PART I

Foundations

1

Theoretical Perspectives

A Biopsychosocial Approach to Positive Aging

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A Historical Introduction

The topic of successful human aging has engaged many great minds, including the Roman orator Cicero (43 BCE/1923), who observed, "It is not by muscle, speed, or physical dexterity that great things are achieved but by reflection, force of character, and judgment; in these qualities, old age is usually not only not poorer, but is even richer" (Chandler, 1948). Similarly, Plato associated old age with calm and freedom (Griffin, 1949). Nearly two millennia would pass before positive aging would emerge as a topic of scientific inquiry. Such work began in the 1940s with a group of scholars at the University of Chicago who were interested in personal and social adjustment in old age (Burgess, 1960; Cavan, Burgess, Havighurst, & Goldhamer, 1949; Pollak, 1948). The Kansas City Studies of Adult Life (Williams & Wirths, 1965) continued the Chicago tradition and offered a conception of successful aging based on four dimensions: the amount of activity in which the individual was engaged, the ability to disengage, satisfaction with life, and maturity or integration of personality. Two additional components were later added: a balanced exchange of energy between the individuals and the social system, and a stable social system. Few of these ideas were accompanied by tools for empirical assessment.

In the decades that followed, life satisfaction became the most frequently investigated dimension of successful aging (for reviews see Cutler, 1979; Larson, 1978). The construct included components of zest versus apathy, resolution and fortitude, relationships between desired goals and achieved goals, self-concept, and mood tone (Neugarten,

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Havighurst, & Tobin, 1961). Others elaborated the meaning of successful aging to include happiness, adjustment, affect balance, morale, subjective well-being, and optimal interplay between the individual and the environment (Fozard & Popkin, 1978; Herzog, Rodgers, & Woodworth, 1982; Lawton, 1977; Stock, Okun, & Benin, 1986). Some of these initiatives grew out of a specific focus on old age, while others were imported from different domains and applied to the later years.

Limitations of these early approaches were noted, such as the lack of guiding theory (Ryff, 1982, 1989a) which resulted in related problems (i.e., elusive definitions of constructs, assessment instruments lacking evidence of validity) (Sauer & Warland, 1982). Despite the emphasis on positive aging, much research was conducted with tools designed to assess ill-being (e.g., anxiety, depression, worry, anomie, loneliness, somatic symptoms; for reviews, see Lawton, 1977, 1984). Even on the positive side, much successful aging research utilized dependent variables that could characterize optimal functioning *at any age*, which, in turn, meant that the unique challenges and opportunities of growing old were neglected. Clark and Anderson (1967) drew attention to the challenges of aging by describing "adaptive tasks," which included having an awareness of aging and a sense of instrumental limitations, redefining one's physical and social life space, substituting alternative sources of need satisfaction, reassessing the criteria for evaluation of self, and reintegrating values and life goals. On the opportunity side of aging, Ryff (1989a) drew on multiple theories of psychosocial development (Bühler, 1935; Bühler & Massarik, 1968; Erikson, 1959; Jung, 1933; Neugarten, 1968, 1973) to advance an approach to well-being that incorporated such constructs as personal growth, purpose in life, and self-acceptance, all of which could potentially improve with age.

Other advances in successful aging research focused on psychological processes of selection, optimization, and compensation (Baltes & Baltes, 1990). Illustrated largely in the context of cognitive function, selection referred to the restriction of one's life world to fewer domains of functioning, given age-related loss in adaptive potential. Optimization referred to engaging in behaviors that enrich and augment general reserves (e.g., cognitive reserve) and maximize chosen life directions and associated behaviors. Compensation resulted from restrictions in range of plasticity and adaptive potential, combined with the use of new strategies (e.g., external memory aids, when internal memory mechanics are insufficient).

Adopting a broader, less discipline-bound formulation, Rowe and Kahn (1998) defined successful aging to include three elements: absence of physical illness or disability, high levels of cognitive function and physical functioning, and active engagement with life. Little empirical research accompanied their formulation, although recent research with older Canadians showed that only one of the three criteria was empirically viable (Weir, Meisner, & Baker, 2010). That is, the majority of older Canadians maintained connections with their community (active life engagement), but with increasing age, many experienced disease-related disability and impaired physical functioning.

This brief introductory overview underscores diverse formulations of successful aging evident in gerontological research over the past 70 years, with some having more lasting impact than others. That the ideal of positive aging evolves through time is meaningful and appropriate, to the extent that new versions build on what has gone before by refining core conceptualizations and strengthening empirical underpinnings. With such evolution in mind, we posit that two overarching criteria are critical to theoretical and empirical

formulations of successful aging. First, normally occurring changes in the aging mind and body must be incorporated – that is, the formulation must be explicitly *developmental*, while also giving notable attention to individual differences in the timing of such change. Although lifespan developmental criteria have been previously prominent in psychological formulations of successful aging (e.g., Baltes & Baltes, 1990; Ryff, 1982), they have been curiously absent in formulations of physical aging. The Rowe and Kahn (1998) criteria of successful aging, in fact, neglect the reality that over the course of aging most older persons will develop multiple medical conditions. Comorbidity is thus part of normal aging and, as such, should be considered in formulating optimal later life functioning – something recognized half a century ago by Clark and Anderson (1967). Others have begun to endorse a conception of successful aging in which disease and functional limitations coexist, along with compensatory psychological or social mechanisms (Young, Frick, & Phelan, 2009).

A second key criterion is that the inherent interplay between biological, psychosocial, and social aspects of aging (Ryff & Singer, 2009) must be recognized – that is, formulations of successful aging must be fundamentally *biopsychosocial*. Our call for greater emphasis on a biopsychosocial approach is intended to address the neglect of biological processes in most prior formulations of positive aging, whether about psychological functioning or physical health. In this regard, we seek to connect the field of gerontology to a long and growing tradition in health research, which emanates from dissatisfaction with traditional medical models (Engel, 1977). Our intent is to build on advances in this literature, including those emerging from psychoneuroimmunology (Lutgendorf & Costanzo, 2003) and psychoneuroendocrinology (Campeau, Day, Helmreich, Kollack-Walker, & Watson, 1998; de Kloet, 2003). Combined with recognition of the wide heterogeneity among aged persons, we see the route to understanding why some age well and others do not as occurring via integrative models built on diverse combination of risk and protective factors (biological, psychological, social).

What follows is organized in four main sections. We first provide an overview of biopsychosocial approaches to health that we believe have useful import for the field of aging. Second, we address what it means to live well in later life, despite the emergence of medical comorbidities. Third, we consider what it means to live well in the face of social inequality. With both of these topics, we give primacy to psychological and social strengths, which are important not only for quality of life and positive subjective experience, but also because they are increasingly linked to biological regulation, brain activity, and unfolding trajectories of morbidity and mortality. Given the cascade of mechanisms and processes situated around these phenomenological experiences, which define the human condition, we conclude with consideration of interventions designed to promote psychosocial well-being.

Biopsychosocial Approaches to Health

Decades ago, psychiatrist George Engel proposed the adoption of a biopsychosocial model as an alternative to the dominant biomedical model (Engel, 1977). Engel recognized the

extraordinary power of the biomedical model to identify "biochemical defects" within the body and to guide the development of treatments for these defects, but he called for physicians to pay more attention to the psychological and social aspects of illness and the patient. He believed that while many of the causes of and treatments for psychiatric conditions likely involve specific biological processes within the brain, important other aspects of treating psychiatric conditions – environmental factors associated with mental illness, cultural and psychological factors influencing a person's decision to seek treatment, physician–patient communication, a patient's willingness and ability to follow treatment recommendations – require that physicians become familiar with the social and psychological contexts of their patients' lives. Engel called for the integration of the biopsychosocial perspective into the training of medical students, and he himself brought biopsychosocial training to the medical curriculum at the University of Rochester where he taught.

Engel's goal of fundamentally changing the practice of medicine has not been extensively adopted; the biomedical model continues to dominate medical education and practice. Thus his exhortation to the medical community remains as pertinent now as it was 30 years ago (Alonso, 2004; Borrell-Carrio, Suchman, & Epstein, 2004). The biopsychosocial model has been incorporated into medical practice in a limited number of ways (Bitton et al., 2008; Finestone, Alfeeli, & Fisher, 2008; Griffith, 2009; Koppe, 2010; McCabe et al., 2010; McCollum & Pincus, 2009; Widerstrom-Noga, Finnerup, & Siddall, 2009), but its largest impact has been in providing the framework for a generation of basic science researchers and as a conceptual foundation for research disciplines favoring an integrative perspective on biological processes relevant to health, such as psychosomatic medicine (Fava & Sonino, 2010; Novack et al., 2007), psychoneuroimmunology (Lutgendorf & Costanzo, 2003), and psychoneuroendocrinology (Campeau et al., 1998; de Kloet, 2003). Psychoneuroimmunology (PNI) is the study of how the immune system is affected by social and psychological experiences and the biological pathways, including brain regulation, by which these influences impinge on immune function. Psychoneuroendocrinology (PNE) is the study of neural and hormonal responses to social and psychological experiences. Psychosomatic medicine integrates the basic sciences of PNI and PNE with a focus on clinical outcomes and potential interventions to improve health. Many of the same biological systems and social and psychological processes feature in research in all of these fields, so for the sake of parsimony we will not dwell on conceptual or empirical distinctions among them. Rather, using PNI as an organizing framework, we aim to present a broad overview of research that exemplifies a biopsychosocial perspective and, as such, may inform integrative approaches to successful aging.

Long before PNI became a formal area of research, the physiologist Hans Selye characterized a set of physiological changes that routinely occurred in animals after exposure to stressors ranging from cold and surgical injury to sublethal doses of a variety of drugs. These changes included a rapid decrease in the size of tissues related to the immune system, such as lymph nodes and the thymus gland (Selye, 1936). Subsequent efforts showed that adrenal hormones mediated the effects of Selye's stressors on immune cells and tissues (Dougherty, 1952), and to this day adrenal hormones remain central elements of research focused on the biological effects of social and psychological experiences. Other seminal lines of research that led to the development of PNI as a discipline included links

between personality characteristics and autoimmune disease (e.g., Solomon & Moos, 1964); between impaired immune function and extremes of negative mood, such as bereavement (Bartrop, Luckhurst, Lazarus, Kiloh, & Penny, 1977) or depression (Irwin, 2002); and the demonstration that the immune system could be trained to respond to nonimmunological stimuli through Pavlovian classical conditioning (Ader & Cohen, 1975). There was also a rapid expansion of PNI research that followed the identification of mechanisms by which the brain and major hormone systems communicated with and received communications from the immune system (see Ader, 2007, for overview).

The embedding of the immune system in a larger network of biological systems provides a plausible biological route by which social and psychological experiences can affect immune processes and resistance to illness. We now focus on a line of PNI research that may serve as an exemplar of biopsychosocial integration that is relevant for aging: inflammation. Inflammation as an adaptive process is a cascade of events that is triggered by damage to tissues or by the detection of a potentially infectious agent, such as a bacterium, and an optimal inflammatory response is critical for tissue repair and healing. The term *inflammation* is also used to describe a family of proteins that mediate the inflammatory response and help to promote tissue repair and healing, including tumor necrosis factor alpha (TNFa), interleukin-6 (IL-6), and C-Reactive Protein (CRP). And while elevations in these proteins in the context of infection or injury is important for healing, elevations in these same proteins in the blood in the absence of injury or infection is associated with increased risk of future morbidity and mortality (Abraham et al., 2007; Blake & Ridker, 2003; Ershler, 1993; Ferrucci et al., 1999; Stork et al., 2006). Inflammation is of specific interest for researchers in the field of aging because some inflammatory proteins increase with age, and these increases are not fully explained by the onset of chronic disease conditions (Ershler, 1993).

Importantly, circulating levels of inflammatory proteins are associated with social, psychological, and biological processes. At the level of social experience, a subordinate position in the social hierarchy, for example, as measured by low income, education, occupational status, or subjective social status, is linked to higher circulating levels of inflammatory proteins, and this association is evident across the life course (Alley et al., 2006; Demakakos, Nazroo, Breeze, & Marmot, 2008; Friedman & Herd, 2010; Gruenewald, Cohen, Matthews, Tracy, & Seeman, 2009; Morozink, Friedman, Coe, & Ryff, 2010). There is also evidence for developmental influences on the link between social status and inflammation. Children who grow up in low socioeconomic conditions – living in a rented home, having a parent with a low status occupation – are more likely to have higher circulating levels of inflammatory proteins once they grow to adulthood (Danese et al., 2009; Miller & Chen, 2007; Miller, Chen, et al., 2009).

At the level of the individual, social relationships are associated with variations in inflammation. Consistent with studies linking isolation from social communities with increased mortality risk (Berkman et al., 2004; House, Landis, & Umberson, 1988), middle-aged and older adults who are socially isolated also have higher circulating levels of inflammatory proteins than those who are more socially integrated (Loucks, Berkman, Gruenewald, & Seeman, 2005, 2006). Perturbations to important social relationships, such as marital conflict, are associated not only with increases in circulating levels of

inflammatory proteins but also with impairments in adaptive inflammatory responses to tissue damage (Gouin et al., 2010; Kiecolt-Glaser et al., 2005; Robles & Kiecolt-Glaser, 2003). Older adults often face the challenge of caring for a spouse or family member with chronic illness, and one component of that challenge is isolation from social networks and consequent loneliness. Studies of caregivers have shown not only that they have higher levels of inflammatory proteins in circulation (Lutgendorf et al., 1999), but also that the rate at which inflammatory proteins accumulate in the blood with age is higher compared to noncaregivers (Kiecolt-Glaser et al., 2003). Moreover, the relatively steeper rate of increase does not always resolve once the burden of caregiving is removed (Kiecolt-Glaser et al., 2003), suggesting a lasting change in the biological regulation of inflammation. Complementing these adverse associations is a growing literature on positive social factors and their links to lower levels of inflammation. Among adult women with late-stage gynecologic cancer, those who reported having high quality social relationships had lower levels of IL-6 both in the blood and at the site of the tumor (Costanzo et al., 2005). In a sample of community-dwelling older women, we found that higher ratings of social well-being predicted lower circulating levels of IL-6 (Friedman, Hayney, Love, Singer, & Ryff, 2007).

The production of inflammatory proteins is regulated by a number of other biological systems, most notably the hypothalamic-pituitary-adrenal (HPA) axis and the adrenal hormone cortisol as well as the sympathetic branch of the autonomic nervous system; cortisol in particular is robustly anti-inflammatory. Recent studies have shown that the regulation of inflammation by the HPA axis and the sympathetic nervous system (SNS) is altered by social and psychological experiences acting at cellular and genetic levels. One study compared parents caring for a child with cancer with parents of healthy children and found that the stressed parents had higher circulating levels of inflammatory proteins than parents with healthy children. Importantly, analyses of cell function in culture showed that a synthetic version of cortisol had less of an inhibitory effect on production of inflammatory proteins in cells from stressed parents compared to controls (Miller, Cohen, & Ritchey, 2002), suggesting that the chronic stress of having and caring for a child with cancer altered the ability of the HPA axis to regulate inflammation. More recent studies have shown that social isolation and loneliness are associated with patterns of gene expression that are consistent with greater production of inflammatory proteins, including reduced expression of genes for receptors that make cells more sensitive and responsive to cortisol (Cole, 2009).

These different lines of research converge on an integrative biopsychosocial approach to the regulation of inflammation. Social adversity, in the form of low social status, is associated with higher levels of cortisol as well as patterns of hormonal dysregulation (Cohen et al., 2006; Hajat et al., 2010; Kunz-Ebrecht, Kirschbaum, & Steptoe, 2004). As noted above, low social status is associated with higher levels of inflammatory proteins across the life course. Studies of gene expression related to inflammatory proteins show that adverse social environments, including backgrounds of low socioeconomic status (SES), are associated with patterns of expression, including loss of sensitivity to the anti-inflammatory effects of cortisol, that favor higher circulating levels of inflammatory proteins (Chen et al., 2009; Miller, Chen, et al., 2009). In children with asthma, the association between social status and inflammatory processes appear to be partially

mediated by psychosocial factors. Low SES children from stressful and threatening family environments had cells that produced higher levels of inflammatory proteins than children from less threatening environments (Chen et al., 2006). Conversely, cells from asthmatic children who perceived support from their parents produced lower levels of inflammatory proteins than cells from children with less supportive parents (Miller, Gaudin, Zysk, & Chen, 2009). Thus, social factors and chronic stressors are linked to dysregulation of hormone systems that regulate inflammation, and impairments in these regulatory systems can result in chronically elevated levels of inflammation. The impact of social environments on inflammatory processes may be mitigated or exaggerated by the presence or absence of psychosocial resources, such as supportive social networks.

The regulation of inflammation is one of a number of examples of biopsychosocial models that are relevant for successful aging. The length and regulation of telomeres on chromosomes is another model in which social processes and psychosocial resources are linked to biological processes that have implications for aging (Epel et al., 2004). In each of these instances, biological processes related to health and aging are patterned by social environments and psychological strengths and liabilities as well as the ways in which they interact with one another. Accurately reflecting the composition of the literature, most studies mentioned to this point have focused primarily on factors that predict increased risk of disease and mortality. Given our emphasis on successful aging, we turn in the next sections to an explicit consideration of the role of positive influences in mitigating the potential adverse outcomes in two domains of aging: living with medical comorbidities and social inequalities.

Living Well with Later Life Comorbidity

Consistent with our view that theoretical and empirical formulations of successful aging must incorporate developmental changes in mind and body that occur with age, in this section we consider age-related declines in physical health and functional capacities and the challenges such declines pose for notions of what it means to age successfully. The absence of physical disease or disability is one of the three criteria for successful aging set out by Rowe and Kahn (1987, 1998). Other models of successful aging similarly highlight the prevention or delay of disease and disability as a central component of aging successfully (Depp & Jeste, 2006). According to a recent report from the 1998 Medical Expenditures Panel Survey, however, almost 50% of women and 40% of men in the United States have at least one chronic medical condition and over 20% of adults have two or more. Among those 65 years old or older, 62% have two or more conditions (Anderson & Horvath, 2004), a number that is projected to increase substantially in coming years (Vogeli et al., 2007). Living with medical comorbidity has thus become the norm for older adults. Indeed, fewer than 19% of participants aged 65–99 years from the Alameda County Study (Strawbridge, Wallhagen, & Cohen, 2002) and fewer than 12% of respondents over the age of 65 from the Health and Retirement Study (McLaughlin, Connell, Heeringa, Li, & Roberts, 2010) met the criteria for successful aging formulated by Rowe and Kahn, largely because of disease and/or physical impairments.

These numbers stand in stark contrast to older adults' views of their own aging. In one study of approximately 200 community-dwelling adults over the age of 60 in Southern California, only 15% were free of physical illness, but 92% of the sample considered themselves to be aging successfully (Montross et al., 2006). Similarly, among the older adults from the Alameda County Study, half (50.3%) agreed with the statement "I am aging successfully (or aging well)" in spite of the presence of chronic disease conditions (Strawbridge et al., 2002). We therefore agree with many others (McLaughlin et al., 2010; Strawbridge et al., 2002; Young et al., 2009) that the absence of physical disease or disability is too strict a criterion for successful aging. Rather, a biopsychosocial perspective on aging successfully highlights compensatory processes that enable a high quality of life in the context of physical decline, and illumination of such processes comes from a number of quarters, one being studies of exceptional longevity.

Although living longer is not equivalent to aging successfully, long life is generally viewed as one component of successful aging. Longevity is substantially influenced by genetic endowment – heritability studies suggest that as much as 50% of individual variability in length of life can be attributed to genetic influences – and a number of genes related to both longevity and various aspects of successful aging have recently been identified; in some cases longevity is predicted by interactive relationships among two or more genes (Glatt, Chayavichitsilp, Depp, Schork, & Jeste, 2007; Jazwinski et al., 2010). This also means that at least half of individual variability in longevity is attributable to nongenetic influences, including demographic and psychosocial factors. The Georgia Centenarian Study, begun in 1988, has followed a cohort of over 200 centenarians and octogenarians as they age. Although most of the oldest study participants had at least one disease condition, most commonly cardiovascular disease, they were typically living full and engaged lives in independent settings (Poon, Clayton, et al., 1992). Inquiries into characteristics of centenarians have found strong evidence of strengths: positive subjective ratings of health, a strong predictor of morbidity and mortality at all ages (Idler & Benyamini, 1997; Idler & Kasl, 1995), and quality of life, which, in turn, are associated with a variety of demographic and psychosocial resources, such as education, conscientiousness, and social support (Poon et al., 2010). Educational attainment in particular was related to better cognitive functioning in study participants (Davey et al., 2010), and cognitive resources are a key component of managing daily life among centenarians (Poon, Martin, et al., 1992). Moreover, analyses of events across the course of participants' lives suggested cumulative effects of both negative and positive experiences, particularly those occurring earlier in life (Arnold et al., 2010), as well as greater happiness in those that hold positive feelings about their past experiences (Bishop et al., 2010). Exceptional longevity is thus a product of genetic, demographic, and psychosocial processes, and good quality of life in very old age is less likely to involve the avoidance of disease than successful adaptation to disease.

Research on centenarians has also shed new light on cognitive decline and dementia, signature concerns of aging adults. While rates of dementia typically rise with age, a recent meta-analysis showed that the rate of increase slows and then plateaus in adults in their eighties and nineties (Ritchie & Kildea, 1995). Moreover, while specific genes, such as ApOE4, markedly increase the risk of Alzheimer's disease (AD) in middle-aged adults, the association with AD in older adults is significantly weaker, suggesting potential

interactions between genetic susceptibility and other factors in predicting risk of AD in older adults (Breitner et al., 1999). Particularly intriguing are results from the Nun Study, a longitudinal study of aging and AD in over 600 Catholic nuns who were 75–100 years old at intake. In addition to submitting to annual examinations, the nuns agreed to donate their brains at death. The nuns had diverse backgrounds and life experiences, and in old age while some were virtually incapacitated by dementia, others showed no signs of cognitive impairment. On average, postmortem neurological examinations showed that neuropathology was associated with assessments of cognitive performance and functional limitations (Tyas, Snowdon, Desrosiers, Riley, & Markesbery, 2007). However, examination of specific cases also revealed moderate to severe AD-related neuropathology in the *complete absence* of any clinical signs of dementia; these nuns remained active and scored high on annual tests of cognitive performance right up until their deaths (Snowdon, 1997, 2003).

Such findings join other studies in showing that neuropathology and dementia are not inevitable consequences of getting older (Morris, 1999; Ritchie & Kildea, 1995). Moreover, they point to potential compensatory processes by which the presence of neuropathology does not result in cognitive decline or dementia. Compensatory processes within the brain may play a role in preserving function (Mattson & Magnus, 2006), but there may also be a role for demographic and psychosocial processes. Nuns with greater linguistic ability earlier in life – assessed from autobiographies written when the nuns were 22 years old – showed less cognitive decline and had reduced risk of AD later in life (Riley, Snowdon, Desrosiers, & Markesbery, 2005; Snowdon et al., 1996). A companion study showed that those nuns who expressed more positive emotions in their writing lived significantly longer than those with less (Danner, Snowdon, & Friesen, 2001), although links to cognitive decline or AD dementia have not been reported.

We end this section with a consideration of studies explicitly focused on the role of psychosocial strengths in preventing morbidity and mortality as well as probing how such effects might occur. The Rush Memory and Aging Project is a longitudinal study of 1,200 older adults living in communities in and around Chicago that includes assessment of chronic medical conditions, cognitive function, personality, depressive symptoms, social networks, and positive psychological functioning using the Purpose in Life subscale from Ryff's scales of psychological well-being (Ryff, 1989b). All were free of dementia at the start of the study. Two recent prospective studies examined links between well-being at baseline and subsequent outcomes by comparing participants with scores in the 90th percentile on purpose in life against those with scores in the 10th percentile. In one study, those participants with high purpose in life scores were 2.4 times less likely to develop Alzheimer's disease over the course of a 7-year follow-up period than those with the lowest scores (Boyle, Buchman, Barnes, & Bennett, 2010). A second study found that those high in purpose in life had a mortality risk over a 5-year follow-up period that was 57% the risk for those with scores in the 10th percentile (Boyle, Barnes, Buchman, & Bennett, 2009). It is important to emphasize that these studies were prospective and rigorous, controlling for a variety of potential confounds, including age, gender, health, depression, and personality. The results suggest that a strong sense of life purpose may be protective against age-related dementia and mortality. Finally, our work examined the extent to which psychological well-being might be associated with reduced biological risk of morbidity and mortality in aging adults with existing medical conditions. Circulating levels of

inflammatory proteins like IL-6 and CRP are prospectively related to morbidity and mortality in both healthy adults and those with diagnosed disease conditions, particularly in elderly people (Blake & Ridker, 2003; Cesari et al., 2003; Stork et al., 2006). In this analysis, we showed that greater burden of medical comorbidities were associated with declines in well-being and increases in IL-6 and CRP. However, among middle-aged and older adults with greater well-being – higher scores on purpose in life and positive relations with others – increases in disease burden were associated with much smaller increases in inflammation compared to adults with lower well-being (Friedman & Ryff, 2010).

In summary, as the population of the United States ages, medical comorbidities are increasingly the norm, and theories of successful aging must account for the realities of biological decline. Studies of exceptional longevity make it clear that even a substantial burden of medical conditions is not an inevitable barrier to leading a full and engaged life. They also highlight numerous instances where neuropathology is not accompanied by loss of cognitive function or mental health. And newer studies suggest that a strong sense of life purpose in aging adults may reduce biological risk associated with myriad diseases and delay the onset of cognitive decline and mortality. All of these studies are cogent illustrations of the biopsychosocial perspective, where risk factors and strengths interact with one another to predict outcomes, and social or psychological strengths may mitigate the adverse outcomes associated with biological decline.

Living Well in the Face of Inequality

A large and growing literature shows systematic linkages between a person's standing in the socioeconomic hierarchy and health (Adler et al., 1994; Matthews & Gallo, 2011). The current challenge in such research is filling in the mechanisms and processes that account for these connections. Among the possible pathways under consideration are psychosocial factors, such as vulnerability to psychological distress (Gallo & Matthews, 2003) as well as exposure to traumatic events, chronic stress, and daily hassles (Almeida, Neupert, Banks, & Serido, 2005; Gallo, Bogart, Vranceanu, & Matthews, 2005; Hatch & Dohrenwend, 2007). Positive psychosocial resources, such as social support from others as well as self-esteem, sense of control, and optimism, have also been examined as intervening influences in the link between SES and health (Lachman & Weaver, 1998; Marmot et al., 1998; Matthews, Gallo, & Taylor, 2010; Uchino, 2006).

Understanding how inequalities in health come about has also led to a developmental emphasis, which addresses factors in early life that create risk for health problems among low SES children (Chen, Matthews, & Boyce, 2002), as well as life course approaches, which examine long-term profiles of social status and health (Alwin & Wray, 2005). In studies of adulthood and later life, the idea of cumulative disadvantage over time has been of interest (House, Lantz, & Herd, 2005; Mirowsky & Ross, 2008; Ross & Chia-Ling, 1996). It suggests that SES discrepancies in health progressively worsen over the life cycle, presumably due to the confluence of multiple factors (e.g., stress exposure, coping strategies, health behaviors). Comprehensive analyses (cross-sectional and longitudinal) with population-based samples, in fact, show that socioeconomic disparities in health are

small in early adulthood, and then increase through midlife and early old age, although they lessen in later life, possibly due to selective attrition (House et al., 2005).

Despite the pervasive emphasis on negative processes that underlie health inequality, there is growing recognition that some from disadvantaged backgrounds are able to avoid adverse health outcomes. For example, Werner's (1995) classic study of children growing up in extreme poverty showed that some were notably resilient. She identified multiple protective factors to account for these outcomes: those within the individual (e.g., being bright, outgoing, active); those within the family (e.g., having close bonds with at least one nurturing, competent parent); and those in the community (e.g., receiving support from peers and elders). Resilience has also been of interest in later life, although with less explicit linkage to socioeconomic standing (Staudinger, Marsiske, & Baltes, 1995). Our objective herein, given the overarching focus on successful aging, is to highlight emergent findings in adulthood and later life that show how psychosocial strengths can serve as buffers against the forces of inequality (Hatch, 2005). Many are based on findings from the MIDUS (Midlife in the US) national study (Brim, Ryff, & Kessler, 2004).

Lachman and Weaver (1998) examined sense of control as moderating influence between income and poor health. Respondents with lower income had lower perceived mastery and higher perceived constraints as well as poorer health. For all income groups, higher perceived mastery and lower perceived constraints were related to better self-rated health, greater life satisfaction, and lower depressive symptoms. However, control beliefs played a moderating role: Participants in the lowest income group with a high sense of control showed levels of health (self-rated health, functional limitations, acute symptoms) and well-being (life satisfaction, depressive symptoms) comparable to that of high income groups. Thus, among those who perceived that they had high mastery and limited constraints, economic disadvantage was not inevitably linked to poorer health.

A further study from MIDUS focused on the challenges of inequality related to ethnic minority status (Ryff, Keyes, & Hughes, 2003), which also confers increased risk for ill health (Braveman, Egerter, & Williams, 2011). Surprisingly, the results showed that ethnic minority status was a *positive* predictor, compared to majority status, of most aspects of eudaimonic well-being (e.g., environmental mastery, personal growth, purpose in life) after adjusting for numerous factors. Such outcomes suggest that certain aspects of well-being may possibly be honed by the adversities and challenges of inequality. The idea of finding meaning and purpose in adversity is not new – it was Victor Frankl's (1992) response for explaining how some were able to survive the horrors of Nazi concentration camps. The growing literature on posttraumatic growth (Tedeschi & Calhoun, 2004; Tedeschi, Park, & Calhoun, 1998) similarly invokes the emergence of strengths in the aftermath of trauma.

That adverse experiences can foster resilience was recently bolstered by findings from a multiyear national longitudinal sample (Seery, Holman, & Silver, 2010). Those with a history of some lifetime adversity reported better health and well-being, not only compared to people with a high history of adversity, but also compared to those with no history of adversity. There are parallel formulations in physiology, where Dienstbier (1989) described a kind of "toughness" shown by some in response to intermittent stressors. It included a pattern of arousal (i.e., low SNS activity, combined

with strong, responsive challenge-induced SNS – adrenal – medullary arousal, with resistance to brain catecholamine depletion and suppression of pituitary adrenal-cortical responses) that works in interaction with effective psychological coping, to comprise positive physiological reactivity. The emphasis on resistance to catecholamine depletion (SNS activity), combined with rapid return of cortisol levels (HPA axis activity) to normal operating range following stress exposure, and thereby maintenance within optimal operating ranges of other biomarkers (inflammatory processes, cardiovascular risk factors) offers a provisional formulation of what might constitute optimal physiological response to adversity. Mechanisms of resilience at the biological level have also been elaborated by Charney (2004), who focuses on neurochemical response patterns to acute stress assessed in laboratory contexts.

More investigations that explicate the interplay between psychosocial strengths, real-life adversity, and biological processes are needed. To that end, we conclude this section with a summary of our recent findings (Morozink et al., 2010) from the MIDUS study showing that psychological well-being is a moderator of links between educational status and the inflammatory protein IL-6. As predicted, the analyses showed that greater educational attainment was linked with lower levels of IL-6, after adjusting for multiple controls. However, psychological well-being interacted with education to predict IL-6, such that adults with less education but higher levels of purpose in life, environmental mastery, self-acceptance, positive relations with others, and positive affect had lower levels of IL-6.

In summary, research on social inequalities in health increasingly reflects a biopsychosocial approach that integrates multiple levels of inquiry – socioeconomic status, psychosocial vulnerabilities and resources, and biological mechanisms. Our emphasis has been to highlight the role of psychosocial strengths in the face of inequality – qualities such as self-esteem, sense of control, optimism, social support, coping strategies, and psychological well-being – all of which constitute protective resources vis-à-vis the life challenges associated with inequality. The scientific objective is to understand the biological mechanisms through which these effects occur; hence our descriptions of physiological toughness and the biology of resilience. Our recent findings documenting the protective influence of psychological well-being on risk for increased inflammatory risk among low-educated adults illustrates the biopsychosocial integration needed to explicate why some are able to live well in the face of inequality.

Interventions to Promote Psychosocial Well-Being

We have repeatedly emphasized the potential health benefits associated with positive psychosocial factors, including in later periods of life when chronic conditions and comorbidity become realities, as well as in contexts of socioeconomic inequality. Given this emphasis, a fundamental question is whether psychosocial strengths can be cultivated. To the extent that protective resources can be promoted, they could potentially be made available to ever larger segments of society. Fortunately, work in interventions for treatment of psychological disorders suggests this is possible. Specifically, "well-being

therapy" (WBT), developed by Fava and colleagues, has helped to prevent relapse among individuals suffering from mood and anxiety disorders (Fava, 1999; Fava, Rafanelli, Cazzaro, Conti, & Grandi, 1998). The intervention, provided in combination with cognitive behavioral therapy (CBT), was initially effective in preventing relapse of major depression over a 2-year period (Fava, Rafanelli, Grandi, Conti, & Belluardo, 1998). Subsequent work showed that these effects persisted over 6 years (Fava et al., 2004). Other related studies showed the effectiveness of the CBT-WBT sequential combination in treating generalized anxiety disorder (Fava et al., 2005).

What is well-being therapy? Fava and Ruini (2003) describe the key components of the intervention, which is based on Ryff's (1989a) multidimensional model of psychological well-being. The goal of therapy is to improve patients' experiences of well-being in hopes of preventing relapse in the residual phase of mood and anxiety disorders. It is a short-term (8 week) therapeutic strategy involving the use of structured diaries kept by patients, combined with interaction with the therapist about diary entries. Clients are required to record positive experiences from their daily lives, however fleeting. The focus in therapy sessions is then on helping clients sustain such experiences, rather than prematurely interrupting them by maladaptive cognitions. The fundamental idea behind the therapy is that recovery from mood and anxiety disorders requires the capacity to experience well-being (Fava, Ruini, & Belaise, 2007). That is, eliminating the symptoms of distress is, in and of itself, insufficient to achieve full recovery; the client must also be able to participate in positive psychological experience.

Because well-being therapy has been shown to be effective in preventing relapse of psychological disorders, it is now being adapted for use in preventive contexts as well. Ruini, Belaise, Brombin, Caffo, and Fava (2006) developed an intervention protocol, derived from well-being therapy, for students in school settings. Pilot research showed that the intervention resulted in a reduction in psychological symptoms and an increase in psychological well-being. We submit that community interventions designed to instill and enhance experiences of well-being among elderly people may also constitute promising future directions in promoting successful aging. That is, because research shows that well-being constitutes an important moderator of later life morbidity and mortality, and because clinical findings show that the promotion of well-being helps prevent relapse of psychological disorders, we see notable promise for interventions designed to nurture psychological well-being among older adults.

Summary and Conclusions

The overarching objective of this chapter has been to call for a new approach to successful aging that is explicitly developmental – that is, deals with changes that occur mentally and physically as individuals move across later life, and is explicitly biopsychosocial in approach – that is, seeks to understand the interplay of biological, psychological, and social factors that underlie why some age well and others do not. We began with a historical overview of how successful aging has been formulated from the middle of the last century to the present. To make the case for what we see as needed refinements, we then distilled

the history of the biopsychosocial approach to health and illustrated its use in explicating the interplay between biological systems, primarily those dealing with inflammatory processes, and socioeconomic factors as well as psychosocial factors. Examples came from early development in childhood as well as aging. Because most of that literature has emphasized negative, vulnerability factors (low SES, stress, psychological disorders), we then shifted to a focus on the role of psychosocial strengths in helping to explain why some older individuals are able to live well, despite increased chronic conditions, which define normal aging. The scientific nexus between these psychosocial moderators and inflammatory processes was emphasized. A second context for illustrating positive psychosocial factors pertained to why some individuals who lack socioeconomic advantage are nonetheless doing well in terms of mental and physical health outcomes. Their resilience vis-à-vis the challenge of inequality were examined, again with a focus on how psychosocial strengths relate to intervening inflammatory processes.

Our recurrent emphasis on the positive side of the psychosocial ledger led to an important question: Namely, are these factors modifiable? Can they be promoted? We briefly reviewed recent intervention strategies to treat individuals with mood and anxiety disorders using "well-being therapy." Because these strategies have been shown to be effective in preventing relapse, they are now used in educational contexts with children, in hopes of engendering skills that nurture and sustain experiences of well-being and that will last into adulthood and later life. Given our overview of recent evidence that well-being delays onset of later life morbidity, promotes length of life, and is linked with reduced inflammatory processes, even in the face of increased chronic conditions, we thus issued a call for community interventions that are designed to engender greater experiences of psychosocial well-being among community elders. The underlying assumption, which rests at the core of our biopsychosocial formulation of successful aging, is that seeking, savoring, and sustaining well-being offers benefits, not only for how one feels subjectively, but also for healthy regulation of underlying biological systems. In effect, positive aging has become fundamentally a mind/body enterprise.

References

Abraham, J., Campbell, C. Y., Cheema, A., Gluckman, T. J., Blumenthal, R. S., & Danyi, P. (2007). C-reactive protein in cardiovascular risk assessment: A review of the evidence. *Journal of the Cardiometabolic Syndrome*, *2*(2), 119–123.

Ader, R. (Ed.). (2007). *Psychoneuroimmunology* (4th ed.). San Diego, CA: Academic Press.

Ader, R., & Cohen, N. (1975). Behaviorally conditioned immunosuppression. *Psychosomatic Medicine*, *37*(4), 333–340.

Adler, N. E., Boyce, T., Chesney, M. A., Cohen, S., Folkman, S., Kahn, R. L., et al. (1994). Socioeconomic status and health: The challenge of the gradient. *American Psychologist*, *49*, 14–24.

Alley, D. E., Seeman, T. E., Ki Kim, J., Karlamangla, A., Hu, P., & Crimmins, E. M. (2006). Socioeconomic status and C-reactive protein levels in the US population: NHANES IV. *Brain, Behavior, and Immunity*, *20*(5), 498–504.

Almeida, D. M., Neupert, S. D., Banks, S. R., & Serido, J. (2005). Do daily stress processes account for socioeconomic health disparities? *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *60B*, 34–39.

Alonso, Y. (2004). The biopsychosocial model in medical research: The evolution of the health concept over the last two decades. *Patient Education and Counseling*, *53*(2), 239–244.

Alwin, D. F., & Wray, L. A. (2005). A life-span developmental perspective on social status and health. *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences 60B*, 7–14.

Anderson, G., & Horvath, J. (2004). The growing burden of chronic disease in America. *Public Health Reports*, *119*(3), 263–270.

Arnold, J., Dai, J., Nahapetyan, L., Arte, A., Johnson, M. A., Hausman, D., . . . Poon, L. W. (2010). Predicting successful aging in a population-based sample of Georgia centenarians. *Current Gerontology and Geriatrics Research* doi: 10.1155/2010/989315

Baltes, P. B., & Baltes, M. M. (Eds.). (1990). *Successful aging: Perspectives from the behavioral sciences*. New York: Cambridge University Press.

Bartrop, R. W., Luckhurst, E., Lazarus, L., Kiloh, L. G., & Penny, R. (1977). Depressed lymphocyte function after bereavement. *Lancet*, *1*(8016), 834–836.

Berkman, L. F., Melchior, M., Chastang, J. F., Niedhammer, I., Leclerc, A., & Goldberg, M. (2004). Social integration and mortality: A prospective study of French employees of Electricity of France-Gas of France: The GAZEL Cohort. *American Journal of Epidemiology*, *159*(2), 167–174.

Bishop, A. J., Martin, P., MacDonald, M., Poon, L., Jazwinski, S. M., Green, R. C., et al. (2010). Predicting happiness among centenarians. *Gerontology*, *56*(1), 88–92.

Bitton, A., Dobkin, P. L., Edwardes, M. D., Sewitch, M. J., Meddings, J. B., Rawal, S., et al. (2008). Predicting relapse in Crohn's disease: A biopsychosocial model. *Gut*, *57*(10), 1386–1392.

Blake, G. J., & Ridker, P. M. (2003). C-reactive protein and other inflammatory risk markers in acute coronary syndromes. *Journal of the American College of Cardiology*, *41*(4 Suppl. S), 37S–42S.

Borrell-Carrio, F., Suchman, A. L., & Epstein, R. M. (2004). The biopsychosocial model 25 years later: Principles, practice, and scientific inquiry. *Annals of Family Medicine*, *2*(6), 576–582.

Boyle, P. A., Barnes, L. L., Buchman, A. S., & Bennett, D. A. (2009). Purpose in life is associated with mortality among community-dwelling older persons. *Psychosomatic Medicine*, *71*(5), 574–579.

Boyle, P. A., Buchman, A. S., Barnes, L. L., & Bennett, D. A. (2010). Effect of a purpose in life on risk of incident Alzheimer disease and mild cognitive impairment in community-dwelling older persons. *Archives of General Psychiatry*, *67*(3), 304–310.

Braveman, P., Egerter, S., & Williams, D. R. (2011). The social determinants of health: Coming of age. *Annual Review of Public Health*, *32*(1), 381–398.

Breitner, J. C., Wyse, B. W., Anthony, J. C., Welsh-Bohmer, K. A., Steffens, D. C., Norton, M. C., et al. (1999). APOE-epsilon4 count predicts age when prevalence of AD increases, then declines: The Cache County Study. *Neurology*, *53*(2), 321–331.

Brim, O. G., Ryff, C. D., & Kessler, R. C. (Eds.). (2004). *How healthy are we?: A national study of well-being at midlife*. Chicago: University of Chicago Press.

Bühler, C. (1935). The curve of life as studied in biographies. *Journal of Applied Psychology*, *43*, 653–673.

Bühler, C., & Massarik, F. (Eds.). (1968). *The course of human life*. New York: Springer.

Burgess, E. W. (1960). *Aging in Western societies*. Chicago: University of Chicago Press.

Campeau, S., Day, H. E., Helmreich, D. L., Kollack-Walker, S., & Watson, S. J. (1998). Principles of psychoneuroendocrinology. *Psychiatric Clinics of North America*, *21*(2), 259–276.

Cavan, R. S., Burgess, E. W., Havighurst, R. J., & Goldhamer, H. (1949). *Personal adjustment in old age*. Oxford: Science Research Associates.

Cesari, M., Penninx, B. W., Newman, A. B., Kritchevsky, S. B., Nicklas, B. J., Sutton-Tyrrell, K., et al. (2003). Inflammatory markers and cardiovascular disease (The Health, Aging and Body Composition [Health ABC] Study). *American Journal of Cardiology*, *92*(5), 522–528.

Chandler, A. R. (1948). Cicero's ideal old man. *Journal of Gerontology*, *3*, 285–289.

Charney, D. S. (2004). Psychobiological mechanisms of resilience and vulnerability: Implications for successful adaptation to extreme stress. *American Journal of Psychiatry*, *161*(2), 195–215.

Chen, E., Hanson, M. D., Paterson, L. Q., Griffin, M. J., Walker, H. A., & Miller, G. E. (2006). Socioeconomic status and inflammatory processes in childhood asthma: The role of psychological stress. *Journal of Allergy and Clinical Immunology*, *117*(5), 1014–1020.

Chen, E., Matthews, K. A., & Boyce, W. T. (2002). Socioeconomic differences in children's health: How and why do these relationships change with age? *Psychological Bulletin*, *128*(2), 295–329.

Chen, E., Miller, G. E., Walker, H. A., Arevalo, J. M., Sung, C. Y., & Cole, S. W. (2009). Genome-wide transcriptional profiling linked to social class in asthma. *Thorax*, *64*(1), 38–43.

Cicero (44 BCE/1923). *Cato major de senectute*. Cambridge, MA: Loeb Classical Library, Harvard University Press.

Clark, M., & Anderson, B. G. (1967). *Culture and aging*. New York: Charles C. Thomas.

Cohen, S., Schwartz, J. E., Epel, E., Kirschbaum, C., Sidney, S., & Seeman, T. (2006). Socioeconomic status, race, and diurnal cortisol decline in the Coronary Artery Risk Development in Young Adults (CARDIA) Study. *Psychosomatic Medicine*, *68*(1), 41–50.

Cole, S. W. (2009). Social regulation of human gene expression. *Current Directions in Psychological Science*, *18*(3), 132–137.

Costanzo, E. S., Lutgendorf, S. K., Sood, A. K., Anderson, B., Sorosky, J., & Lubaroff, D. M. (2005). Psychosocial factors and interleukin-6 among women with advanced ovarian cancer. *Cancer*, *104*(2), 305–313.

Cutler, N. E. (1979). Age variations in the dimensionality of life satisfaction. *Journal of Gerontology*, *34*, 573–578.

Danese, A., Moffitt, T. E., Harrington, H., Milne, B. J., Polanczyk, G., Pariante, C. M., et al. (2009). Adverse childhood experiences and adult risk factors for age-related disease: Depression, inflammation, and clustering of metabolic risk markers. *Archives of Pediatric and Adolescent Medicine*, *163*(12), 1135–1143.

Danner, D. D., Snowdon, D. A., & Friesen, W. V. (2001). Positive emotions in early life and longevity: Findings from the Nun Study. *Journal of Personality and Social Psychology*, *80*(5), 804–813.

Davey, A., Elias, M. F., Siegler, I. C., Lele, U., Martin, P., Johnson, M. A., et al. (2010). Cognitive function, physical performance, health, and disease: Norms from the Georgia Centenarian Study. *Experimental Aging Research*, *36*(4), 394–425.

de Kloet, E. R. (2003). Hormones, brain and stress. *Endocrine Regulations*, *37*(2), 51–68.

Demakakos, P., Nazroo, J., Breeze, E., & Marmot, M. (2008). Socioeconomic status and health: The role of subjective social status. *Social Science & Medicine*, *67*(2), 330–340.

Depp, C. A., & Jeste, D. V. (2006). Definitions and predictors of successful aging: A comprehensive review of larger quantitative studies. *American Journal of Geriatric Psychiatry*, *14*(1), 6–20.

Dienstbier, R. A. (1989). Arousal and physiological toughness: Implications for mental and physical health. *Psychological Review*, *96*, 84–100.

Dougherty, T. F. (1952). Effect of hormones on lymphatic tissue. *Physiological Reviews*, *32*(4), 379–401.

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, *196* (4286), 129–136.

Epel, E. S., Blackburn, E. H., Lin, J., Dhabhar, F. S., Adler, N. E., Morrow, J. D., et al. (2004). Accelerated telomere shortening in response to life stress. *Proceedings of the National Academy of Science USA*, *101*(49), 17312–17315.

Erikson, E. H. (1959). Identity and the life cycle: Selected papers. *Psychological Issues*, *1*, 1–171.

Ershler, W. B. (1993). Interleukin-6: A cytokine for gerontologists. *Journal of the American Geriatrics Society*, *41*(2), 176–181.

Fava, G. A. (1999). Well-being therapy: Conceptual and technical issues. *Psychotherapy and Psychosomatics*, *68*, 171–179.

Fava, G. A., Rafanelli, C., Cazzaro, M., Conti, S., & Grandi, S. (1998). Well-being therapy: A novel psychotherapeutic approach for residual symptoms of affective disorders. *Psychological Medicine*, *28*, 475–480.

Fava, G. A., Rafanelli, C., Grandi, S., Conti, S., & Belluardo, P. (1998). Prevention of recurrent depression with cognitive behavioral therapy. *Archives of General Psychiatry*, *55*, 816–821.

Fava, G. A., & Ruini, C. (2003). Development and characteristics of a well-being enhancing psychotherapeutic strategy: Well-being therapy. *Journal of Behavior Therapy and Experimental Psychiatry*, *34*(1), 45–63.

Fava, G. A., Ruini, C., & Belaise, C. (2007). The concept of recovery in major depression. *Psychological Medicine*, *37*(3), 307–317.

Fava, G. A., Ruini, C., Rafanelli, C., Finos, L., Conti, S., & Grandi, S. (2004). Six-year outcome of cognitive behavior therapy for prevention of recurrent depression. *American Journal of Psychiatry*, *161*(10), 1872–1876.

Fava, G. A., Ruini, C., Rafanelli, C., Finos, L., Salmaso, L., Mangelli, L., et al. (2005). Well-being therapy of generalized anxiety disorder. *Psychotherapy and Psychosomatics*, *74*(1), 26–30.

Fava, G. A., & Sonino, N. (2010). Psychosomatic medicine: A name to keep. *Psychotherapy and Psychosomatics*, *79*(1), 1–3.

Ferrucci, L., Harris, T. B., Guralnik, J. M., Tracy, R. P., Corti, M. C., & Cohen, H. J., et al. (1999). Serum IL-6 level and the development of disability in older persons. *Journal of the American Geriatrics Society*, *47*(6), 639–646.

Finestone, H. M., Alfeeli, A., & Fisher, W. A. (2008). Stress-induced physiologic changes as a basis for the biopsychosocial model of chronic musculoskeletal pain: A new theory? *Clinical Journal of Pain*, *24*(9), 767–775.

Fozard, J. L., & Popkin, S. J. (1978). Optimizing adult development: Ends and means of an applied psychology of aging. *American Psychologist*, *33*(11), 975–989.

Frankl, V. E. (1992). *Man's search for meaning: An introduction to logotherapy* (I. Lasch, Trans.) Boston, MA: Beacon Press (Originally work published 1959).

Friedman, E., & Ryff, C. D. (2010). Chronic disease co-morbidity and inflammation in aging adults: Moderation by psychological well-being. *Brain, Behavior, and Immunity*, *24* (Supplement 1), S31. doi: 10.1016/j.bbi.2010.07.102

Friedman, E. M., Hayney, M., Love, G. D., Singer, B. H., & Ryff, C. D. (2007). Plasma interleukin-6 and soluble IL-6 receptors are associated with psychological well-being in aging women. *Health Psychology*, *26*(3), 305–313.

Friedman, E. M., & Herd, P. (2010). Income, education, and inflammation: Differential associations in a national probability sample (The MIDUS study). *Psychosomatic Medicine*, *72*(3), 290–300.

Gallo, L. C., Bogart, L. M., Vranceanu, A.-M., & Matthews, K. A. (2005). Socioeconomic status, resources, psychological experiences, and emotional responses: A test of the reserve capacity model. *Journal of Personality and Social Psychology*, *88*(2), 386–399.

Gallo, L. C., & Matthews, K. A. (2003). Understanding the association between socioeconomic status and physical health: Do negative emotions play a role? *Psychological Bulletin*, *129*(1), 10–51.

Glatt, S. J., Chayavichitsilp, P., Depp, C., Schork, N. J., & Jeste, D. V. (2007). Successful aging: From phenotype to genotype. *Biological Psychiatry*, *62*(4), 282–293.

Gouin, J. P., Carter, C. S., Pournajafi-Nazarloo, H., Glaser, R., Malarkey, W. B., Loving, T. J., et al. (2010). Marital behavior, oxytocin, vasopressin, and wound healing. *Psychoneuroendocrinology*, *35*(7), 1082–1090.

Griffin, J. J. (1949). Plato's philosophy of old age. *Geriatrics*, *4*, 242–255.

Griffith, K. A. (2009). Biological, psychological and behavioral, and social variables influencing colorectal cancer screening in African Americans. *Nursing Research*, *58*(5), 312–320.

Gruenewald, T. L., Cohen, S., Matthews, K. A., Tracy, R., & Seeman, T. E. (2009). Association of socioeconomic status with inflammation markers in black and white men and women in the Coronary Artery Risk Development in Young Adults (CARDIA) study. *Social Science & Medicine*, *69*, 451–459.

Hajat, A., Diez-Roux, A., Franklin, T. G., Seeman, T., Shrager, S., Ranjit, N., et al. (2010). Socioeconomic and race/ethnic differences in daily salivary cortisol profiles: The multi-ethnic study of atherosclerosis. *Psychoneuroendocrinology*, *35*(6), 932–943.

Hatch, S. L. (2005). Conceptualizing and identifying cumulative adversity and protective resources: Implications for understanding health inequalities. *Journal of Gerontology: Social Sciences*, *60B*, S130–S134.

Hatch, S., & Dohrenwend, B. (2007). Distribution of traumatic and other stressful life events by race/ethnicity, gender, SES and age: A review of the research. *American Journal of Community Psychology*, *40*(3), 313–332.

Herzog, A. R., Rodgers, W. L., & Woodworth, J. (1982). *Subjective well-being among different age groups*. Ann Arbor: University of Michigan, Institute for Social Research, Survey Research Center.

House, J. S., Landis, K. R., & Umberson, D. (1988). Social relationships and health. *Science*, *241* (4865), 540–545.

House, J. S., Lantz, P. M., & Herd, P. (2005). Continuity and change in the social stratification of aging and health over the life course: Evidence from a nationally representative longitudinal study from 1986 to 2001/2002 (Americans' Changing Lives Study). *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *60* (Special Issue 2), S15–S26.

Idler, E. L., & Benyamini, Y. (1997). Self-rated health and mortality: A review of twenty-seven community studies. *Journal of Health & Social Behavior*, *38*(1), 21–37.

Idler, E. L., & Kasl, S. V. (1995). Self-ratings of health: Do they also predict change in functional ability? *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *50*(6), S344–S353.

Irwin, M. (2002). Psychoneuroimmunology of depression: Clinical implications. *Brain, Behavior, and Immunity*, *16*(1), 1–16.

Jazwinski, S. M., Kim, S., Dai, J., Li, L., Bi, X., Jiang, J. C., et al. (2010). HRAS1 and LASS1 with APOE are associated with human longevity and healthy aging. *Aging Cell*, *9*(5), 698–708.

Jung, C. G. (1933). *Modern man in search of a soul* (W. S. Dell & C. F. Baynes, Trans.). New York: Harcourt, Brace & World.

Kiecolt-Glaser, J. K., Loving, T. J., Stowell, J. R., Malarkey, W. B., Lemeshow, S., Dickinson, S. L., et al. (2005). Hostile marital interactions, proinflammatory cytokine production, and wound healing. *Archives of General Psychiatry*, *62*(12), 1377–1384.

Kiecolt-Glaser, J. K., Preacher, K. J., MacCallum, R. C., Atkinson, C., Malarkey, W. B., & Glaser, R. (2003). Chronic stress and age-related increases in the proinflammatory cytokine IL-6. *Proceedings of the National Academy of Science USA*, *100*(15), 9090–9095.

Koppe, H. (2010). Two HEADSSS are better than one – a biopsychosocial screening tool for use when treating other doctors. *Australian Family Physician*, *39*(5), 329–331.

Kunz-Ebrecht, S. R., Kirschbaum, C., & Steptoe, A. (2004). Work stress, socioeconomic status and neuroendocrine activation over the working day. *Social Science & Medicine*, *58*(8), 1523–1530.

Lachman, M. E., & Weaver, S. L. (1998). The sense of control as a moderator of social class differences in health and well-being. *Journal of Personality and Social Psychology*, *74*(3), 763–773.

Larson, R. (1978). Thirty years of research on the subjective well-being of older Americans. *Journals of Gerontology: Series A: Biological Sciences and Medical Sciences*, *33*, 109–125.

Lawton, M. P. (1977). Morale: What are we measuring? In C. N. Nydegger (Ed.), *Measuring morale: A guide to effective assessment* (pp. 6–14). Washington, DC: Gerontological Society.

Lawton, M. P. (1984). The varieties of well-being. In C. Z. Malatesta& C. E. Izard (Eds.), *Emotion in adult development* (pp. 67–84). Beverly Hills, CA: Sage.

Loucks, E. B., Berkman, L. F., Gruenewald, T. L., & Seeman, T. E. (2005). Social integration is associated with fibrinogen concentration in elderly men. *Psychosomatic Medicine*, *67*(3), 353–358.

Loucks, E. B., Berkman, L. F., Gruenewald, T. L., & Seeman, T. E. (2006). Relation of social integration to inflammatory marker concentrations in men and women 70 to 79 years. *American Journal of Cardiology*, *97*(7), 1010–1016.

Lutgendorf, S. K., & Costanzo, E. S. (2003). Psychoneuroimmunology and health psychology: An integrative model. *Brain, Behavior, and Immunity*, *17*(4), 225–232.

Lutgendorf, S. K., Garand, L., Buckwalter, K. C., Reimer, T. T., Hong, S. Y., & Lubaroff, D. M. (1999). Life stress, mood disturbance, and elevated interleukin-6 in healthy older women. *Journals of Gerontology: Series A: Biological Sciences and Medical Sciences 54*(9), M434–M439.

Marmot, M. G., Fuhrer, R., Ettner, S. L., Marks, N. F., Bumpass, L. L., & Ryff, C. D. (1998). Contribution of psychosocial factors to socioeconomic differences in health. *Milbank Quarterly*, *76*(3), 403–448.

Matthews, K. A., & Gallo, L. C. (2011). Psychological perspectives on pathways linking socioeconomic status and physical health. *Annual Review of Psychology*, *62*(1), 501–530.

Matthews, K. A., Gallo, L. C., & Taylor, S. E. (2010). Are psychosocial factors mediators of socioeconomic status and health connections? *Annals of the New York Academy of Sciences*, *1186*(1), 146–173.

Mattson, M. P., & Magnus, T. (2006). Ageing and neuronal vulnerability. *Nature Reviews. Neuroscience*, *7*(4), 278–294.

McCabe, M., Althof, S. E., Assalian, P., Chevret-Measson, M., Leiblum, S. R., Simonelli, C., et al. (2010). Psychological and interpersonal dimensions of sexual function and dysfunction. *Journal of Sexual Medicine*, *7* (1 Pt 2), 327–336.

McCollum, L., & Pincus, T. (2009). A biopsychosocial model to complement a biomedical model: Patient questionnaire data and socioeconomic status usually are more significant than laboratory tests and imaging studies in prognosis of rheumatoid arthritis. *Rheumatic Disease Clinics of North America*, *35*(4), 699–712.

McLaughlin, S. J., Connell, C. M., Heeringa, S. G., Li, L. W., & Roberts, J. S. (2010). Successful aging in the United States: Prevalence estimates from a national sample of older adults. *Journals of Gerontology: Series B: Psychological Sciences and Social Sciences*, *65B*(2), 216–226.

Miller, G., & Chen, E. (2007). Unfavorable socioeconomic conditions in early life presage expression of proinflammatory phenotype in adolescence. *Psychosomatic Medicine*, *69*(5), 402–409.

Miller, G. E., Chen, E., Fok, A. K., Walker, H., Lim, A., Nicholls, E. F., et al. (2009). Low early-life social class leaves a biological residue manifested by decreased glucocorticoid and increased

proinflammatory signaling. *Proceedings of the National Academy of Science USA*, *106*(34), 14716–14721.

Miller, G. E., Cohen, S., & Ritchey, A. K. (2002). Chronic psychological stress and the regulation of pro-inflammatory cytokines: A glucocorticoid-resistance model. *Health Psychology*, *21*(6), 531–541.

Miller, G. E., Gaudin, A., Zysk, E., & Chen, E. (2009). Parental support and cytokine activity in childhood asthma: The role of glucocorticoid sensitivity. *Journal of Allergy and Clinical Immunology*, *123*(4), 824–830.

Mirowsky, J., & Ross, C. E. (2008). Education and self-rated health: Cumulative advantage and its rising importance. *Research on Aging*, *30*(1), 93–122.

Montross, L. P., Depp, C., Daly, J., Reichstadt, J., Golshan, S., Moore, D., et al. (2006). Correlates of self-rated successful aging among community-dwelling older adults. *American Journal of Geriatric Psychiatry*, *14*(1), 43–51.

Morozink, J. A., Friedman, E. M., Coe, C. L., & Ryff, C. D. (2010). Socioeconomic and psychosocial predictors of interleukin-6 in the MIDUS national sample. *Health Psychology*, *29*(6), 626–635.

Morris, J. C. (1999). Is Alzheimer's disease inevitable with age?: Lessons from clinicopathologic studies of healthy aging and very mild Alzheimer's disease. *Journal of Clinical Investigation*, *104*(9), 1171–1173.

Neugarten, B. L. (1968). *Middle age and aging*. Chicago: University of Chicago Press.

Neugarten, B. L. (1973). Personality change in late life: A developmental perspective. In C. Eisodorfer& M. P. Lawton (Eds.), *The psychology of adult development and aging* (pp. 311–335). Washington, DC: American Psychological Association.

Neugarten, B. L., Havighurst, R. J., & Tobin, S. S. (1961). The measurement of life satisfaction. *Journal of Gerontology*, *16*, 134–143.

Novack, D. H., Cameron, O., Epel, E., Ader, R., Waldstein, S. R., Levenstein, S., et al. (2007). Psychosomatic medicine: The scientific foundation of the biopsychosocial model. *Academic Psychiatry*, *31*(5), 388–401.

Pollak, O. (1948). *Social adjustment in old age: A research planning report. (Social Science Research Council Bulletin., No. 59.)*. Oxford: Social Science Research.

Poon, L. W., Clayton, G. M., Martin, P., Johnson, M. A., Courtenay, B. C., Sweaney, A. L., et al. (1992). The Georgia Centenarian Study. *International Journal of Aging and Human Development*, *34*(1), 1–17.

Poon, L. W., Martin, P., Bishop, A., Cho, J., da Rosa, G., Deshpande, N., et al. (2010). Understanding centenarians' psychosocial dynamics and their contributions to health and quality of life. *Current Gerontology and Geriatrics Research*. doi: 10.1155/2010/680657.

Poon, L. W., Martin, P., Clayton, G. M., Messner, S., Noble, C. A., & Johnson, M. A. (1992). The influences of cognitive resources on adaptation and old age. *International Journal of Aging and Human Development*, *34*(1), 31–46.

Riley, K. P., Snowdon, D. A., Desrosiers, M. F., & Markesbery, W. R. (2005). Early life linguistic ability, late life cognitive function, and neuropathology: findings from the Nun Study. *Neurobiology of Aging*, *26*(3), 341–347.

Ritchie, K., & Kildea, D. (1995). Is senile dementia "age-related" or "ageing-related"? Evidence from meta-analysis of dementia prevalence in the oldest old. *Lancet*, *346*(8980), 931–934.

Robles, T. F., & Kiecolt-Glaser, J. K. (2003). The physiology of marriage: Pathways to health. *Physiology and Behavior*, *79*(3), 409–416.

Ross, C. E., & Chia-Ling, W. (1996). Education, age, and the cumulative advantage in health. *Journal of Health & Social Behavior*, *37*(1), 104–120.

Rowe, J. W., & Kahn, R. L. (1987). Human aging: Usual and successful. *Science*, *237*(4811), 143–149.

Rowe, J. W., & Kahn, R. L. (1998). *Successful aging*. New York: Pantheon Books.

Ruini, C., Belaise, C., Brombin, C., Caffo, E., & Fava, G. A. (2006). Well-being therapy in school settings: A pilot study. *Psychotherapy and Psychosomatics*, *75*(6), 331–336.

Ryff, C. D. (1982). Successful aging: A developmental approach. *The Gerontologist*, *22*, 209–214.

Ryff, C. D. (1989a). Beyond Ponce de Leon and life satisfaction: New directions in quest of successful aging. *International Journal of Behavioral Development*, *12*, 35–55.

Ryff, C. D. (1989b). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, *57*(6), 1069–1081.

Ryff, C. D., Keyes, C. L. M., & Hughes, D. L. (2003). Status inequalities, perceived discrimination, and eudaimonic well-being: Do the challenges of minority life hone purpose and growth? *Journal of Health & Social Behavior*, *44*(3), 275–291.

Ryff, C. D., & Singer, B. H. (2009). Understanding healthy aging: Key components and their integration. In V. L. Bengtson, M. Silverstein, N. Putney& D. Gans (Eds.), *Handbook of theories of aging* (pp. 117–144). New York: Springer.

Sauer, W. J., & Warland, R. (1982). Morale and life satisfaction. In D. A. Mangen& W. A. Peterson (Eds.), *Research instruments in social gerontology: Vol. 1. Clinical and social psychology* (pp. 195–240). Minneapolis: University of Minnesota Press.

Seery, M. D., Holman, E. A., & Silver, R. C. (2010). Whatever does not kill us: Cumulative lifetime adversity, vulnerability, and resilience. *Journal of Personality and Social Psychology*, *99*(6), 1025–1041.

Selye, H. (1936). A syndrome produced by diverse nocuous agents. *Nature*, *138*, 32.

Snowdon, D. A. (1997). Aging and Alzheimer's disease: Lessons from the Nun Study. *Gerontologist*, *37*(2), 150–156.

Snowdon, D. A. (2003). Healthy aging and dementia: Findings from the Nun Study. *Annals of Internal Medicine*, *139*(2), 450–454.

Snowdon, D. A., Kemper, S. J., Mortimer, J. A., Greiner, L. H., Wekstein, D. R., & Markesbery, W. R. (1996). Linguistic ability in early life and cognitive function and Alzheimer's disease in late life. Findings from the Nun Study. *Journal of the American Medical Association*, *275*(7), 528–532.

Solomon, G., & Moos, R. (1964). Emotions, immunity, and disease. *Archives of General Psychiatry*, *11*, 657–674.

Staudinger, U. M., Marsiske, M., & Baltes, P. B. (1995). Resilience and reserve capacity in later adulthood: Potentials and limits of development across the life span. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology. Volume 2: Risk, disorder and adaptation* (pp. 801–847). New York: Wiley.

Stock, W. A., Okun, M. A., & Benin, M. (1986). Structure of subjective well-being among the elderly. *Psychology & Aging*, *1*, 91–102.

Stork, S., Feelders, R. A., van den Beld, A. W., Steyerberg, E. W., Savelkoul, H. F., Lamberts, S. W., et al. (2006). Prediction of mortality risk in the elderly. *American Journal of Medicine*, *119*(6), 519–525.

Strawbridge, W. J., Wallhagen, M. I., & Cohen, R. D. (2002). Successful aging and well-being: Self-rated compared with Rowe and Kahn. *Gerontologist*, *42*(6), 727–733.

Tedeschi, R. G., & Calhoun, L. G. (2004). Posttraumatic growth: Conceptual foundations and empirical evidence. *Psychological Inquiry*, *15*(1), 1–18.

Tedeschi, R. G., Park, C. L., & Calhoun, L. G. (Eds.). (1998). *Posttraumatic growth: Positive changes in the aftermath of crisis*. Mahwah, NJ: Erlbaum.

Tyas, S. L., Snowdon, D. A., Desrosiers, M. F., Riley, K. P., & Markesbery, W. R. (2007). Healthy ageing in the Nun Study: Definition and neuropathologic correlates. *Age Ageing*, *36*(6), 650–655.

Uchino, B. N. (2006). Social support and health: A review of physiological processes potentially underlying links to disease outcomes. *Journal of Behavioral Medicine*, *29*(4), 377–387.

Vogeli, C., Shields, A. E., Lee, T. A., Gibson, T. B., Marder, W. D., Weiss, K. B., et al. (2007). Multiple chronic conditions: Prevalence, health consequences, and implications for quality, care management, and costs. *Journal of General Internal Medicine*, 22 Suppl. 3, 391–395.

Weir, P. L., Meisner, B. A., & Baker, J. (2010). Successful aging across the years: Does one model fit everyone? *Journal of Health Psychology*, *15*(5), 680–687.

Werner, E. E. (1995). Resilience in development. *Current Directions in Psychological Science*, *4*, 81–85.

Widerstrom-Noga, E. G., Finnerup, N. B., & Siddall, P. J. (2009). Biopsychosocial perspective on a mechanisms-based approach to assessment and treatment of pain following spinal cord injury. *Journal of Rehabilitation Research and Development*, *46*(1), 1–12.

Williams, R. H., & Wirths, C. G. (1965). *Lives through the years: Styles of life and successful aging*. Oxford: Atherton Press.

Young, Y., Frick, K. D., & Phelan, E. A. (2009). Can successful aging and chronic illness coexist in the same individual? A multidimensional concept of successful aging. *Journal of the American Medical Directors Association*, *10*(2), 87–92.