© Academy of Management Review
2008, Vol. 33, No. 1, 137–162.

POSITIVE SOCIAL INTERACTIONS AND THE HUMAN BODY AT WORK: LINKING ORGANIZATIONS AND PHYSIOLOGY

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Human physiological systems are highly responsive to positive social interactions, but the organizational importance of this finding largely has been unexplored. After reviewing extant research, we illustrate how consideration of the physiology of positive social interactions at work opens new research questions about how positive social interactions affect human capacity and how organizational contexts affect employee health and physiological resourcefulness. We also address the practical implications of integrating physiological data into organizational research. Our paper invites a fuller consideration of how employees' bodies are affected by everyday work interactions and, in so doing, encourages a stronger tie between human physiology and organizational research.

For medical researchers, the importance of understanding human physiology is obvious. After all, medical researchers' primary goal is to improve the health of patients through understanding health and disease processes. For organizational researchers, human physiology is a distant concern. We typically seek to understand social life in organizations using cognitive, affective, and behavioral explanations. To the extent that organizational researchers do focus on physiology, we tend to use physiological markers as indicators of job stress and strain (Cooper, Dewe, & O'Driscoll, 2001; Karasek & Theorell, 1990).

In this paper we argue that human physiology deserves greater attention in organizational research. Our physiological systems are constantly shifting and adjusting to the social world, yet the organizational importance of this finding largely has been unexplored. We bring together unfamiliar physiological research and familiar organizational theories to propose a new agenda in organizational research. Positive social interactions provide the bridge between these two research areas. Specifically, we build on twenty years of research to show that positive social interactions at work have beneficial physiological effects. We propose pathways through which the physiology of positive social interactions builds human capacity and pathways through which organizations shape the physiology of employees by creating, facilitating, or minimizing opportunities for positive social interactions.

This effort is consistent with organizational scholars who call for a focus on specific aspects of human physiological responses (Wright & Diamond, 2006), with researchers who want a more holistic treatment of leaders and employees (Boyzatis, Smith, & Blase, 2006), with sociologists who are trying to bring the biological body into the study of sociology (Fitzhugh & Leckie, 2001; Freund, 1988), and with economists who are trying to understand the microprocesses of decision making (Breiter, Aharon, Kahneman, Dale, & Shizgal, 2001; Platt & Glimcher, 1999). All of these researchers see scholarship that does not take physiological processes

We thank Rita Benn, Ruth Blatt, Marlys Christianson, Cedric de Leon, Adam Grant, Andy Molinsky, Ryan Quinn, and Scott Sonenshein for comments on earlier drafts of this paper, and Grace Chen for help in preparing the manuscript. We also thank Art Brief and three anonymous reviewers whose comments contributed to the quality of our arguments. In addition, we thank the Faculty Scholars Program in the Center for Integrative Medicine at the University of Michigan for its support. Amy Saunders and Cara Sandelands provided assistance in many ways. We presented an earlier version of the paper at the 2003 annual meeting of the Academy of Management, in Seattle.

into account as incomplete and see promise in bringing the body back into accounts of social life.

Our perspective builds on the established and relatively simple linkage between individuals' experience of positive social interactions and salutary physiological processes and establishes its relevance to organizational contexts. This paper provides evidence that people's subjective experience of their connections with others has immediate, enduring, and consequential effects on their bodies. This focus adds a critical new dimension to understanding why and how social interactions matter for individual and organizational functioning. It documents and explains the variety of ways that social interactions with others leave lasting imprints through how they affect the functioning of key bodily systems. In this way, our focus on the body as physiology affirms the fundamentally important effect of work contexts—for better or for worse. We see this depiction as a theoretical and practical view that more completely recognizes employees' embodied existence as a complicated and consequential bearer of the effects of organizational systems and the social interactions they cultivate.

The paper is organized around four questions germane to organizational research. The first is "What do we know about the physiological effects and correlates of positive social interactions at work?" The vast majority of physiological studies of social interactions focus on marital relationships, caregivers of chronically ill patients, and people recovering from a major health event (such as a heart attack), or they take place in lab settings (Uchino, Cacioppo, & Kiecolt-Glaser, 1996). Yet there are important differences between these contexts and social interactions at work. Workplace social interactions tend to be more instrumental, less discretionary, and more short-lived than many of the relationships studied by health researchers (Duck, 2007). Thus, answering this question is a critical first step.

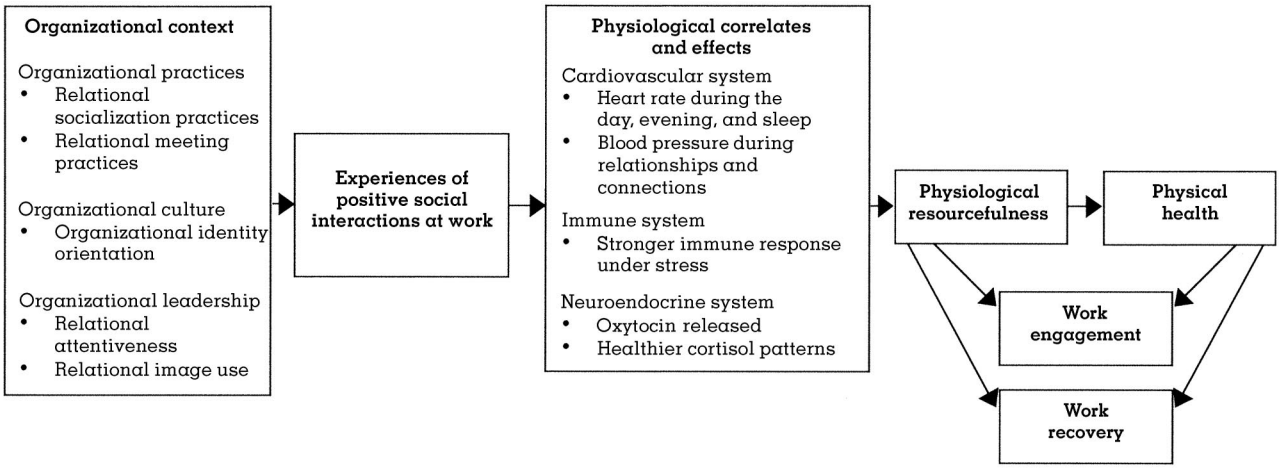
Second, we ask, "What do the findings about the physiological correlates and effects of positive social interactions contribute to organizational research?" Medical researchers and health psychologists' interests in these findings are tied to their disciplinary focus on disease prevention and health promotion. In sociology, the study of physiological functioning is more controversial (Freese, Li, & Wade, 2003). For organizational scholars, the theoretical implications are only beginning to be discussed outside of the stress paradigm (e.g., White, Thornhill, & Hampson, 2006). We argue that a focus on the physiology of social interactions provides theoretical room for broader consideration of the body. Most of our theories assume that workers are "bodiless" (Acker, 1990; Hassard, Holliday, & Wilmott, 2000) or that the body is under the control of the mind (Joas, 1996). The result is that we don't know very much about how the body contributes to human action and capability. Conceptualizing the body as a physiological system that can create physiological resourcefulness and physical health provides one way of theorizing the body not as a burden but as a valuable resource and potential source of agency (Heaphy, 2007).

The third question is "How can organizational scholars contribute to physiological research?" One limitation of the research so far is a lack of attention to the social and cultural contexts in which social interactions occur (Uchino, 2004). Organizational scholars have a wealth of theories that speak to how organizational contexts shape our relationship experiences. We build on research on organizational practices, culture, and leadership behavior to illustrate organizational scholars' potential contributions to this interdisciplinary conversation. The research agenda we suggest stands in contrast to scholars who draw on evolutionary psychology. Instead of conceptualizing physiological processes as shaped by the evolutionary past (Freese et al., 2003; Ilies, Arvey, & Bouchard, 2006), we focus on the more local, social construction of physiological resources and physical health.

Finally, we ask, "What are the practical and methodological implications of integrating physiological measures into our research?" Understanding physiology and how to measure it is not typically part of organizational researchers' toolbox. We provide a brief overview of some general properties of physiology and suggest that organizational researchers begin by collaborating with experts in other disciplines to conduct this interdisciplinary research.

The principal contributions of this paper are to assemble and critically review organizationally relevant empirical literature, to identify how organizational researchers can both learn

FIGURE 1
The Physiology of Positive Social Interactions at Work



from and contribute to research on the physiology of social interactions, and to introduce basic measurement principles involved in conducting physiological research. Overall, this paper depicts a novel view of organizational life as physiologically embodied. The model for our arguments is presented Figure 1.

THE PHYSIOLOGY OF POSITIVE SOCIAL INTERACTIONS AT WORK

Key Assumptions

Our paper builds on the robust finding that social relationships have significant effects on human health[1] (Seeman & McEwen, 1996). We focus specifically on positive social interactions at work because recent research has shown that positive and negative relationships function through bivariate, not bipolar, processes. Positive social interactions are *appetitive*, characterized by the pursuit of rewarding and desired outcomes, whereas negative ones are *aversive*, characterized by unwelcome and punishing outcomes (Reis & Gable, 2002). This means, for example, that the psychological experiences of positive social interactions, such as mutuality and growth (Miller & Stiver, 1997), are not the opposite of the experiences of negative ones, such as jealousy and isolation (Cacioppo et al., 2002; Fleischmann, Spitzberg, Andersen, & Roesch, 2005). Instead, these psychological experiences of relationships are characterized by different eliciting conditions, mechanisms, and outcomes.[2] Putting the appetitive and aversive processes together, we assume that people view their encounters at work as positive, negative, neutral, or ambivalent (Uchino et al., 2001). Within this framework, a focus on positive social interactions can obviously only tell one part of the story. Therefore, we see this paper as one important first step.

Throughout the paper we use the terms *connection* and *relationship* to refer to specific types of social interactions. A connection is the microunit of a relationship. It implies that two people have interacted and are mutually aware of the interaction (Dutton & Heaphy, 2003; Miller & Stiver, 1997).[3] Connections vary in length, lasting one moment or many, and they may be re-

[1] Social relationships are an independent predictor of human health, even when controlling for stressful events, depression, and health-related behaviors such as smoking, exercise, and diet (Seeman & McEwen, 1996; Uchino, Holt-Lunstad, Uno, & Flinders, 1996).

[2] While we have illustrated this perspective with psychological examples, there are physiological parallels (Gable, Reis, & Elliot, 2003).

[3] We also use the word "connection" differently than Jean Baker Miller and colleagues, who define connections as positive and growth fostering (Miller, 1988; Miller & Stiver, 1997). This allows for the possibility that connections can be growth fostering (life giving) or growth depleting (life depleting).

curring (Berscheid & Lopes, 1997). When connections between two people recur, they are often called relationships (e.g., Gutek, 1995). The value of discussing connections as well as relationships is that connections suggest that brief encounters with another person can be consequential moments of interpersonal contact. This, in turn, allows us to attend to the body's "exquisite responsiveness" to positive connections (Seeman, 2001: 204). In the studies we review, researchers assess both connections (e.g., participants evaluate the quality of a particular interaction with a work colleague) and relationships (e.g., employees rate the overall quality of their relationships with their supervisor).

Key Definitions and Distinctions

A key term in our argument is *physiological resourcefulness,* a form of positive health in which the body can build, maintain, and repair itself during times of rest and can more easily deal with challenges when they occur (Epel, McEwen, & Ickovics, 1998). We argue that positive social interactions build people's physiological resourcefulness by fortifying the cardiovascular, immune, and neuroendocrine systems. Over time, the physiological resourcefulness created in positive social interactions contributes to better physical health through individual physiological pathways, as well as in combination, since many diseases affect multiple systems. This argument is related to but distinct from both existing physiological constructs and the literature on social support.

Physiological constructs. Physiological resourcefulness builds on previous work on allostatic load (McEwen, 1988), physical thriving (Epel et al., 1998), and physiological toughness (Dienstbier, 1989). All four constructs document how people's life experiences shape the capacity of key physiological systems, which, over the long term, affect physical health. However, three of the constructs (allostatic load, physical thriving, and physiological toughness) focus on individuals' responses to stress, with a particular focus on how particular types of stress (e.g., acute versus chronic) or cognitive appraisals of stress (e.g., challenge versus threat) lead to more or less resilient physiological responses. In contrast, stress is not a necessary condition for physiological resourcefulness. It can be built directly through exposure to positive social interactions. Theoretically, this allows us to understand a broad range of relational settings (e.g., mentoring, collaboration), which may or may not be stressful.

Social support. Our argument is also distinct from the social support literature, which suggests two ways in which positive social interactions affect health. Proponents of the "main effect" model argue that positive connections affect health by prompting the exchange of resources or increases in healthy behaviors (Uchino, 2004). In contrast, our argument suggests that positive connections directly impact the body's physiological resourcefulness. This means that physiological changes can be created in interactions, without prompting a change in access to external resources (e.g., emotional or instrumental support) or a change in healthy behaviors (e.g., increases in exercise or eating more nutritious meals).

Proponents of the second social support model argue that having social support promotes health by protecting people from stress. There are two major mechanisms in this account. First, social support changes how individuals view stressful stimuli (e.g., seeing a disease as a challenge as opposed to a threat), and, second, it provides instrumental resources that allow a person to cope with the stressful situation (Cohen & Willis, 1985; Uchino, 2004). While the argument we develop here does not rely on stress as a necessary condition for physiological resourcefulness, we suggest that the physiological strengthening that occurs in positive social interactions improves individuals' responses to a stressor.

Scope of the Reviewed Studies

Study settings. To the best of our knowledge, this is the first paper to focus solely on the physiology of social interactions at work. As we stated earlier, most studies focus on nonwork contexts. To capture relevant findings, we selected studies measuring actual work connections and, in three cases, lab settings approximating them. We located these studies through the ancestry method, expert recommendations, and literature searches in psychological, business, and medical databases.

Physiological systems. To understand how positive social interactions at work effect physiological functioning, we examine three major

TABLE 1
Cardiovascular Studies with Relationship Measures and Day and Evening Cardiovascular Measures

Study	Work Context and Participants	Positive Relationship Construct and Measure	Physiology Measure	Results
Undén, Orth-Gomér, & Elofsson (1991)	148 members of 7 occupational groups (31 women): physicians, teachers, musicians, police officers, train engineers, prison personnel, saw mill workers	5 items intended to operationalize a three-part definition of SS (high-quality relationships with coworkers, good working environment, strong group cohesion): "I have a good relationship with supervisor," I am getting on well with my coworkers," "There is a pleasant atmosphere at my workplace," "There is good group cohesion at my workplace," "There are often conflicts and arguments at work" (no Cronbach's α provided)	SBP, DBP, HR measured every 5 minutes for 24-hour period, including one normal workday	• Higher perceived SS associated with lower HR during work, leisure, and sleep; SBP not associated with SS • Subjects with low SS had higher SBP than those with high or mid levels of support
Ituarte, Kamarck, Thompson, & Bacanu (1994)	120 employees of universities, hospitals, city and county offices, and private firms in the Pittsburgh metropolitan area (26 black men, 30 white men, 34 black women, 30 white women)	6 items for coworker and work supervisor support with SS subscale of Job Content Questionnaire (Karasek, Gordon, Pietrovosky, & Frese, 1985). Items not specified (Cronbach's α = .84); source of support not separated in analysis	24-hour ambulatory SBP, DBP, HR on one normal workday. *Dependent variable:* nocturnal dipping, calculated by subtracting nighttime BP from daytime BP; higher scores indicate greater dipping	In partial correlation analysis, greater work SS was significantly associated with nocturnal systolic dipping; no difference in work SS between black and white participants (researchers' interest was in racial differences, so no further analysis was conducted on work SS)
Landsbergis, Schnall, Warren, Pickering, & Schwartz (1994)	262 men at 8 New York City work sites	4 items for coworker support (competent coworkers, friendly coworkers, coworkers helpful in getting the job done, coworkers taking a personal interest in me) and 4 items for supervisor support (supervisor getting people to work together, supervisor helping get the work done, supervisor paying attention to what I am saying, supervisor concerned about welfare of those under him or her). Based on modified Job Content Questionnaire (Karasek et al., 1985). (Cronbach's α = .70); source of support not separated in analysis	24-hour ambulatory SBP and DBP on one normal workday	• High SS did not have a main effect on SBP or DBP; did not report HR • High SS had mild but inconsistent effects under high job strain conditions
Evans & Steptoe (2001)	61 nurses and 32 accountants (53 women)	Replication of Undén et al. (1991); see summary above (Cronbach's α = .76)	HR, SBP, and DBP measured five times during the day and evening with self-monitoring equipment, on three normal workdays and two leisure days	High SS associated with lower HR during day and evening of workdays; not related to SBP and DBP
Rau, Georgiades, Fredrikson, Lemne, & deFaire (2001)	75 working men with borderline hypertension from small Swedish town; 74 age-matched healthy controls	4 items regarding the possibility of interacting with coworkers and habit of seeing colleagues outside of work. No further information provided (no Cronbach's α provided)	SBP, DBP, HR measured every 15 minutes for 24 hours on one workday	High SS related to lower HR at work, night, and during recovery at night; SBP and DBP not related to SS; effects did not differ by hypertension status

Note: SS = social support; SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate; BP = blood pressure.

physiological systems: cardiovascular, immune, and neuroendocrine. While physical health and disease are likely created through multiple physiological systems, these three are the most frequently studied. Each section begins with a brief overview of the system and then describes what existing research can tell us about the physiological correlates and effects of positive social interactions at work.

Social interaction measures. The studies we review measured social interactions in a variety of ways, reflecting the diversity of the researchers. We include every study measuring the physiological effects of the *quality* of social relationships and connections. Common measures include individuals' perceptions of emotional support, social closeness, high-quality relationships, or positivity of the interaction (details can be found in Tables 1 through 4). All of the studies cited used a definition that falls under the broad definition of positive connections subjectively perceived as rewarding or desirable in some way, and all of them focused on one person's perception of the interaction.

The nine cardiovascular studies assessed work relationships or connections in naturalistic settings, whereas the two immune studies were set in naturalistic contexts but measured only work relationships. In our review of the neuroendocrine system, we report on three lab studies that modeled work contexts, and a fourth in a naturalistic context. All of the naturalistic studies used self-report measures of social interactions, consistent with our emphasis on individuals' experiences of connection quality. In contrast, the three lab studies manipulated social interaction quality. With the exception of the three lab studies, the reviewed research allows us to identify significant associations but does not support causal claims.

Protective Cardiovascular Effects During and After Work

Cardiovascular overview. The cardiovascular system's major pump (the heart) and distribution system (e.g., veins, arteries, and lymphatics) are responsible for distributing nutrients (i.e., oxygen) and removing waste (i.e., carbon dioxide) from every cell in the body. The studies we review in this section relied on three cardiovascular measures: systolic blood pressure, diastolic blood pressure, and heart rate. Blood pressure (BP) and its components, systolic and diastolic blood pressure (SBP and DBP, respectively), are of interest because they have been linked to cardiovascular disease (CVD), hypertension, and other cardiovascular illnesses. SBP is considered a more reliable predictor of cardiovascular disease than DBP (Asmar, Darne, el Assaad, & Topouchian, 2001) because it is regulated by the sympathetic nervous system (SNS), which governs the body's "fight or flight" response to stress. Heart rate (HR) is also commonly measured, with elevated HR linked to cardiovascular health risks, such as plaques in the carotid artery (Asmar et al., 2001). However, HR is a more difficult variable to interpret because it is governed by both the SNS and the parasympathetic nervous systems (PNS). Therefore, the underlying causes and consequences of HR are more difficult to determine.

Tables 1 through 3 reflect all the studies that, to our knowledge, measure positive social interactions and cardiovascular activity according to current methodological standards. Ambulatory blood pressure (ABP)—readings obtained at regular intervals during everyday life—are particularly strong predictors of future cardiovascular problems (Uchino, 2004), in part because they are more reliable than one-time measures. By looking at cardiovascular patterns over time, researchers can make stronger claims about the links between social interactions and the cardiovascular system. The studies in each table are categorized by the duration of the measurement period (day only or day and night) and whether relationships or connections were measured. We excluded studies that had work-related samples but did not specifically measure work interactions (e.g., Steptoe, 2000), as well as six studies that used cardiovascular measures in ways not allowing for strong inferences (Fletcher & Jones, 1993; Houben, Diederiks, Kant, & Notermans, 1990; Kaufmann & Beehr, 1986; Lercher, Hortnagel, & Kofler, 1993; Thomas & Ganster, 1995; Winnubst, Marcelissen, & Kleber, 1982).[4]

[4] These six studies assessed cardiovascular measures only once and/or outside of the course of the normal workday. Current psychophysiological methods advise against these practices, for two reasons. First, it is now known that one-time cardiovascular measures are unreliable (Semmer, Grebner, & Elfering, 2004). Second, when they are taken outside the context of one's normal environment, they are

Empirical evidence. Our review shows that positive social interactions at work have both immediate and enduring effects on the cardiovascular system, in the form of lower HR and BP. The first group of studies reported the effects of positive work relationships on cardiovascular measures taken during the day and evening (Table 1). Researchers assessed cardiovascular patterns beyond the workday to see if work relationships have lasting effects. Researchers had two strategies for studying this. Some took frequent measures beyond the workday (e.g., every twenty minutes for twenty-four hours), whereas others focused on "nocturnal dipping" (Ituarte, Kamarck, Thompson, & Bacanu, 1994)—the difference in BP during waking hours and sleep. Nondipping, or small differences, is associated with cardiovascular damage, because the cardiovascular system is working at more taxing, daytime levels for longer periods of time. It has been associated with a number of cardiovascular and circulatory problems, such as organ damage (Palatini et al., 1992; Staessen et al., 2001). Both approaches reveal the degree to which the cardiovascular system is able to recover from the day's exertions. While these researchers assessed participants' experiences of specific relationships (e.g., manager, coworker), they created composite measures of positive work relationships for analysis.

Four of five studies utilized the first strategy—frequent measures during the day and into evening hours. The three studies that reported HR found that perceptions of positive work relationships were significantly correlated with lower HR during the day and evening and, when it was measured, during sleep (Evans & Steptoe, 2001; Rau, Georgiades, Fredrikson, Lemne, & deFaire, 2001; Undén, Orth-Gomér, & Elofsson, 1991). None of the studies found a significant relationship between perceptions of positive work relationships and SBP and DBP. The fifth study in this group measured nocturnal dipping and found that greater work social support was correlated with greater nocturnal dipping (Ituarte et al., 1994).

Together, these studies provide some support for the hypothesis that when employees experience their work relationships positively, the cardiovascular system is less taxed not only at work but also into nonwork and resting times. These studies' samples drew people from multiple occupations, suggesting that this pattern is likely to be found for employees in many settings. However, none of the studies found significant results for BP. Physiologically, BP has a narrower homeostatic range than HR, meaning that the body more tightly regulates BP compared to HR. To capture BP's more subtle and fleeting changes, we may need more finely grained measures of social interactions than the general ones used in these studies. We could also be more confident of the health impact of these effects with studies that demonstrated results for BP variables. The next sets of studies address these issues.

The second group of cardiovascular studies reports on the effect of positive work relationships on cardiovascular measures during the day only (Table 2). The studies differ from the previous set in that their samples consist of one type of employee in a single organization, instead of the multiple occupations and organizations represented in the Table 1 studies. They also analyze the effect of specific positive relationships (e.g., coworker, immediate supervisor).

First, a study of New York City traffic agents revealed the relative effect of coworkers, immediate supervisors, and unit supervisors and found that not all positive relationships have cardiovascular benefits (Karlin, Brondolo, & Schwartz, 2003). For women, immediate supervisor support was associated with lower average SBP and DBP, but not HR. For men, coworker support was associated with lower average SBP level, but not DBP or HR. Under high-stress conditions, immediate supervisor support and coworker support were associated with lower SBP for both men and women. Relationships with unit supervisors never had cardiovascular effects. Second, a study of health care assistants

especially vulnerable to "whitecoat hypertension," or higher readings that result from the stress of having one's blood pressure read in, for example, a medical context (Stern, Ray, & Quigley, 2001). More recent studies guard against these two methodological weaknesses by taking an initial baseline measure as well as frequent measures over the course of the time period of interest (Semmer et al., 2004). Because these six studies do not meet these criteria, we did not include them. It is important to note that Uchino et al. (1996: 491) based their statement that work relationships may not be related to blood pressure on four of the six studies we excluded for methodological reasons. More recent studies, which we review here, have stronger research designs and provide more valid and reliable evidence that workplace social interactions are consequential for cardiovascular functioning.

TABLE 2
Cardiovascular Studies with Relationship Measures and Frequent Daytime Cardiovascular Measures

Study	Work Context and Participants	Positive Relationship Construct and Measure	Physiology Measure	Results
Karlin, Brondolo, & Schwartz (2003)	70 New York City traffic agents (36 women)	Perceived emotional support from (1) coworkers (7 items; Cronbach's α = .83), (2) immediate supervisors (16 items; Cronbach's α = .77), (3) unit supervisors (7 items; Cronbach's α = .86); based on modified Job Content Questionnaire (Karasek et al., 1985). Items included those listed in Landsbergis et al. (1994), as well as "My coworkers care about me," "The people I work with encourage each other to work together," "My supervisor gives me credit for things I do well," "My supervisor cares about me," "My supervisor appreciates me"	SBP, DBP, HR collected during one 8-hour workday; measured every 15 minutes	• For women, immediate supervisor support associated with lower SBP and DBP (not HR) • For men, coworker support associated with lower SBP level (not DBP and HR) • Under high stress conditions, immediate supervisor and coworker support both associated with lower SBP
Wager, Feldman, & Hussey (2003)	28 female health care assistants; 13 worked for two divergently perceived supervisors; 15 worked for similarly perceived supervisor	47-item supervisor interactional style. Items included "My supervisor encourages discussion before making a decision," "I am treated fairly by my supervisor" (Cronbach's α = .98). Supervisor interactional style defined as the manner in which information, meanings, and feelings are conveyed to the subordinate through the communication of both verbal and nonverbal messages; four factors of the instrument: consideration, interpersonal fairness, social maturity, empowerment	SBP and DBP measured every 30 minutes over three 12-hour periods: working with (1) favorably perceived supervisor, (2) less favorably perceived supervisor, (3) non-workday	Within-group difference: higher SBP and DBP when working for less favored supervisor compared to favored supervisor

Note: SBP = systolic blood pressure; DBP = diastolic blood pressure; HR = heart rate.

TABLE 3
Cardiovascular Studies with Connection Measures

Study	Work Context and Participants	Positive Connection Construct and Measure	Physiology Measure	Results
Brondolo et al. (2003)	104 employees or students at a New York City medical center and its affiliated school (65 women); mean age = 30 (SD = 7.70, range = 18–46)	• *Positive interactions:* participants' interaction exceeded individual's average positive intensity score (rating of interaction as pleasant, friendly, agreeable; Cronbach's α = .94) • *Negative interactions:* anger, discomfort, upset, or tension in interaction (Cronbach's α = .84)	BP and HR measured every 20 minutes throughout one workday, with participants recording information about social interactions and activities at the time of BP and HR readings (random sampling of social interactions)	• Participants averaged 16 interactions (SD = 8.13, range = 2–36) with others at time of cuff inflation • Positive interactions associated with DBP only; negative interactions associated with DBP and SBP
Holt-Lunstad, Uchino, Smith, Olson-Cerny, & Nealey-Moore (2003)	102 participants (53 women); 86 percent were employed, others were full-time students; included nontraditional college students (working and attending school); mean age = 24 (range = 18–46)	• Individuals' general feelings of positivity and negativity about interaction partner • Perceptions of interaction: positive affect, negative affect, intimacy, self-disclosure	BP 5 minutes into social interactions, in which the two people were mutually engaged with one another, on three days (approximately 12-hour days); data collection occurred on two work/school days and one non-work/school day (event-contingent sampling of social interactions)	• Participants had an average of 6.3 interactions/day including 2.14 with coworkers, .62 with boss, 13 with client or customer • Work relationships were viewed more negatively than interactions with nonwork relationships and were associated with lower positive affect, greater negative affect, lower intimacy, and lower self-disclosure • There was no significant difference between work and nonwork interactions in predicting SBP, DBP, or HR • Participants in ambivalent interactions had higher SBP and DBP, but not HR, compared to all other relationship categories

Note: BP = blood pressure; HR = heart rate; SBP = systolic blood pressure; DBP = diastolic blood pressure.

(Wager, Feldman, & Hussey, 2003) found that average levels of SBP and DBP were lower when the assistants worked for a direct supervisor whom they viewed positively compared to one they viewed negatively. This study reinforces the importance of examining the quality of relationships and not assuming that two people's structural positions within an organization are sufficient for understanding either beneficial or harmful cardiovascular effects.

The final group of cardiovascular studies provides insight into the physiological effects of connections as opposed to relationships (Table 3). In both studies participants rated the quality of specific social interactions at work. Holt-Lunstad, Uchino, Smith, Olson-Cerny, and Nealey-Moore (2003) used event-contingent sampling of social interactions over three days, where the event was any interaction over five minutes. Participants averaged 6.3 interactions

TABLE 4
Immune and Neuroendocrine Studies

Study	Work Context and Participants	Positive Connection Measure	Physiology Measure	Results
Levy, Herberman, Whiteside, Sanzo, Lee, & Kirkwood (1990)	61 breast cancer patients (from a larger sample of 120) who recently completed surgery	Perceived emotional support from family members, doctors, nurses, and others. Five sources of support considered: spouse or intimate other, family member, friend, nurse, doctor. Measure specifically designed for sample of breast cancer patients (Cronbach's α = .79 to .95)	NK cell activity	Higher perceived emotional support from spouse and doctor associated with lower NK cell lysis in cancer patients; perceived emotional support from nurse not associated with NK cell lysis
Theorell, Orth-Gomér, & Eneroth (1990)	49 subjects (10 women) from six occupations (musician, air traffic controller, physician, freight handler, waiter, mechanic)	Availability and adequacy of SS, including but not limited to work relationships (measured once and used as a constant; analysis did not separate sources of support). Based on measure by Orth-Gomér and Undén (1987)	Measures of immunoglobulin G measured four times over the course of one year (immunoglobulin G changes as a result of long-lasting stressors, not short-term ones)	Job strain (psychological demands and decision latitude) associated with higher levels of immunoglobulin G for participants with low levels of SS but not for those with intermediate or high levels of SS
Adam & Gunnar (2001)	70 middle class mothers of 2-year-old children in Minnesota	Composite measure based on four relationship measures: Adult Attachment Interview, Social Closeness Scale from the Multidimensional Personality Questionnaire, Relationship with Spouse Scale of the Parenting Stress Index; Family Supports and Stresses Scale. Combined construct defined as "the extent to which the participant tends to have positive feelings about relationships and effectively uses them for support and comfort" (p. 194)	Salivary cortisol measured six times a day for two days (from just before wake-up to just before sleep)	More positive relational functioning predicts higher morning cortisol values and steeper decline in cortisol values over the course of the day
Heinrichs, Baumgartner, Kirschbaum, & Ehlert (2003)	37 healthy men in laboratory setting; Trier Social Stress Test (5-minute mock job interview with an unknown panel, followed by 5-minute public mental arithmetic task)	Best friend providing support in preparation for task, or done alone; instructions to friend were to be as helpful as possible during 10-minute preparation for speech task and to offer both instrumental and emotional support	Intranasal OT; salivary cortisol measured a total of eight times, both before and after test	Combined SS and OT condition had lowest levels of cortisol during and after task; no SS (alone) and no OT had highest levels. When participants had SS and OT (one or both), they showed increased calmness and decreased anxiety scores during stress process; subjects without SS and with placebo experienced decreased calmness and increased anxiety
Schnorpfeil, Noll, Schulze, Ehlert, Frey, & Fischer (2003)	324 employees at a German manufacturing plant (52 women)	SS by coworker (4 items), supportive supervisor behavior (4 items) scales from larger "salutogenic subjective work analysis," or SALSA questionnaire (Rimann & Udris, 1997)	14 items to measure allostatic load, including overnight urinary cortisol excretion	Workers experiencing high SS experienced significantly lower cortisol than those with low SS
Zak, Kurzban, & Matzner (2004)	82 male and female students	• Positive social cue (trust): Investor conveyed trust to partner by choosing amount of money given to the trustee. Presumably, the trustee perceived the exhanged amount as a signal of investor's good intentions • Impersonal cue (control): Amount exchanged was publicly and randomly assigned. The trustee knew that the exchange involved no beneficent intentions	OT (plasma); blood drawn after subjects made their decision in game	• Trustee's OT levels twice as high when received social signal of trust compared to purely exchange-based relationship condition • Trustee transferred back to investor 53 percent of the money received, compared to no money in control condition
Kosfeld, Heinrichs, Zak, Fischbacher, & Fehr (2005)	121 male students in trust experiment; 61 male students in risk experiment	• Trust experiment: Participants assigned to role of "investor" or "trustee." Both are given initial amount of 12 monetary units (MUs). Investor allocates 0, 4, 8, 12 MUs to trustee. Trustee allocates amount of return to investor. Investor payoff is calculated as [initial amount transfer to trustee + amount received from trustee]. Trustee payoff is calculated as [initial amount + 3(transfer from investor) amount returned to investor] • Risk experiment: "Investor" allocates 0, 4, 8, 12 MUs to a "project." Amount returned randomly determined (not by another person). Payoff distribution same as in trust experiment • Both: Half of the participants given OT, half given placebo. Repeated four times, always with different "trustee" or "project"	Intranasal OT versus intranasal placebo (with same inactive ingredients as OT)	• OT significantly increased the amount investors transferred in trust experiment only, not in risk experiment • OT did not affect back transfer amount of trustee (in trust experiment) • Participants' optimism about outcome did not vary across conditions, so OT did not appear to affect people's beliefs about others

Note: NK = natural killer; SS = social support; OT = oxytocin.

per day, which is similar to studies using time-based definitions of interactions (Tschan, Semmer, & Inversin, 2004). Eighteen percent of total interactions involved work relationships. Analytically, the researchers were interested in finding if work and nonwork relationships affected cardiovascular rates differently; they did not. Brondolo's et al.'s (2003) study of social interactions of employees and students at a medical center is more illuminating for our purposes. Their analysis was based on a random sampling of cardiovascular measures throughout one workday, and participants averaged sixteen interactions per day (at the time of cuff inflation). These researchers found that positive connections were associated with lower SBP and DBP, compared to negative ones.

Taken together, the cardiovascular studies provide evidence from a variety of contexts that positive relationships at work have both immediate (Table 2) and enduring (Table 1) effects on the cardiovascular system. Research on the effects of positive connections (Table 3) was less clear, with one of two studies providing evidence that positive connections affect BP. From a measurement perspective, it is important to note that studies that assessed specific relationships were associated with BP, which is more clearly linked to health outcomes than HR. This suggests that, in future work, measures of specific interactions may capture more powerful evidence for the relationship between positive social interactions on physiological resourcefulness and health.

Strengthening the Capacity of the Immune System

Immune overview. The immune system defends the body against such challenges as disease and tissue damage (Cacioppo, Bernston, Sheridan, & McClintock, 2000). The study of the psychological modulation of the immune system is a field called psychoneuroimmunology (PNI). PNI researchers typically study health-related outcomes, such as the rate of wound healing, or the mechanisms underlying those outcomes, such as testing how specific immune cells, proteins, or functions respond to challenges like exposure to a virus (Kiecolt-Glaser & Glaser, 1995; Kiecolt-Glaser, McGuire, Robles, & Glaser, 2002). One of the most robust findings of PNI is that positive social relationships can strengthen the immune system (Kiecolt-Glaser et al., 2002; Uchino et al., 1996).

Empirical evidence. Two studies[5] focus on the link between quality of work relationships and the immune system (Table 4). Levy et al. (1990) found that breast cancer patients recovering from surgery had healthier immune responses when they gave higher ratings of emotional support to their doctor and their spouse, whereas the ratings of nurses did not show significant effects. While this is not a study of employees, doctors and nurses do have a form of working relationship with patients. Theorell, Orth-Gomér, and Eneroth (1990) found that workers' immune systems were buffered from the immunological effects of job strain when they viewed their social support as adequate, but not when they viewed their social support as inadequate.

Consistent with studies of nonwork relationships (Uchino et al., 1996), both studies suggest that positive connections strengthen the immune system during periods of acute and chronic stress. But there are a number of unanswered questions that future research can address. First, the two studies discussed here illustrate only the buffering effects of positive social interactions, or how social interactions protect against the deleterious effects of significant stress on immune functioning. Future research is needed to determine whether work relationships also have direct physiological effects (outside the context of a challenge) on immune functioning. Second, because both studies measured relationships, not connections, they can only inform us about the physiological effects of more enduring positive relationships. However, the immune system is responsive to short-term stressors of as little as five minutes (e.g., giving a speech in front of strangers; Segerstrom & Miller, 2004), so future research may be able to capture immune strengthening of shorter positive connections. Finally, like the cardiovascular studies, the study of breast cancer patients provided additional evidence that not all work relationships are associated with physiological outcomes.

[5] We excluded Jemmott and Magloire (1988) because of questions about the methodology previously identified by Stone, Cox, Vladimarsdottir, and Neale (1987) and Herbert and Cohen (1993).

Healthier Patterns of Neuroendocrine Response

Neuroendocrine overview. The neuroendocrine system refers to the interactions between the nervous system and the hormones of the endocrine system. Researchers in this area seek to understand the functions, distribution, and effects of these biologically active agents (Snowdon & Ziegler, 2000). The neuroendocrine system helps activate a number of other physiological processes, including the immune and cardiovascular systems. Social scientists are particularly interested in the neuroendocrine system because hormones are highly responsive to the quality of social relationships (Seeman & McEwen, 1996) and have effects on behavior (Lovallo & Thomas, 2000). The existing neuroendocrine research related to work relationships focuses on oxytocin (OT) and cortisol. We do not address the other hormones that have been studied in relation to a broader set of human relationships, such as marital relationships (Kiecolt-Glaser, Bane, Glaser, & Malarkey, 2003; Kiecolt-Glaser & Newton, 2001).

All hormones have multiple physiological functions. It is the patterns and proportionality of their response that can have health-enhancing or -damaging effects (Epel et al., 1998). For example, cortisol is released when people experience certain types of psychological stress, and it then breaks down stored sugars (glucogenesis) and suppresses some anabolic processes (e.g., growth and digestion). A healthy response to stress includes both a spike in cortisol and a return to baseline levels, a process governed by other hormones. Both cortisol under- and overactivity are associated with health outcomes (Adam & Gunnar, 2001; Dickerson & Kemeny, 2004).

Researchers studying positive social interactions are particularly interested in the neuroendocrine system because of recent research that shows that the neuropeptide OT may be an important physiological substrate of affiliation behaviors (Carter, 1998), increasing social behaviors and attenuating hormone responses (e.g., cortisol) to stress (DeVries, Glasper, & Detillion, 2003). OT has been featured in many prominent social and medical scientists' theories of social interactions, including theories of love (Carter, 1998; Porges, 1998), maternal and mate attachment (Bartels & Zeki, 2004; Insel, 2000), adult attachment and affiliation (Henry & Wang, 1998), positive social interactions (Uvnäs-Moberg, 1998), and Taylor's (2002) tend-and-befriend stress response theory. Although it was previously thought of as a "women's hormone" because of its role in such female reproductive processes as birth and lactation, it is found in both men and women, and recent research has shown that it is associated with a broad array of social activities, including social elements of learning and memory (Engelmann, Wotjak, Neumann, Ludwig, & Landgraf, 1996; Ferguson, Young, & Insel, 2002).

In spite of OT's promise, we are only beginning to understand how to measure and study OT in humans. No reliable salivary measure has been developed thus far (Horvat-Gordon, Granger, Schwartz, Nelson, & Kivlighan, 2005), making expensive and intrusive blood sampling a necessity for measuring OT.[6] As a result, most of the studies to date have relied on animal samples. Given these challenges, the only studies of OT applicable to work connections have taken place in lab settings. In addition, theoretical interest in neuroendocrine responses arose from studies of the human stress response, with a tendency to view social relationships as an evolutionary means for ensuring species survival and reproduction. These theories focus on romantic, reproductive, or parental relationships. Therefore, importing these theories and their evolutionary logic into the study of relationships at work should be done with caution (Newton, 2003).

Empirical evidence. Neuroendocrine studies relevant for positive social interactions focus on the hormones OT and cortisol. We include three lab experiments because they modeled organizationally relevant social interactions. Two studies used a paradigm from experimental economics designed to learn about trust and reciprocity in exchange relationships. In this paradigm, one person plays the role of "investor" and the other the "trustee." Both people are given an initial sum of money. Only one exchange is

[6] OT can be introduced intranasally, a technology that was developed to stimulate labor and induce lactation in women. Manufactured by Novartis, it is not available in the United States. It is rarely used to manipulate OT levels for research because of disagreement about whether intranasal OT functions in the same way as OT released naturally in the brain (for a discussion of these issues, see Born et al., 2002; Carter & Altemus, 1997; Stockhorst & Pietrowsky, 2004).

made in any investor-trustee dyad, with the investor making the first move. Any money the investor allocates to the trustee will triple; the trustee then has the choice of returning any amount of money (including zero) to the investor. Each person then keeps any remaining money. (See Table 4 and Berg, Dickhaut, and McCabe [1995] for more details.)

Zak, Kurzban, and Matzner (2004) used this paradigm to examine the effects of positive social cues of trust on trustees' OT levels. They found that when trustees received a positive social cue from an investor, their OT levels were twice as high as trustees who received an impersonal cue. Even though trustees in both the positive and impersonal conditions received (on average) the same amount of money from their investor partners, trustees in the positive social cue/high OT group returned 53 percent of the money they had received, whereas the impersonal cue group returned zero. This suggests that even momentary positive connections have consequential behavioral, as well as neuroendocrine, effects.

Kosfeld, Heinrichs, Zak, Fischbacher, and Fehr (2005) used the same paradigm but made two important modifications. First, investors allocated money either to a trustee (which they called the "trust" version) or to a "project" (the "risk" version). Both the trust and risk versions provided equal opportunity for profit, but in the "project" condition, the investor's return on investment was randomly determined. Second, these researchers manipulated OT levels, with half of the participants receiving intranasal OT and the other half receiving an intranasal placebo. The results showed that OT significantly increased the amount investors transferred to trustees in the trust experiment, but not in the risk experiment. Participants in both conditions had similar mood and calmness measures before and after the administration of OT, which suggests that OT does not have general psychological and behavioral effects but, instead, operates specifically in the context of social interactions.

It is important to note that Kosfeld and colleagues found that intranasally administered OT did not affect trustees' behavior; in both the OT and placebo conditions, trustees returned the same amount of money to investors. Thus, these researchers claim that OT does not affect reciprocity. The most likely explanation for these contradictory findings is that the researchers did not take into account the natural increase in OT levels that we saw in Zak et al.'s study, in which trustees' OT levels increased simply as a result of receiving an initial amount from the investor. If that is the case, then it is not surprising that the experimentally induced OT would fail to have an effect. In fact, *all* trustees' OT levels may have been saturated. However, replication and more detailed testing of mechanisms underlying these effects can resolve these discrepancies.

In a third experiment using a different paradigm, men were asked to give a mock job interview to a panel of unfamiliar interviewers (Heinrichs, Baumgartner, Kirschbaum, & Ehlert, 2003). This study was a 2 (alone versus emotional and instrumental support from a best friend) $\times$ 2 (intranasal OT versus placebo) design. The dependent variable was cortisol level, which is a marker of stress and SNS activation. The researchers found that both OT and social support independently decreased cortisol levels, increased calmness, and decreased anxiety. When OT and social support were combined, the effects on cortisol were amplified, providing support for the argument that OT is a mechanism through which positive social interactions build health by decreasing cortisol levels during stress.

Two studies have addressed the link between positive social interactions and cortisol's diurnal patterns. Health outcomes are associated with the degree to which one's cortisol levels follow the normal pattern (high before waking, low from evening to 2 to 3 a.m.; Adam, 2005; Antoni, 1987; Lovallo & Thomas, 2000). First, Adam and Gunnar (2001) looked at the effect of relationship functioning and home and work demands on the cortisol levels of seventy mothers of toddlers. They created a composite measure of general relationship functioning based on four qualitative and quantitative measures. However, the measures did not focus explicitly on work relationships, so this only has suggestive implications for the neuroendocrine effects of work relationships. The researchers found that higher scores on positive relationship functioning, as well as lower numbers of children and fewer hours of work, were associated with healthier cortisol rhythms. A second study of German workers found that those workers experiencing high social support had healthier cor-

tisol patterns compared to those with low social support (Schnorpfeil et al., 2003).

Together, these five studies suggest that positive social interactions have beneficial effects on neuroendocrine functioning, either through the release of OT or through contributing to healthier diurnal cortisol response, and these effects, in turn, are associated with better physical health. The OT findings also point toward intriguing physiological mechanisms of trust and reciprocity. While this research confirms the general theories about the benefits of positive social interactions on neuroendocrine functioning, future research will have to answer questions about the relative contribution of work relationships and determine the mechanisms that underlie these effects.

Summary

Collectively, this review illustrates humans' exquisite physiological responsiveness (Seeman, 2001) to positive social interactions at work. The cardiovascular studies provide evidence that positive work relationships are associated with decreases in cardiovascular reactivity at work and beyond. Over time, elevated HR and BP can have serious effects on cardiovascular health (Uchino, 2004). Positive work relationships appear to strengthen the immune system by bolstering components of immune response. Because the immune system is always alert for challenges, such as viruses, the strength of the immune system can have effects on short- (Kiecolt-Glaser, Garner, Speicher, Penn, & Glaser, 1984) and long-term health (Esterling, Kiecolt-Glaser, Bodnar, & Glaser, 1994; Kiecolt-Glaser et al., 2002). The neuroendocrine studies suggest that positive work relationships contribute to healthier hormone patterns. Positive social connections appear to prompt the release of OT, which has been shown to have short-term effects on attenuating hormonal reactions to stress and long-term effects on anabolic processes such as growth (Uvnäs-Moberg, 1998). The cortisol findings suggest that positive relationships contribute to more proportional responses to stress and build long-term reserves of health. In the next sections we consider the implications of these findings for organizational research.

CONTRIBUTIONS TO ORGANIZATIONAL RESEARCH

Our review reveals that experiences of positive social interactions at work directly affect the body's physiological processes. The focus on the physiology–social interaction link helps us see health not as a gross outcome measured in days absent or health care costs (Danna & Griffin, 1999) but as momentary ebbs and flows that can be built up or whittled down through social interactions. This suggests that health can be strengthened or weakened across multiple interactions and that this process occurs over time (Epel et al., 1998). Organizational research currently lacks a way of capturing this form of health.

To capture this more finely grained form of health, we propose that positive social interactions build people's physiological resourcefulness by fortifying the cardiovascular, immune, and neuroendocrine systems through immediate and enduring decreases in cardiovascular reactivity, strengthened immune responses, and healthier hormonal patterns. As we argued above, these physiological responses increase the body's ability to build, maintain, and repair itself during times of rest and to deal more easily with challenges when they occur. Over time, the physiological resourcefulness created in positive social interactions contributes to better physical health through individual physiological pathways as well as in combination, since many diseases affect multiple systems. To illustrate how physiological resourcefulness can contribute to organizational research, we use the examples of work recovery and engagement.

Work Recovery

Recent research has shown that relationships are one key pathway through which work and nonwork domains influence one another (e.g., Greenhaus & Powell, 2003), yet organizational researchers have overlooked the physiological substrates of relationships. Considering the physiological effects of work relationships provides us with a new window into understanding why and how work and nonwork contexts affect one another. We can see this through research on work recovery.

Recovery refers to the process by which an individual's functioning returns to its pre-

stressor levels and the experience of strain is reduced (Sonnentag & Natter, 2004). Work recovery focuses specifically on employees' recovery from the workday during evening hours, and it is an important window into understanding how to prevent depletion from work (Rothbard, 2001; Sonnentag, 2001). Studies have shown that lack of work recovery results in more health complaints and absence due to sickness two years later (DeCroon, Sluiter, & Frings-Dresen, 2003; Elfering, Grebner, Semmer, & Gerber, 2002; Jansen, Kant, & van den Brandt, 2002; Sluiter, Van der Beek, & Frings-Dresen, 1999). One study found that cortisol levels during work recovery were related to subsequent health care costs, while cortisol levels during work were not (Ganster, Schaubroeck, Sime, & Mayes, 1991), suggesting that the physiological factors contributing to work recovery contribute to physical health over the long term.

Workplace social interactions, and their physiological correlates, have not yet been studied in this literature (Sonnentag & Fritz, 2006). However, the studies reviewed here suggest that positive social interactions play an important role in the physiological basis of work recovery. First, the cardiovascular studies summarized in Table 1 suggest that when people experience positive social interactions at work, their cardiovascular systems are more likely to return to resting levels after work. Second, the cortisol study of working mothers found that positive relationship functioning is associated with healthier cortisol rhythms, which includes the recovery time after work (Adam & Gunnar, 2001). This suggests that positive social interactions at work leave a lasting physiological imprint, one that affects people after they have left work.

> *Proposition 1: The physiological resourcefulness generated during positive social interactions facilitates the work recovery process and, over time, contributes to better physical health.*

Engagement

Engagement describes a form of intentional participation and involvement in a work role (Adam, 2005; Benner, 1984, 2000; Kahn, 1990; Rothbard, 2001). People experience moments of engagement or disengagement in their work roles throughout each day (Britt, Dickinson, Greene, & McKibben, 2007; Kahn, 1990). Engagement requires effort (Nes, Segerstrom, & Sephton, 2005) or vigor (Schaufeli & Bakker, 2004). One antecedent of engagement is the availability of resources, including physical or bodily resources (Kahn, 1990; Loehr & Schwartz, 2003). Researchers have considered how physical resources can be depleted from working in a taxing environment, such as under the hot sun (Kahn, 1990) or under stressful conditions (Frankenhaeuser, 1978), and can be replenished through exercise regimens (Loehr & Schwartz, 2003; Sonnentag & Natter, 2004).

We propose that the physiological resourcefulness and physical health generated in positive social interactions are an additional bodily source of engagement at work. As the studies have shown, positive social interactions have both immediate and enduring effects on physiological functioning. This physical strengthening builds up a foundation for engagement, supporting the body's ability to expend effort, adapt to changing circumstances, and utilize energy efficiently (Epel et al., 1998). The research reviewed from all three physiological systems also suggests that positive social interactions contribute to less physiologically taxing experiences of stress. This suggests, therefore, that when people experience positive social interactions at work, they have a stronger physiological foundation for the effort needed to engage in their work role.

> *Proposition 2: The physiological resourcefulness generated in positive social interactions contributes to higher levels of physiological resources for engagement in a work role.*

These two examples illustrate the potential theoretical contributions of considering the physiological correlates and effects of positive social interactions at work. Physiology has primarily been incorporated into stress research, in which scholars view physiology primarily as a dependent variable—one that is negatively affected by workplace experiences (Cooper et al., 2001). In contrast, we suggest that physiological variables can measure the construct of physiological resourcefulness, which, in turn, functions as an independent variable in explaining individual-level processes of work recovery and engagement.

CONTEXTUALIZING EMBODIED POSITIVE SOCIAL INTERACTIONS IN ORGANIZATIONS

Research into the link between positive social interactions at work and physiology has the potential to contribute to the fields emerging at the intersection of the social and medical sciences. We suggest new ways of theorizing about how organizational contexts shape employees' bodies through experiences of positive social interactions at work. In particular, we build on researchers' claims that organizational contexts (e.g., organizational practices, culture, and leadership) shape patterns of social networks (Baker, 2000; Cross & Parker, 2004) and patterns of social interactions (Dutton, 2003), which, in turn, shape employee attitudes and behaviors.

However, our focus on the connection between positive relationships and employee physiology directs attention to the features of organizational contexts that would be particularly potent in affecting employees' physiological resourcefulness because of their capacity to foster the building or sustaining of the experience of positive social interactions. Below we develop a series of research propositions illustrating how organizational behavior can enrich the study of human physiology by specifying how social (in this case, organizational) conditions foster processes (social interactions) that directly affect human physiology.

Organizational Practices

Baker and Dutton (2007) have identified seven clusters of practices that foster the building of positive connections in organizations. By "practices," they mean, drawing from Orlikowski (2002), recurrent, materially bounded, situated activities of a particular unit or organization. The seven sets of practices fall into two major groups: (1) human resource practices (selection, socialization, evaluation, rewards) and (2) everyday work practices (conduct of meetings, collaborative technologies, practices of interpersonal helping). They theorize that certain forms of these practices increase the experience of positive interactions through how they shape the motivation to connect and the opportunity structures for connection. We use two examples of an organizational practice (e.g., socialization practices and meeting practices) to illustrate how a positive social interaction–physiology link encourages new theorizing about how organizational contexts (in this case, patterns of practices) affect employees' physiological resourcefulness through positive social interactions.

Organizations vary considerably in the ways that they help employees become members of new units, new projects, or the organization itself. Although much of organizational research has focused on the sensemaking and interpretative side of socialization (e.g., Louis, 1980), there is a very important relational component to socialization practices. By "relational," we mean conducive to building positive connections between people. In particular, organizations vary in how easily and broadly they facilitate employees' connection with old and other new members of the organization during this crucial onboarding process (Baker & Dutton, 2007).

For example, some organizations routinely rotate people through multiple departments as part of the socialization process (Cross & Parker, 2004). If this is done in a way that allows people to meet each other in affirming ways, then they are more likely to experience positive social interactions during this process. Some organizations create specified roles, such as new member advocates or mentors, who help newcomers learn about the organization and interact in ways that are culturally appropriate, often increasing the chances positive social interactions will occur (Dutton, 2003; Rollag, Parise, & Cross, 2005).

Organizations also vary in their practices of rewarding people for successfully locating and bringing on board new organizational members (e.g., Fernandez, Castilla, & Moore, 2000), which, in many situations, directly increases new employees' chances of having positive social interactions with others during their socialization process. When organizations reward employees for locating new members, "old-timers" are more invested in having people get integrated and exert greater effort in helping them meet others and get up to speed more quickly. These more relational socialization practices make it more likely that new employees will be physiologically strengthened and more resourceful during the socialization process because they have more opportunities to engage in positive social interactions.

Proposition 3: The greater the extent of relational socialization practices used in an organization (or unit), the greater the level of physiological resourcefulness of employees.

Virtual and face-to-face meetings are frequent forums for social connecting at work, and, thus, the meeting practices that typify organizations or units shape patterns of social interacting. We posit that meeting practices shape employees' physiological resourcefulness in several ways. First, as a critical conversational space, organizations can have practices that effectively prepare people at the meeting to understand and appreciate meeting members' contributions to each other. For example, Cohen and Prusak (2001) have suggested that UPS and Hewlett-Packard explicitly encourage and design physical spaces that foster face-to-face meetings as an explicit means of fostering positive social interactions. Dutton (2003) has argued that meetings can affect the degree to which they encourage respectful interactions, trust, and task enabling, any one of which facilitates the experience of positive social interactions. If a context exhibits more relational meeting practices (marked by the encouragement of listening, supporting and equipping meeting members to contribute, more respectful engagement, task enabling, and trust), then we would expect to see increased physiological resourcefulness (Baker & Dutton, 2007).

Proposition 4: The greater the extent of relational meeting practices used in an organization (or unit), the greater the level of physiological resourcefulness of employees.

Organizational Culture

An organization's shared values, beliefs, norms, and artifacts (Schein, 2004) are distinguishing and critical features of organizational contexts. Variance in shared values and beliefs, for example, is associated with different patterns of interrelating among organizational members (Perlow, Gittell, & Katz, 2004). This assertion allows us to build illustrative propositions about how organizational culture can shape employees' physiological resourcefulness through shaping patterns and perceptions of positive social interactions.

For example, Brickson (2005, 2007) recently argued that organizations vary systematically in what she calls "identity orientation," which is the shared assumptions about how an organization relates to stakeholders. One can conceptualize identity orientation as a form of shared cultural belief. Brickson's empirical research suggests that an organization's identity orientation toward outside stakeholders is empirically related to its identity orientation toward internal stakeholders (what she calls "internal identity orientation"; Brickson, 2005). Her research further suggests three distinct types of identity orientations. A relational identity orientation is one in which members define the organization as a partner to its stakeholders, which, in turn, is often associated with a motivation to care and trust partners.

We posit that organizations that have a strong relational identity orientation will have more frequent positive social interactions, building the physiological resourcefulness of members. This proposition aligns with Brickson's (2007) argument that organizations with a more relational organizational identity will have stronger dyadic ties between members and internal and external stakeholders.

Proposition 5: The stronger the relational identity orientation of an organization, the greater the level of physiological resourcefulness of the organization's employees.

Organizational Leadership

For as long as there have been organizational researchers, there has been an interest in the impacts of organizational leadership. A physiological take on social interactions invites consideration of how leadership behaviors shape patterns of positive social interactions and, thus, employee health and resourcefulness. We develop two propositions that explore this possibility as another way of seeing how studies of organizational behavior and human physiology enrich one another.

The assertion that leaders' behaviors affect patterns of social interactions is not surprising, given that many researchers construe leadership as fundamentally about relationships (e.g., Fletcher, 2007; Graen & Uhl-Bien, 1995; Pearce & Conger, 2003). However, certain leadership be-

haviors may be particularly powerful means of encouraging and facilitating positive social interactions, and these, in turn, enable physiological resourcefulness of the persons in the interaction. Relational attentiveness captures a leader's capacity to perceive and respond to other people's emotional state and has been argued to be an important component of emotional intelligence (Salovey, Mayer, & Caruso, 2002). Frost (2003) has argued that the relational attentiveness of leaders is particularly important for the detection of and response to the emotional pain of followers, which serves to foster positive interactions through activating processes of relational repair. Dutton has argued that relational attentiveness fosters the creation of high-quality connections between people in organizations, because leaders with this strength "can play a key role in sustaining and repairing the connective tissue of a work group, department or organization" (2003: 164).

Proposition 6: The more a leader is relationally attentive, the greater the level of employee physiological resourcefulness.

Leaders behave in ways that not only directly shape social interaction patterns but also shape interactions by creating and galvanizing meaning. Podolny, Khurana, and Hill-Popper (2005) recently emphasized this path of leadership impact by articulating the different ways leaders shape organizational action through meaning making. We argue that when leaders propagate meaning that evokes collaboration, cooperation, and interdependence between people—what we call "relational images"—they motivate people to connect and ease connection possibilities. This, in turn, should increase physiological resourcefulness. For example, in studies of collaboration among organizations with conflicting views on environmental protection, Wondolleck and Yaffee (2000) showed that inclusive language and meaning that calls forth a common identity fosters positive social interactions between previously warring groups. When leaders are able to foster a sense of shared fate, common identity, and interdependence, differences between people become less extreme, and the ground for positive interactions is tilled.

Proposition 7: The more leaders cultivate and spread relational images, the greater the level of physiological resourcefulness of employees.

In summary, we suggest that organizational scholars can contribute to research on the physiology of social interactions by using organizational research to understand how organizations shape people's opportunities to experience positive social interactions at work. Theoretically, our perspective responds to the call for a greater understanding of the social and cultural embeddedness of the physiology of social interactions (Uchino, 2004). These propositions are not exhaustive but are meant to illustrate the unique contributions that organizational scholars can offer to this vibrant research area. In the process, we recast organizations as consequential vessels of physiological resourcefulness and physical health.

IMPLICATIONS OF INTEGRATING PHYSIOLOGICAL DATA INTO ORGANIZATIONAL RESEARCH

The time is ripe to integrate physiology into organizational research because of technological innovations that make measures more widely available, of higher quality, and less intrusive for potential research participants. In this section we briefly review key issues for incorporating physiological measures into organizational research.

First, it is important to remember that "physiological systems . . . follow their own basic laws and are only loosely coupled with each other and with other response systems such as psychological and behavioral reactions" (Semmer et al., 2004: 225). Thus, it is important to understand how a particular physiological measure is affected by larger physiological systems. To illustrate, we can consider the example of the hormone cortisol. There are at least three ways of measuring cortisol. Cortisol is released under some type of stress (a cortisol spike) and then returns to baseline levels. Cortisol also has a strong diurnal pattern, which is influenced by both "trait" or stable factors and "state" or time-varying factors. One study found that between 24 and 36 percent of variation in morning cortisol levels was due to stable factors, about 62 to 74 percent was due to state factors, and the rest was due to measurement error (Shirtcliff, Granger, Booth, & Johnson, 2005, as cited in

Adam, 2005). All three ways of measuring cortisol—cortisol spikes, return to baseline after a spike, and diurnal patterns—are associated with health outcomes, albeit different ones.

If one is interested in measuring cortisol spikes in reaction to stress (e.g., Fischer, Calame, Dettling, Zeier, & Fanconi, 2000), it is important to control for the time of day (the diurnal pattern). If one is interested in explaining the state variation in diurnal patterns of cortisol (e.g., Adam, 2005), then it is important to take multiple measures throughout the day, in order to compare not just levels but changes in the levels (or slopes). Ideally, one should measure more than one day to see if the *pattern* is stable. Each of the issues mentioned here in relation to cortisol could be said about any physiological measure or construct, such as allostatic load.

Second, the relationships among social, psychological, physiological, and behavioral variables are "loosely coupled." Researchers have found that the correlations among physiological data, self-rated health, physician-rated health, subjective experiences of one's body (e.g., symptoms), and measures of subjective well-being are generally quite low (Brief, Butcher, George, & Link, 1993; Pennebaker, 1983). They are not interchangeable measures, even though they are sometimes treated as such (Jex & Beehr, 1991). In addition, in order to interpret physiological measures, it is important to couple them with other kinds of data, such as self-report and observation (Semmer et al., 2004). For research on positive social interactions, self-report data that capture peoples' subjective views of the quality of connections and relationships are especially important. Finally, there are often sets of standard control variables that are essential to making sense of the data, including medication and current health status, smoking and caffeine intake, and physical activity, among others (Cacioppo, Tassinary, & Berntson, 2000; Kiecolt-Glaser & Glaser, 1988).

Third, some physiological measures are easier to assess in naturalistic settings than others. Technology to measure the cardiovascular system is relatively portable and unintrusive. Assessing the immune and neuroendocrine systems typically requires collecting saliva or blood, so these data are more difficult to collect in the field (for examples, see Adam, 2005; Marucha, Kiecolt-Glaser, & Favagehi, 1998; Schaubroeck & Ganster, 1993).

Stepping back from the specific considerations of measurement and research design, the research agenda that we have outlined requires interdisciplinary collaboration. This brief overview of the practical considerations of using physiological data in research can only scratch the surface of this complex topic. The wealth of knowledge that has developed in the last twenty years has occurred in large part through the collaboration of experts from many fields (e.g., Ohio State's Institute for Behavioral Medicine Research). In classic fish-scale fashion (Campbell, 1969), scientific innovation has occurred through the overlapping of fields. Our hope is that this paper will provoke interest in a physiological perspective on social interactions in organizations, prompting continuing innovations across fields.

DISCUSSION

This paper has suggested that positive social interactions at work are associated with immediate and enduring effects on the cardiovascular, immune, and neuroendocrine systems. A physiological perspective invites consideration of the body as a source of human action and capability, because positive social interactions at work can build physiological resourcefulness and physical health. We illustrate this possibility with propositions about work recovery and engagement. Organizational scholars can make valuable contributions to the extant literature by bringing in our unique perspective on how organizational contexts shape employees' experiences of social interactions. We have begun to describe the organizational embeddedness of human physiology at work with propositions about organizational practices, culture, and leadership. Positive social interactions are one core pathway through which human physiology is embedded in organizations. This kind of research involves learning about a kind of data unfamiliar to most organizational researchers, and collaboration with experts in other fields may be the best way to start such a research program.

Establishing the link between positive social interactions and physiology is an important first step, and it provokes a number of questions and extensions for future research. While we have focused on positive social interactions, future research will have to address questions about

people's larger relational landscape. Employees' relational contexts are full of connections and relationships, some of which are positive, whereas others are undoubtedly neutral, harmful, or ambivalent (Holt-Lunstad et al., 2003). Research has suggested that negative interactions—for example, undermining behaviors—can be more potent in their impact on employees than positive relationships—for example, social support (Duffy, Ganster, & Pagon, 2002). Given the potent effect of negative interactions at work (e.g., Pearson, Andersson, & Wegner, 2001; Tepper, 2000), it may be especially important to understand how to remedy or nullify these effects by creating occasions for positive interactions that are health building rather than health depleting. Researchers, for example, can examine how protective or health enhancing positive relationships can be in the context of a toxic work environment (Frost, 2003; Kahn, 2001). One stream of research suggests that examining the ratio of positive to negative interactions over time (e.g., over the course of a meeting) can be a useful strategy for understanding how negative and positive interactions combine to shape outcomes (Gottman, 1993; Losada & Heaphy, 2004).

It is important to note that several cardiovascular and immune studies have shown that some but not all work relationships are associated with physiological outcomes. This raises important questions about which work relationships matter and why. These questions are only beginning to be addressed by researchers, who suggest that people are physiologically reactive to those relationships that are meaningful to the self, which, in turn, is shaped by social and cultural forces (Dressler, Balieiro, & Dos Santos, 1997; Kiecolt-Glaser & Newton, 2001).

By paying attention to physiological-level changes, we can begin to consider physical health in more nuanced ways. Typically, it is measured as the absence of disease (Patrick & Begner, 1990). In organizational research this often means using such coarse-grained measures as days absent and health insurance costs (Danna & Griffin, 1999). Consistent with this focus, most research on physical health has focused on stress, which often has negative effects on physical health (Cooper et al., 2001). But recent critiques of this model have pushed for definitions of positive health, measures that can capture it, and interventions that can build it (Bower & Segerstrom, 2004; Patrick & Begner, 1990; Ryff & Singer, 2000). We believe that our paper provides one such alternative. Physiological measures can help us capture more finely grained measures of health, such as immune system strength, healthy cortisol patterns, and cardiovascular reactivity, and physiological resourcefulness is one of a number of ideas (e.g., physical thriving; Epel et al., 1998) that can help us see how physical health can be strengthened. Our paper suggests a series of organizational pathways through which these measures of positive health can be built.

A focus on how an organizational context shapes the physiological resourcefulness of individuals is part of a broader quest for organizational scholars to better understand endogenous resourcefulness—or the processes through which resources are generated from within a person, dyad, group, or organization (see Dutton & Ragins, 2007; Feldman, 2005; Rousseau & Ling, 2007). Such a view assumes that resources are not fixed assets but are valuable elements that are created and changed by people in the way that they behave. A focus on processes of endogenous resourcefulness is consistent with positive organizational scholarship's goal of detailing conditions and processes that contribute to optimal functioning in individuals, dyads, groups, and organizations (Cameron, Dutton, & Quinn, 2003; Dutton, Worline, Frost, & Lilius, 2006). By linking features of an organizational context to physiological resourcefulness, researchers and practitioners alike are drawn to consider how organizational conditions contribute to measures of optimal functioning (like engagement, health, etc.) through how they affect positive social interactions and physiological processes.

This perspective on relationships as cultivars of physiological resourcefulness is particularly important to the study of work. Work is increasingly characterized by greater degrees of collaboration, cooperation, and cross-boundary work, and the economy is increasingly based in service as opposed to manufacturing industries (National Research Council, 1999). It is not surprising, then, that social interactions often account for the largest proportion of individuals' work time (Waldron, 2000). Accordingly, organizational scholars who wish to bring work back in to how we theorize and study employee and organizational experiences (Barley & Kunda, 2001) would do well to find ways to study how

interactions shape work processes and work outcomes. Our paper also invites researchers to bring the body back into the study of work, not as an instrument of physical labor but by seriously considering how social interactions leave consequential physiological imprints (Heaphy, 2007). If scholars answer this invitation, we see new possibilities for how organizational scholarship can inform not only our own discipline but studies of human physiology as well.

CONCLUSION

This paper began with the acknowledgment that physiology is not typically considered to be within organizational researchers' domain. Social interactions, however, are at the heart of many streams of organizational research (Dutton & Heaphy, 2003). We link physiology and social interactions together by establishing that social interactions at work, whether brief connections or enduring relationships, have physiological correlates and effects. We can then see how the physiological resourcefulness built in positive social interactions shapes micro-organizational behavior, such as engagement and work recovery, and how organizations shape employees' bodies by providing (or failing to provide) opportunities for these positive social interactions to occur. At a fundamental level, these arguments invite organizational researchers to add a bodily, physiological dimension to their research on organizational life, and to offer organizational explanations to the ongoing interdisciplinary conversations about the physiology of social relationships occurring throughout the academy.

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