechanisms for coping with stressors, such as problem-solving and cognitive restructuring, and are more likely to use less adaptive coping responses such as expressing negative emotion, withdrawing from others, using wishful thinking, and substance use (Connor-Smith & Flaschbart, 2007). High levels of chronic stress and maladaptive coping responses may further stress the physiological system, making the individual more susceptible to disease.

Further, psychophysiological effects most likely are bidirectional. Depression and anger increase the risk of disease and illness (Friedman & Booth-Kewley, 1987), but

inflammatory responses, disease development, and neurological changes can cause depression, anxiety, anger, and other negative emotions (Kemeny, 2007; Räikkönen, Matthews, & Kuller, 2002). Thus, both psychologically and physiologically, a negative spiral may occur in which the person becomes more depressed and anxious, which in turn affects levels of neurotransmitters, stress reactions, and an accumulation of health risks, and these in turn make the person more depressed and anxious.

The trajectory of negative emotion is also important to consider. In the Normative Aging Study, mortality risk was highest for men who were high on neuroticism and became more neurotic, which suggests that both level *and* change are important (Mroczek & Spiro, 2007). In a 20-year longitudinal study, individuals who experienced a traumatic life event increased in neuroticism, especially on the anger and frustration facets, over the subsequent 5- to 10-year period (Lockenhoff, Terracciana, Patriciu, Eaton, & Costa, 2009). High neuroticism at baseline did not predict mental health 20 years later, whereas increasing levels of neuroticism did predict poor mental health, again suggesting that changes in neuroticism may be more consequential than levels alone. In another study with the Normative Aging Study, trajectory analyses suggest that anxiety and hostility may predispose individuals to maladjustment at some point in the lifespan, but the timing may depend on other psychosocial factors (Aldwin, Spiro, Levenson, & Cupertino, 2001).

In sum, although neuroticism is often considered an unhealthy trait, much depends on the social context and other characteristics. Optimism is not always protective, and negative emotionality is not always harmful.

Conclusion

Individual differences in health, well-being, and longevity are commonly observed and are of obvious importance. Although variations in health are sometimes due to chance infections, accidental trauma, or random genetic changes, most individual differences in health and longevity are due to predictable but complex combinations of biological, psychological, and socio-environmental factors, which cumulatively develop as consistent patterns across time. Because modern scientific conceptions view personality as likewise having biological, psychological, and social aspects, the biopsychosocial approach to personality can be an excellent means of analyzing biopsychosocial influences on health.

Overall, we have repeatedly found that conscientiousness plays an important role in all aspects of health, both individually and interactively with other traits. For example, the combination of low conscientiousness and high neuroticism can be especially hazardous. Although high levels of agreeableness are often associated with self-reports of well-being, this relationship often fails to appear in more objective health outcomes, which suggests that third variables, especially aspects of the social context, may be influencing both agreeableness and health. A double-edged story may be true with extraversion, such that extraversion may positively or negatively influence health, depending on the life circumstances. Finally, neuroticism and optimism are probably the most misunderstood and misinterpreted aspects of personality with respect to their relation to health.

One important implication of this biopsychosocial perspective is that simultaneous consideration should be given to multiple aspects of personality *and* to multiple health outcomes. Traits of conscientiousness, extraversion, optimism, hostility, agreeableness, and neuroticism can all be relevant to physical health, subjective well-being, social accomplishment, and longevity. The second important implication of this perspective is that personality interacts with psychosocial contexts across time to affect health, and so the best conceptions and the optimal research designs and analyses will include trajectories of individuals within their social contexts. An individual may have a tendency toward emotional instability, but enter a supportive marriage, practice healthy behaviors, and develop good social skills. That individual may learn to filter her anxiety into productive areas, effectively manage stress, and experience positive health outcomes. Another individual may avoid social interactions, self-medicate with alcohol and tobacco, struggle with social relationships and employment stress, and slip into a pattern of ill-health. Biological predispositions, early experiences, and subsequent stressful and social experiences impact these trajectories. If one ignores the broader social context in which the trait unfolds, the simple paradigm of good and bad is insufficient for describing personality and health relationships. A deeper conception of the relevant issues and more appropriate models of health across the lifespan will facilitate the systematic accumulation of research findings into an understanding that more validity captures the causal relations and makes it possible to design the best interventions in order to improve health.

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