THE LIFE COURSE, BIOLOGY AND HEALTH*

Mary Elizabeth Hughes
Duke University

Linda J. Waite
University of Chicago

Louise C. Hawkley
University of Chicago

John T. Cacioppo
University of Chicago

September 2004

* This research is supported by Grant P01 AG 18911 from the Office of the Demography of Aging, Behavioral and Social Research Program, National Institute on Aging. We thank Tracey LaPierre and Ye Luo for research assistance. Direct correspondence to the first author at Department of Sociology, Box 90088, Duke University, Durham, NC 27708, email mehughes@soc.duke.edu.

One of the key developments in recent health research has been the application of life course principles to understanding health and well-being. A growing literature documents the influence of early and accumulated life experience on later health (e.g. Hayward and Gorman 2004; Hughes and Waite 2004; McDonough and Berglund 2003). The shift to a life course perspective is especially important because, in developed nations, chronic conditions cause most suffering and death. Because chronic conditions have long etiologies, their onset and development are especially likely to reflect the long-term patterning of life experience.

As evidence linking lifetime experiences to current health accumulates, interest has turned to the pathways through which earlier life events and statuses affect later health. Some research focuses on social pathways. For example, Hayward and Gorman (2004) show that childhood social environment is mediated by, among other factors, adult economic status. However, other research has begun to examine the underlying biological processes. Spurred by recent work in social neuroscience emphasizing the role of the body's regulatory systems in adapting to environmental challenge, or stress, researchers have begun to link social experiences with their "biological signature" (Hawkley, Bosch, Engeland, Marucha, & Cacioppo, in press; Singer and Ryff 1999). The latter work is particularly exciting because it offers a more integrated perspective on human health than that provided by either the social or the biological account alone.

Although a small but critical mass of studies now links social factors to a set of general biological markers of chronic stress (e.g. Seeman et al. 2002; Singer and Ryff 1999; Weinstein et al. 2003), we know much less about the processes by which social life "gets under the skin" over time. In this paper, we consider these processes. Our general aim is to leverage the state of the art in both life course studies and social neuroscience to produce a more nuanced framework for thinking about the links between social experience and the biology

of stress. eroding

We will begin by developing a conceptual model linking the lifetime patterning of social and biological processes. Our model expands previous thinking in three ways. First, and most critical, our framework emphasizes the roles of both catabolic (degenerative) and anabolic (restorative) processes (Cacioppo and Bernston, in press). Most research linking biological processes and long term health is based on the paradigm of allostatic load. Allostasis is the process by which the body's regulatory systems adapt to environmental challenge. Current understanding suggests that although the allostatic response has short-term gains, it may have long-term costs. Over time, the repeated over- or under-activation of allostatic responses can lead to allostatic load, or cumulative wear and tear on the body's regulatory mechanisms (McEwen and Stellar 1993). However, focusing solely on the allostatic process ignores the role of the restorative processes which are operating at the same time. Just as challenges or "stressors" are socially structured, so are opportunities for recovery and restoration. Thus observed social differentials in health should reflect the long term effects of socially structured experiences of both stress and recovery – and the balance between them.

The second aspect of our framework is our emphasis on linking specific life conditions to specific biological processes. The notion of allostatic load is quite general; it assumes that social stressors are largely interchangeable and produce generalized effects on the body's regulatory systems. In contrast, we argue that specific social stressors are likely to produce distinct stress responses. Furthermore, we believe that knowledge of the overlying social process provides important guidance about which biological systems will be affected by a particular social stressor. Clearly, a detailed knowledge of the biological processes is critical as well. We expect that specificity will also characterize processes of recovery,

Finally, we emphasize the ways in which the links between social and biological process are mediated by psychological processes. Sociologists and demographers often leap from the social to the biological, ignoring the role of cognition and emotions. The exception is the extensive literature on "coping" which examines the ways in which individuals interpret, buffer, and respond to stressors. Here we refer not these processes of external detoxification, but to the effects on internal psychological states such as loneliness or depression.

In the second part of the paper, we will apply this framework to the specific life course phenomenon of marital biography. In previous research using a large, nationally representative data set, we established that marital biography is related to health over and above current marital status (Hughes and Waite 2004). We found that current marital status matters most for responsive dimensions of health, such as depression, and marital biography matters most for those that develop slowly, such as chronic conditions. We argued that the costs and benefits of marital events and marital relationships shape the challenges – and the opportunities for recovery -- that an individual faces over the course of his or her life. Thus for example, married people are likely to have higher household incomes than similar others, which reduces the likelihood that a married individual will experience the chronic strain of poverty. A married person has a partner to "take up the slack" when he or she is ill, allowing time for rest and restoration that might not be available to a similar unmarried person. The patterning of these challenges and opportunities then has physiological consequences which are especially noticeable for conditions that develop slowly.

Although we framed our analysis with a biologically based conceptual model, we did not have biological data. In this paper we turn to a smaller scale population-based survey of a similar age group that includes biomarkers to test directly the relationship between marital

biography and biological measures of chronic stress and recovery.

We organize our analysis around three research questions that emerge directly from our conceptual framework. First, do the restorative behaviors that are associated with marriage mask some of the longer term effects of marital history? In other words, are the effects of marital biography on health more pronounced once we control for current restorative behaviors, such as sleep quality, exercise and diet? Second, based on what we know about the social pathways through which marriage affects health and our current understandings of the biological processes of stress and recovery, what biomarkers do we expect to be associated with marital biography? Moreover, social research has shown that marriage benefits health through different social pathways for men and women. For example, women gain from the increased income of the married state, while men benefit from a healthier lifestyle. These differences suggest that the underlying biological processes will differ by gender. Finally, we examine the role of psychological mediators, such as perceived social isolation and depression in the link between marital biography and chronic stress biomarkers. As noted, above, we do not refer to coping mechanisms, but to the effects that marital biography has on underlying, generalized psychological orientations.

We will answer these questions using data from the first year the Chicago Health, Aging, and Social Relations Study (CHASRS), a longitudinal, population-based study of persons born between 1935 and 1952. The aim of CHASRS is to examine the social, psychological and biological aspects of social isolation and health. The target population was White, Black and Hispanic persons between the ages of 50 and 67 living in Cook County IL who were sufficiently ambulatory to come to the University of Chicago for a daylong visit to the laboratory. The sample was selected using a multistage probability design in which Blacks and Hispanics were oversampled and gender equality maintained. First, a sample of

households was selected; then sampled households were screened by telephone for the presence of an age-eligible person. Age-eligible persons were then asked to participate in the study. If a household contained more than one age-eligible person, the person with the most recent birthday was selected. A quota sampling strategy was used to achieve an approximately equal distribution of respondents across the six gender by race/ethnic group combinations.

The response rate among eligible persons was 45%, comparable to those for other well-conducted telephone surveys.1 Considering that participation in CHASRS involved spending an entire day at the University, this response rate is remarkable. The final sample size for year 1 of CHASRS is 229. Comparisons with comparable national data show that CHASRS represents the urban population age 50-67 quite well (Hughes, Waite, Hawkley and Cacioppo 2004).

Using these data, we will construct measures of marital biography, biomarkers of chronic stress (e.g. overnight urinary epinephrine, waist-hip ratio, overnight urinary cortisol), restorative behaviors (including sleep quality, diet and exercise) and covariates (age, gender, education, race/ethnicity). We will then estimate a series of statistical models of the relationship between marital biography and biomarkers of chronic stress.

[1] This response rate assumes that households for which the presence of an eligible individual was unknown (23 percent of all households) were just as likely to contain an eligible individual as households which were successfully screened.

REFERENCES

Cacioppo, J. T., & Bernston, G. G. (in press). "The Brain, Homeostasis, and Health: Balancing Demands of the Internal and External Milieu." In *Oxford Handbook of Health Psychology*, ed. H. S. Friedman, & R. Cohen Silver. New York: Oxford University Press.

Hughes, M. E., & Waite, L. J. (2004). "Marital Biography and Health at Mid Life." Under review.

Hughes, M.E., Waite, L. J., Hawkley, L., & Cacioppo, J. T. (2004). "A Short Scale for Measuring Loneliness in Large Surveys: Results from Two Populatoin Based Studies." *Research on Aging*, November.

McEwen, B., & Stellar, E. (1993). "Stress and the Individual:Mechanisms Leading to Disease." *Archives of Internal Medicine*, 153 (September), 2093-2101.

Singer, B., & Ryff, C. D. (1999). "Hierarchies of Life Histories and Associated Health Risks." In *Socioeconomic Status and Health in Industrial Nations*, ed. N. Adler, & M. Marmot. Annals of the New York Academy of Sciences Volume 896. pp. 96-115.

Hayward, M. D., & Gorman, B. K. (2004). "The Long Arm of Childhood:The Influence of Early Life Social Conditions on Men's Mortality." *Demography*, 41(1), 87-107.

McDonough, P., & Berglund, P. (2003). "Histories of Poverty and Self Rated Health Trajectories." *Journal of Health and Social Behavior*, 44, 198-214.

Seeman, T. E., Singer, B. H., Ryff, C. D., Love, G. D., & Levy-Storms, L. (2002). "Social Relationships, Gender, and Allostatic Load Across Two Age Cohorts." *Psychosomatic Medicine*, 64, 395-406.

Weinstein, M., Goldman, N., Hedley, A., Yu-Hsuan, L., & Seeman, T. (2003). "Social Linkages to Biological Markers of Health Among the Elderly." *Journal of Biosocial Science*, 35, 433-453.