

Health Complaints, Stress, and Distress: Exploring the Central Role of Negative Affectivity

David Watson and James W. Pennebaker
Southern Methodist University

Most current models in health psychology assume that stress adversely affects physical health. We re-examined this assumption by reviewing extensive data from the literature and from six samples of our own, in which we collected measures of personality, health and fitness, stress, and current emotional functioning. Results indicate that self-report health measures reflect a pervasive mood disposition of negative affectivity (NA); self-report stress scales also contain a substantial NA component. However, although NA is correlated with health complaint scales, it is not strongly or consistently related to actual, long-term health status, and thus will act as a general nuisance factor in health research. Because self-report measures of stress and health both contain a significant NA component, correlations between such measures likely overestimate the true association between stress and health. Results demonstrate the importance of including different types of health measures in health psychology research.

Various types of health models have been adopted by clinical, social, and medical researchers. Most of these models assume that psychosocial stressors adversely affect physical health as well as psychological well-being. In recent years, researchers have studied a number of hypothesized precursors of health, including major life changes (e.g., divorce, death of spouse or child; see Holmes & Rahe, 1967; D. H. Schroeder & Costa, 1984), chronic stressors or role strains (e.g., Eckenrode, 1984; Pearlin, Lieberman, Menaghan, & Mullan, 1981), minor daily stressors or hassles (e.g., DeLongis, Coyne, Dakof, Folkman, & Lazarus, 1982; Zarski, 1984), depression and helplessness (Laudenslager, Ryan, Drugan, Hyson, & Maier, 1983; Shekelle, et al., 1981), and personality factors such as hardiness (Kobasa, Maddi, & Kahn, 1982) and the Type A behavior pattern (e.g., Dembroski, Weiss, Shields, Haynes, & Feinleib, 1978; Krantz & Durel, 1983; Matthews, 1982). Results generally indicate that these factors are correlated with various health indices.

Recently, Costa and McCrae (1985a, 1987) have questioned the meaningfulness of many of these findings. They have explored the role of neuroticism, a personality trait that they define as "a broad dimension of individual differences in the tendency to experience negative, distressing emotions and to possess associated behavioral and cognitive traits" (Costa & McCrae, 1987, p. 301). In studying the psychological factors

surrounding coronary heart disease, Costa and McCrae reported data suggesting that whereas neuroticism scores are moderately to strongly correlated with subjective health complaints, they are largely unrelated to objective health indicators (e.g., objective evidence of disease, mortality). Moreover, D. H. Schroeder and Costa (1984) have shown that many self-report stress measures also contain a significant neuroticism component.

Our close inspection of the findings of Costa and his colleagues (Costa & McCrae, 1985a, 1987; D. H. Schroeder & Costa, 1984) suggests that many stress-health correlations may be spuriously inflated because of the common influence of neuroticism when both stress and health variables are measured through self-report. The primary purpose of the present article is to examine this idea in light of a broad range of health research. Specifically, we will examine whether pervasive individual differences in negative emotionality underlie commonly observed correlations between self-reported health and stress levels.

A second goal of this article is to explore the role of *two* general mood dispositions in health research. As noted earlier, the trait of neuroticism is centrally defined by individual differences in the tendency to experience negative emotional states (Costa & McCrae, 1987; see also McCrae & Costa, 1987). However, considerable research indicates that emotional experience is dominated by two broad and largely independent dimensions—negative affect (NA) and positive affect (PA). As we will demonstrate, it is important to examine both factors when studying how mood relates to various phenomena (see also Diener & Emmons, 1984; D. Watson, 1988b; D. Watson, Clark, & Tellegen, 1984; D. Watson & Tellegen, 1985).

Negative affect is a general dimension of subjective distress. The NA factor subsumes a broad range of aversive mood states, including anger, disgust, scorn, guilt, fearfulness, and depression. In contrast, PA reflects one's level of energy, excitement,

Portions of this project were funded by National Institutes of Health Grant HL32547 and National Science Foundation Grant BNS 86-06764.

We are indebted to Sondra Brumbelow, Mary Dieffenwierth, and Chris Osgood for their help in the research, and to Jonathon Brown, Lee Anna Clark, Paul Costa, and Auke Tellegen for their comments on earlier versions of the article.

Correspondence concerning this article should be addressed to David Watson, Department of Psychology, Southern Methodist University, Dallas, Texas 75275.

and enthusiasm. Both mood factors can be measured either as a state (i.e., transient fluctuations in mood) or as a trait (i.e., stable individual differences in general affective level). These traits—which Tellegen (1982) termed *negative affectivity* (or trait NA) and *positive affectivity* (or trait PA)—represent predispositions to experience the corresponding state mood factor. Clearly, trait NA closely resembles Costa and McCrae's conception of neuroticism (see D. Watson & Clark, 1984). Thus, high trait NA individuals are more likely to experience intense states of negative affect, whereas high trait PA individuals report generally higher levels of positive affect. Our article focuses on these trait factors, but we will also consider evidence regarding the mood states.

As outlined by D. Watson and Clark (1984), trait NA is a dimension that reflects stable and pervasive differences in negative mood and self-concept. They review extensive evidence indicating that high NA individuals are more likely to experience significant levels of distress and dissatisfaction at all times and in any given situation, even in the absence of any overt stress. High NA subjects are more introspective and differentially dwell on their failures and shortcomings. They also tend to focus on the negative side of others and the world in general. Consequently, they have a less favorable self-view and are less satisfied with themselves and their lives. In contrast, low NA individuals tend to be content, secure, and self-satisfied. The trait NA construct is measured by a large number of commonly used scales and has been variously called neuroticism (as noted earlier), trait anxiety, and general maladjustment by other investigators (see D. Watson & Clark, 1984).

Trait PA, which can be assessed by trait measures of well-being and extraversion, reflects general levels of energy and enthusiasm. High trait PA individuals lead a full, happy, and interesting life, and maintain a generally high activity level (Costa & McCrae, 1980a; Tellegen, 1982, 1985; D. Watson & Clark, 1984). Although it has emerged as a major factor in mood research, PA has been relatively less studied as a personality dimension.

In the following sections, we will examine how trait NA and trait PA are related to various measures of health and stress. In light of the data presented by Costa and McCrae (1985a, 1987), we will make a fundamental distinction between health complaint scales and other types of physical status measures. Health complaint scales have been widely used in health psychology research; these are questionnaires that ask subjects to assess how frequently or intensely they have experienced various physical symptoms and problems, such as headaches, back pain, nausea, colds, and so on.

As we will see, many of these self-report measures have been extensively validated against hard evidence of dysfunction (e.g., data from medical records), and they clearly assess some true, health-related variance. However, it is equally clear that health complaint scales are, to some extent, *subjective* health measures that partly reflect subjects' perceptions of, and interpretations about, their internal physical sensations. These subjective perceptions may or may not give an accurate assessment of the individual's true physical health (as reflected in their actual physical condition, life expectancy, etc.; see Costa & McCrae, 1985a, 1987; Leventhal, 1975; Mechanic, 1979, 1980; Pennebaker,

1982; Tessler & Mechanic, 1978). Thus, self-report health scales likely have two distinct components, one that is subjective and psychological and the other that is objective and more clearly health-related. If a given variable (such as trait NA) is significantly related to physical complaints, the interpretation of this correlation obviously hinges on whether it is related to the former, the latter, or both components.

These health complaint scales will be contrasted with all other types of health-status indicators, including health-related behaviors (e.g., absenteeism, physician visits), biological markers (e.g., blood pressure levels, serum risk factors, immune system functioning, objective evidence of dysfunction), and health outcomes (e.g., diagnosis of disease, mortality rates). These other classes of health measures clearly play an important role in determining an individual's overall health status and, as we will see, they can yield results that are quite different from those obtained with physical symptom scales.

We will present extensive evidence demonstrating that trait NA is strongly and consistently correlated with health complaint scales. Trait PA, however, is unrelated to somatic complaining. In other words, the data suggest that physical symptoms and negative moods reflect a common, underlying disposition of somatopsychic distress. However, NA is less clearly related to actual long-term health status, as assessed by such indices as mortality rates, extent of current disability, general fitness and lifestyle variables, health-related physician visits and absences, and objective evidence of disease or dysfunction. Because NA is more highly related to subjective than to objective health indicators, it likely acts as a general nuisance factor in health research, although it remains an important element in psychopathology and psychological distress.

Method

In addition to reviewing other relevant studies, we will draw heavily on our own data collected on six subject samples. To simplify the presentation of our findings, we briefly describe our subjects and the personality and health complaint measures we have used.

Subjects

Wellness-1 sample. Subjects were 99 Southern Methodist University (SMU) employees (M age = 38.6 years) who participated in the 1984–1985 University Wellness Program. The Wellness Program is a comprehensive health project that encourages better physical fitness, dietary habits, stress management, and psychological well-being among SMU employees. Personality and health questionnaires, blood pressure readings, and blood chemistry data were collected at the beginning of the program. Subsets of this sample participated in intensive investigations of blood pressure perception that will be described later.

Note that although participation in the Wellness Program is voluntary, external inducements offered by SMU have encouraged a broad range of employees to participate. Thus, at the time they were assessed, these subjects constituted a reasonably representative sample of the overall SMU employee population in terms of their health and fitness. For more information regarding the health status of this sample, see Pennebaker and Watson (1988); for details regarding the Wellness-2 sample, see Barr, Pennebaker, and Watson (1988).

Wellness-2 sample. A new set of 67 SMU employees (M age = 42.1 years) participated in the 1985–1986 Wellness Program. Again, self-

report, blood pressure, and blood chemistry data were collected at the beginning of the year. These subjects also participated in blood pressure studies that will be discussed later.

Adult sample. These were 56 adults (M age = 42.9 years), not affiliated with SMU, who were recruited from a rural community church and social circle. Subjects completed a battery of tests relating to personality, health, stress, and mood.

Student-1 sample. This sample consisted of 193 introductory psychology students who filled out the same series of tests as did the adult sample.

Student-2 sample. Subjects were 125 students from various psychology courses. They filled out two sets of questionnaires spaced 6 weeks apart. At Time 1, the subjects completed brief NA and PA scales, as well as various measures of stress. At Time 2, the subjects completed measures of health, fitness, social support, psychological adjustment, and current emotional functioning. This sample allowed us to assess the stability of NA–health correlations across a 6-week interval.

Student-3 sample. Subjects were 82 introductory psychology students, 80 of whom participated in a longitudinal study of mood and symptom reporting (D. Watson, 1988a). In addition to completing measures of NA and PA, subjects filled out a daily questionnaire over a 6–7 week period. On each day, the subjects reported the extent to which they had felt each of 24 positive and negative mood states, and the degree to which they had experienced 18 physical complaints. Following this daily rating period (3 months after the initial NA and PA questionnaires), the subjects completed the Pennebaker Inventory of Limbic Languidness (PILL; Pennebaker, 1982), a physical symptom inventory that is described in the next section.

Trait Mood Measures

Negative affect. As noted earlier, trait NA is assessed by many common personality measures, including the Eysenck Personality Inventory Neuroticism scale (EPI-N; Eysenck & Eysenck, 1968), the NEO Personality Inventory (NEO-PI; Costa & McCrae, 1985b) Neuroticism scale, the Taylor Manifest Anxiety Scale (TMAS; Taylor, 1953), the State-Trait Anxiety Inventory A-Trait scale (A-Trait; Spielberger, Gorsuch, & Lushene, 1970), the Repression-Sensitization Scale (R-S; Byrne, 1961), and the IPAT Anxiety Scale (Krug, Scheier, & Cattell, 1976), as well as various measures of general maladjustment, low self-esteem, pessimism, and ego strength (reverse-keyed). Given the number of scales and the diversity of content in the scales defining the construct, it is clear that the NA trait is a diffuse, nonspecific measure of subjective distress and dissatisfaction that exerts a pervasive influence in self-report personality assessment (see D. Watson & Clark, 1984).

In our samples we have used the 14-item Negative Emotionality (NEM) scale from Tellegen's Multidimensional Personality Questionnaire (MPQ; Tellegen, 1982; the MPQ was formerly called the Differential Personality Questionnaire) as our trait NA measure. High NEM scorers describe themselves as nervous, apprehensive, irritable, overly sensitive, and emotionally labile. The NEM scale focuses specifically on the experience of negative affect and contains no somatic complaint or health-related items. In contrast, most NA scales include some questions referring to somatic problems. For example, the EPI-N includes such items as "Are you troubled by aches and pains?" and "Do you worry about your health?" Thus, unlike other scales, NEM's relation to physical symptom reporting is uncontaminated by content overlap.

Like other measures of NA, NEM is internally consistent (we have obtained a coefficient alpha of .82, $n = 872$) and demonstrates high test-retest reliability (12-week retest, $r = .72$, $n = 109$). Factor analyses of the NEM items reveal a single general factor.

Positive affect. Trait PA was measured by the 11-item Positive Emotionality (PEM) scale from the MPQ. High PEM scorers describe them-

selves as happy and enthusiastic, and as leading an interesting and exciting life. PEM is also internally consistent (coefficient $\alpha = .80$), reliable over time (12-week retest, $r = .77$, $n = 109$), and unifactorial. In our samples, NEM and PEM are moderately intercorrelated (average $r = -.30$), indicating that they are reasonably independent of one another. Moreover, NEM and PEM show good convergent and discriminant validity when related to state mood scales and other variables (e.g., D. Watson, 1988a; D. Watson, Clark, & Carey, 1988).

Health Complaint Measures

PILL. The PILL (Pennebaker, 1982) includes 54 physical symptoms and complaints (e.g., racing heart, chest pain, indigestion, diarrhea). These are rated on a 1–5-point scale of experienced frequency during the past year, ranging from *have never or almost never experienced the symptom* (1) to *experienced more than once a week* (5). A total score is obtained by summing these frequency responses across items. The PILL's validity is supported by data showing that high PILL scorers make more physician and health-center visits, use more aspirin, and have more health-related work absences than low PILL responders (Pennebaker, 1982).

SMU Health Questionnaire. We originally developed the SMU Health Questionnaire (SMU-HQ) to assess a broader range of health problems than are covered in the PILL. Its 63 items include symptoms and complaints (e.g., abdominal or stomach pain, sore throat), minor illnesses (e.g., cold or flu, appendicitis), and more serious and chronic health problems (e.g., diabetes, hypertension, cancer). Subjects check any problem they have experienced during the past year.

In order to distinguish between symptom and major health items, we subjected the SMU-HQ items to a principal factor analysis (squared multiple correlations in the diagonal) in a sample of 437 SMU undergraduates. This analysis revealed a broad first factor that accounted for 23.2% of the common variance. We constructed a Symptom scale that consists of 13 of the 14 items having the strongest loadings on this factor. The remaining item, *depression*, was excluded because of its obvious conceptual overlap with NA and PA. The final scale consists entirely of various symptoms and complaints (e.g., headaches, cramps, diarrhea). This Symptom scale will be used in all subsequent analyses. The score reflects the number of items checked.

HSCL Somatization scale. The Hopkins Symptom Checklist (HSCL; Derogatis, Lipman, Rickels, Uhlenhuth & Covi, 1974) is a widely used measure of psychological symptomatology (e.g., Kanner, Coyne, Schaefer, & Lazarus, 1981; Rickels, Lipman, Garcia, & Fisher, 1972; Uhlenhuth, Lipman, Balter, & Stern, 1974). The Somatization subscale consists of 12 items describing various physical symptoms and problems (e.g., trouble getting your breath, faintness or dizziness). Subjects rate, on a 5-point scale ranging from *not at all* (1) to *extremely* (5), how intensely they have experienced each of these problems during the past week.

HSQ Symptom scale. The Health Status Questionnaire (HSQ; Belloc & Breslow, 1972; Belloc, Breslow, & Hochstim, 1971) is a self-report health questionnaire assessing a broad range of recent health problems, including disability and functional status, chronic conditions (e.g., arthritis, diabetes, hypertension), specific somatic symptoms, and general energy level. The HSQ has been shown to have acceptable reliability and validity when compared with medical records (Meltzer & Hochstim, 1970). The HSQ Symptom subscale contains 11 items (e.g., swollen ankles, pains in the back or spine). The total score is computed by summing the number of problems experienced during the past year.

CMI Physical. The Cornell Medical Index (CMI; Brodman, Erdmann, & Wolff, 1949) assesses both health and psychiatric status (e.g., Costa & McCrae, 1985a; Elias, Robbins, Blow, Rice, & Edgcomb, 1982; McCrae, Bartone, & Costa, 1976). The first 12 sections refer to

physical problems and are summed into an overall measure of current physical complaints; the total score is the number of endorsed physical problems.

SAQ. The Somatic Anxiety Questionnaire (SAQ) is a 7-item subscale of the Cognitive and Somatic Anxiety Questionnaire (Schwartz, Davidson, & Goleman, 1978). Subjects evaluate the extent to which they experience each symptom (e.g., rapid heart rate) when they feel anxious.

Physical complaint score. Subjects in the Student-3 sample completed an 18-item physical symptom measure each day over a 6–7 week period. Subjects rated the extent to which they had experienced each problem (e.g., headaches, tightness in chest, coughing) on a 1–5 scale ranging from *felt very slightly or not at all* (1) to *felt very much* (5). Item responses were summed to produce a physical complaint score for each day; these scores were used in within-subjects analyses of the relation between symptom reporting and daily fluctuations in state NA and PA. Daily scores were also averaged over the entire rating period ($M = 44.4$ observations per subject) to yield a mean physical complaint score for each subject; these mean scores were then correlated with trait NA and PA scales.

Negative Affect, Positive Affect, and Symptom Reporting

Within each of the aforementioned samples, we intercorrelated various measures of NA, PA, health complaints, and stress. We will first examine how trait NA and PA measures relate to physical symptoms and complaints. Table 1 presents these correlations as well as relevant coefficients from other studies. Unless otherwise noted, trait NA and PA are measured by NEM and PEM, respectively.

The data reveal a remarkably clear and consistent convergent/discriminant pattern: Trait NA reliably correlates with all measures of symptom reporting, whereas trait PA is largely independent of them. Indeed, with the exception of our adult sample, PEM scores are virtually unrelated to physical complaints. In other words, it is entirely possible to lead a full, happy, and interesting life while reporting a large number of physical symptoms and problems.

In contrast, trait NA measures are invariably related to physical complaint scores, with the large majority of the correlations falling in the .30 to .50 range. Moreover, with the exception of the Student-2 sample—which produced generally lower NEM-symptom coefficients—correlations of NA with individual health measures are strikingly consistent. Excluding the Student-2 sample, for example, the PILL correlates .39 to .47 with trait NA across the remaining six data sets. It is noteworthy that this includes a sample (Student 3) in which there was a 3-month interval between the completion of the scales, demonstrating that the association is stable over time. Another important aspect of the data is the consistency of the correlations within each sample. For example, in the data reported by Linden, Paulhus, and Dobson (1986), trait NA correlates .39 with the PILL and .37 with the SAQ. Similarly, in our Student-1 sample, NEM correlated .42, .42, and .40 with the PILL, SMU-HQ Symptom scale, and HSCL Somatization scale, respectively.

In general, the relation between trait NA and physical complaints remains the same regardless of the symptom measure used. This is especially striking when one considers how diverse these measures are in form and content. For example, the symptom scales differ in the number (ranging from 7 to 144) and

Table 1
Correlations Between Trait Mood Measures and Health Complaint Scales

Measure/Sample or study	n	Correlation	
		Trait NA	Trait PA
PILL			
Wellness 1	97	.42*	-.08
Wellness 2	64	.47*	.05
Adult	52	.43*	-.36*
Student 1	192	.42*	-.02
Student 2	125	.27*	-.15
Student 3	82	.43*	.03
Linden, Paulhus, & Dobson (1986) ^a	242	.39*	—
Average <i>r</i>		.40	-.07
SMU-HQ Symptom scale			
Adult	55	.31*	-.35*
Student 1	192	.42*	-.02
Student 2	125	.17	.05
Average <i>r</i>		.33	-.05
HSCL Somatization Scale			
Adult	52	.44*	-.27*
Student 1	190	.40*	-.08
Student 2	124	.27*	-.18*
Average <i>r</i>		.37	-.15
HSQ Symptoms Scale			
Student 2	125	.32*	-.11
Mean physical complaints score			
Student 3	82	.25*	.00
SAQ			
Linden et al. (1986) ^a	242	.37*	—
CMI Physical			
Costa & McCrae (1987) ^b	95	.28*	-.08
Matarazzo, Matarazzo, & Saslow (1961) ^c	82	.62*	—
McCrae, Bartone, & Costa (1976) ^d	786	.28*	—
Weiss (1969) ^c	54	.53*	—
Average <i>r</i>		.33	-.08

Note. Unless otherwise noted, NEM (negative emotionality) is the trait NA (negative affect) measure and PEM (positive emotionality) is the trait PA (positive affect) measure. Average *rs* are weighted by sample size. PILL = Pennebaker Inventory of Limbic Languidness; SMU-HQ = Southern Methodist University Health Questionnaire; HSCL = Hopkins Symptom Checklist; HSQ = Health Status Questionnaire; SAQ = Somatic Anxiety Questionnaire; CMI = Cornell Medical Index. ^a Used the R-S (Repression-Sensitization Scale) and STAI (State-Trait Anxiety Inventory) A-Trait scales to measure trait NA. Value shown is the average correlation. ^b Used the NEO-PI (NEO Personality Inventory) Neuroticism and Extraversion scales as the trait NA and PA measures, respectively. ^c Used the TMAS (Taylor Manifest Anxiety Scale) as the trait NA measure. ^d Used an anxiety measure derived from the 16 PF (Sixteen Personality Factor Questionnaire) as the trait NA measure.

* $p < .05$, two-tailed.

nature of the problems included, the time frame involved (the past week, the past year, or not specified), and the type of response format used (yes/no, checklist, frequency, or intensity of the problem). Given these wide differences, it is interesting to

Table 2
Correlations Among Mood and Physical Complaint Measures in the Student-1 Sample

Measure	1	2	3	4	5	6	7
1. NEM	—						
2. State NA	.47*	—					
3. PILL	.42*	.46*	—				
4. SMU-HQ Symptom scale	.43*	.33*	.49*	—			
5. HSCL Somatization	.41*	.56*	.55*	.41*	—		
6. PEM	-.29*	-.15*	-.03	-.03	-.09	—	
7. State PA	-.25*	.09	.04	.00	-.12	.43*	—

Note. $n = 189$. NEM = Negative Emotionality scale; NA = Negative Affect; PILL = Pennebaker Inventory of Limbic Languidness; SMU-HQ = Southern Methodist University-Health Questionnaire; HSCL = Hopkins Symptom Checklist; PEM = Positive Emotionality scale; PA = Positive Affect.

* $p < .05$, two-tailed.

note that health complaint measures correlate about as highly with NA as they do with each other. In the Linden et al. (1986) study, for example, the R-S scale (a good trait NA marker) correlated .40 with the PILL and .37 with the SAQ, whereas the PILL and SAQ correlated .44 with one another.

A more general illustration of this point can be seen in Table 2, based on our large Student-1 sample. In addition to the trait and symptom measures already described, we have included state measures of NA and PA. These are taken from a 60-item mood questionnaire in which subjects were asked to rate the extent to which they have experienced each mood descriptor during the past few weeks. State PA and NA factor scores were calculated using standardized weights derived from Tellegen's large-scale factor analysis (Zevon & Tellegen, 1982).

Table 2 again shows that the NA and subjective health measures are consistently interrelated, whereas PA is largely independent. Within the NA-health cluster, one sees no clear separation between the physical and psychological measures. Most of the coefficients are in the .40 to .50 range; the NA-symptom correlations are about as high as the correlations among the symptom measures or between trait NA (NEM) and state NA.

Taken together, Tables 1 and 2 suggest that negative mood and symptom scales all strongly reflect a common, underlying factor, namely, a stable and pervasive dimension of somatopsychic distress. We will consider this issue in more detail later, using a wider range of variables (see Table 9). However, to illustrate this point in the current context, we subjected the variables shown in Table 2 to a principal components analysis. Two large factors accounted for 62% of the total variance and were rotated using varimax. As expected, all of the health and NA scales were strong markers of the first factor, with loadings ranging from .67 to .80; the second dimension was a specific factor defined by the two PA scales. Thus, the data strongly suggest that the NA and health scales are all tapping a common factor.

In Table 2, the trait and state mood measures show a similar convergent/discriminant pattern with the physical symptom scales. Data presented in Table 3 extend these findings across several measures of transient mood and over different samples. The results from two different sets of state NA and PA scales are shown. The first pair, based on Tellegen's NA and PA factor scores, is constructed from items asking how subjects felt today

or during the past few weeks. Relevant data from two student samples that were not previously described (Student 4 and Student 5) are also included. The second set of state NA and PA measures was developed by Bradburn (1969; Bradburn & Caplovitz, 1965). Each scale consists of five items that are answered yes or no according to how the subject has felt during the past few weeks. Total NA and PA scores simply reflect the number of yes responses to the relevant items.

However measured, state PA is clearly unrelated to symptom reporting—only one of its correlations is significant, and most cluster around zero. In contrast, state NA is significantly correlated with self-rated health in all but three instances. In general, the state NA coefficients are not quite as high as those found with trait NA, but the average correlations still tend to fall in the .20 to .40 range, with a median value of .30. The very large sample sizes in the studies using the Bradburn scales (Bradburn, 1969; Harding, 1982; Tessler & Mechanic, 1978) offer a fairly precise estimate of the relation between state NA and physical complaints. It is noteworthy that the magnitude of this association is unaffected by the particular mood scale (Tellegen vs. Bradburn) or health measure (e.g., PILL, SMU-HQ, a single-item global health rating) used. As can be seen in Table 3, however, the rated time frame exerts an effect because the NA-symptom correlations are generally higher with past-few-weeks instructions than with today instructions.

Why do state NA scales correlate significantly with health complaint measures? It is unlikely that individuals' transient NA levels at the time of assessment influence their symptom reporting, given the very high test-retest reliabilities of measures like the PILL and CMI Physical (Costa & McCrae, 1985a; Pennebaker, 1982). Moreover, within-subjects analyses of the Student-3 sample (to be discussed more fully later; see also Clark & Watson, 1988; D. Watson, 1988a) indicate that current health problems tend to be associated with transient changes in both (higher) NA and (lower) PA, unlike the pattern of correlations in Table 3. To us, the most likely explanation is that both state NA and physical symptom reporting reflect the common influence of trait NA.

The consistency of the correlations between both state and trait NA and all of the physical symptom measures implies that the association between NA and health complaints is quite gen-

Table 3
Correlations Between State Mood Measures
and Health Complaint Scales

Measure/Time/Sample or study	n	Correlation	
		State NA	State PA
Tellegen mood scores			
PILL			
Past few weeks			
Wellness 1	99	.26*	-.02
Wellness 2	62	.39*	-.07
Student 1	191	.45*	.04
Student 2	122	.34*	.02
Average <i>r</i>		.38	.01
Today			
Adult	53	.36*	-.19
Student 4	50	.39*	.06
Student 5	81	.12	-.05
Average <i>r</i>		.27	-.06
SMU-HQ Symptom scale			
Past few weeks			
Student 1	191	.33*	-.01
Student 2	122	.15	.12
Average <i>r</i>		.26	.04
Today			
Adult	56	.31*	-.11
Student 4	50	.04	.08
Average <i>r</i>		.19	-.02
HSQ Symptoms			
Past few weeks			
Student 2	122	.22*	-.19*
HSCL Somatization			
Past few weeks			
Student 1	191	.56*	-.13
Student 2	122	.44*	-.10
Average <i>r</i>		.52	-.12
Today			
Adult	53	.31*	-.23
Bradburn mood scales			
Bradburn 5-item symptom index			
Past few weeks			
Bradburn (1969):			
Wave 1			
Men	1,259	.30*	.00
Women	1,528	.36*	-.02
Wave 3			
Men	943	.29*	.03
Women	1,220	.34*	-.01
Harding (1982)	932	.34*	-.07
Average <i>r</i>		.33	-.01
1-item global health rating			
Tessler & Mechanic (1978)	379	.27*	—
"Number of psycho-physiological disorders" ^a			
Beiser (1974)	112	.37*	<i>ns</i> ^b

Note. PILL = Pennebaker Inventory of Limbic Languidness; SMU-HQ = Southern Methodist University Health Questionnaire; HSQ = Health Status Questionnaire; HSCL = Hopkins Symptom Checklist.

^a Number of items were not specified. ^b Correlation was reported as nonsignificant, but the coefficient was not given.

* $p < .05$, two-tailed.

eral and that NA is related to a very broad range of physical problems. To test this further, we correlated NEM scores with individual PILL items in two sets of subjects: (a) an aggregated adult sample, formed by combining the Wellness-1 and -2 and adult samples ($n = 211$), and (b) our Student-1 sample ($n = 191$). These analyses strongly confirmed the pervasiveness of the NA-symptom connection: 46 of the 54 PILL items (85.2%) were significantly correlated with NEM ($p < .05$, two-tailed test) in at least one of the two samples. Clearly, NA is not simply related to psychophysiological manifestations of anxiety. Rather, it is significantly correlated with a diverse array of health complaints, including chest and back pains, itchy or painful eyes, sinus congestion, cold hands or feet, toothaches, severe stomach pains or cramps, swollen joints, headaches, and nausea. Analyses of other health scales, such as the CMI Physical, yield similar results (Costa & McCrae, 1980b, 1985a).

To summarize, health complaints are strongly related to both trait and state measures of NA, but are independent of PA. Moreover, physical symptom scales correlate about as highly with NA as they do with each other, and factor analytic data suggest that these somatic, mood, and personality measures all tap a common, underlying dimension. Finally, the relation between NA and physical complaints appears to be quite general. Taken together, the data suggest the existence of a broad and stable disposition of somatopsychic distress.

Negative Affect and Health Complaints: Possible Explanations

How and why are NA and somatic complaints related? We will examine three basic explanations for the data (see also Costa & McCrae, 1985a). The first is a variant of the classic *psychosomatic hypothesis*: High trait NA (with its correspondingly elevated levels of anxiety, tension, anger, and depression) causes health problems. Psychosomatic models of illness have had a long and somewhat checkered history but are still part of psychiatric classification (American Psychiatric Association, 1987). At one time or another, anxiety, depression, anger, hostility, and other negative affects have been causally implicated in a wide array of both minor (e.g., headaches, nausea, acne) and more serious (e.g., ulcers, coronary heart disease, arthritis, asthma, diabetes) health problems (Anderson, Bradley, Young, McDaniel, & Wise, 1985; Diamond, 1982; Friedman & Booth-Kewley, 1987; Harrell, 1980). We must emphasize that we will not examine all possible psychosomatic models here; for example, we will not examine the role of additional factors, such as suppressed hostility (Harrell, 1980), in the disease process. Rather, we will specifically focus on the issue of whether dispositional differences in negative emotionality can be causally implicated in the development of illness.

A second approach, called the *disability hypothesis*, posits that health problems cause high NA. According to this model, accumulated health problems lead to general personality changes, including the development of higher trait NA. It is easily understandable why health problems might heighten feelings of distress and dissatisfaction. Health problems are associated with a number of adverse consequences, including chronic pain, physical disability, and impairment of social and/or occu-

pational functioning (with a concomitant loss of self-esteem and social support). If this disability view is correct, then high NA is simply another negative consequence of disease.

Both the psychosomatic and disability models assume the existence of actual, correlated health problems—that is, they seek to explain why high NA individuals have more health problems than those low in NA. In contrast, the third explanation does not necessarily require any actual physical differences between high and low NA subjects. For want of a better term, we call this the *symptom perception hypothesis*.¹ According to this view, individuals differ in how they perceive, respond to, and/or complain about body sensations. In its strongest form, the symptom perception view would argue that the association between NA and health simply reflects the fact that high NA subjects are more likely to attend to and/or complain about internal physical sensations. A weaker form of this model would posit that perceptual/attentional factors magnify or exaggerate any true NA-related differences in actual health status.

It is important to note that these three explanations are not mutually exclusive. It is entirely possible, for example, that high NA produces physical problems in some individuals but that it is a consequence of health difficulties in others. It is also possible that high NA individuals actually suffer from poorer health but that they nevertheless exaggerate or overreact to these legitimate health concerns. In addition, disentangling the various possible causal pathways is frequently difficult or impossible. Despite these complications, the data we will review generally support some form of the symptom perception view.

The Psychosomatic Hypothesis

Does high NA cause actual health problems (as opposed to subjective complaints)? We will address this question, first, by examining two major foci of behavioral medicine research (coronary disease and cancer), and then discuss the more general health correlates of NA.

Negative Affect and Coronary Heart Disease

In examining the relation of NA to coronary heart disease, we must again distinguish between health complaints and various objective indicators of pathology. As we have seen, NA is broadly correlated with somatic symptoms. Coronary symptoms are no exception: NA is correlated with self-reported complaints often associated with heart disease, such as chest pain and angina pectoris (persistent attacks of severe chest pain).

For example, NEM is significantly correlated with self-rated chest pain (as measured by the PILL) in both our Student-1 and aggregated adult samples. Costa, Fleg, McCrae, and Lakatta (1982) found that NA was not only related to concurrent chest pain, it also predicted the development of angina some 5–20 years later in patients who were initially asymptomatic. We will see, however, that although NA is moderately correlated with chest pain and angina—and angina, in turn, is associated with heart disease—NA is largely unrelated to objective indices of cardiac health, including risk factors for heart disease, coronary

artery stenosis and other evidence for cardiac pathology, and heart-related mortality.

Blood pressure and hypertension. Over the last 3 years, we have collected extensive self-report and physiological data related to NA, blood pressure and hypertension. Hypertension is a well-known risk factor for heart disease, and high premorbid levels of both systolic (SBP) and diastolic (DBP) blood pressure are significant predictors of later cardiac pathology (e.g., Aberg, Lithell, Selinus, & Hedstrand, 1985; Keys, Taylor, Blackburn, Brozek, Anderson, & Simonson, 1971; Newman et al., 1986; Steinberg, 1985). Both of our Wellness samples have participated in intensive studies of the correlates of blood pressure. In order to maximize the generalizability of the results, we have been especially concerned with obtaining reliable assessments in a broad range of settings.

The blood pressure of our Wellness-1 subjects was measured at four different times and in four different settings (see Pennebaker & Watson, 1988, for details):

1. The average of two readings was obtained from 85 subjects at the university health center.
2. Two weeks later, 70 of the subjects were twice retested in their natural work environments.
3. A total of 68 subjects were individually tested as part of a comprehensive laboratory study lasting 90 min and consisting of 22 tasks with 23 alternating rest periods. The tasks were selected to provide a variety of stressful, embarrassing, competitive, physically involving, and relaxing activities that would produce marked fluctuations in blood pressure. Blood pressure readings were collected following each of the 45 periods. In addition to computing average SBP and DBP levels for each subject, we also calculated the subjects' variability on each measure.
4. Six months after the laboratory session, 51 subjects participated in a follow-up field study. Subjects measured their own blood pressure in a variety of natural life settings, including their homes and offices, with a portable Marshall Astropulse-10 electronic sphygmomanometer. Measurements could be taken as often as every 20 min, with a minimum of one every waking hour. The subjects collected an average of 63.6 readings over the 4–5-day rating period. From these we calculated each subject's mean level and variability on both blood pressure indices.

The Wellness-2 subjects participated in two shorter versions of the laboratory study described previously (see Barr et al., 1988, for details). Each laboratory session lasted 45 min and consisted of 25 rating periods, including 14 tasks and 11 rest intervals. Blood pressure was again measured at the end of each period. In all, 66 subjects participated in the two sessions, which were spaced approximately 6 months apart.

Table 4 presents correlations between NEM and PEM and various blood pressure indices. Generally speaking, NEM shows little relation to either mean levels or variability. However, it is noteworthy that NEM tends to correlate negatively with mean blood pressure levels, and in two instances the coefficients are marginally significant. That is, high NA subjects

¹ Costa and McCrae (1985a) used the term *hypochondriacal* in connection with this view, but hypochondriasis has negative connotations and psychiatric implications that we prefer to avoid.

Table 4
Correlations Between Negative and Positive Emotionality (NEM and PEM)
and Blood Pressure Means and Standard Deviations

Measure	Wellness 1				Wellness 2	
	Health center	Work office	Lab	Field	Lab 1	Lab 2
NEM correlation with						
Systolic blood pressure						
<i>M</i>	-.03	.13	-.06	-.21*	-.11	-.13
<i>SD</i>	—	—	.20	-.24**	.01	.08
Diastolic blood pressure						
<i>M</i>	.10	.13	-.06	-.10	-.23*	-.19
<i>SD</i>	—	—	.05	-.08	.03	-.02
PEM correlation with						
Systolic blood pressure						
<i>M</i>	-.05	.05	-.09	.06	.27**	.31**
<i>SD</i>	—	—	.14	-.08	.07	.18
Diastolic blood pressure						
<i>M</i>	-.02	-.04	-.10	-.05	.23*	.29**
<i>SD</i>	—	—	-.09	.06	.05	-.09

Note. Subject *ns* for the Wellness-1 sample are health center (85), work office (70), lab (68), and field (51). Subject *ns* for the two Wellness-2 sessions = 67.

* $p < .10$, two-tailed. ** $p < .05$, two-tailed.

tend to have slightly lower SBP and DBP levels. The data for PEM are inconsistent, but in three cases high PEM scorers (who describe themselves as generally happy and enthusiastic about life) have significantly higher blood pressure. The safest conclusion one can draw from these data is that trait mood measures are unrelated to blood pressure. It is interesting, nonetheless, that there is a slight tendency for those who describe themselves as psychologically healthy (i.e., high PA, low NA) to have higher blood pressure.

Findings from other studies have been inconsistent. For example, Kidson (1973) found that trait NA (measured by the EPI-N) was unrelated to either SBP or DBP in a normal healthy sample. Harburg, Julius, McGinn, McLeod, and Hoobler (1964) reported a low but significant (.26) correlation between NA (using the 16PF; Cattell, Eber, & Tatsuoaka, 1980) and the average of nine SBP readings. In contrast, Davies (1970) divided his subjects into three groups on the basis of their mean DBP (based on 12 assessments); the high DBP subjects had NA scores (EPI-N) that were significantly lower than those of the lowest DBP group. Again, the most reasonable conclusion is that NA has no clear or consistent correlation with blood pressure.

We can also analyze the relation between NA and high blood pressure by comparing the NA scores of hypertensive and normal subjects. Our two Wellness samples contained 14 and 7 diagnosed hypertensive subjects, respectively. The hypertensive subjects were all taking prescribed blood pressure medication (diuretics, vasodilators, or beta blockers). In both samples the hypertensive subjects had lower NEM scores than did the normotensive subjects, but this difference was only significant for the Wellness-2 subjects, $t(63) = 2.01$, $p < .05$. The evidence from other studies is again inconsistent. Some investigators have reported that hypertensive subjects have higher trait NA

scores (Davies, 1970; Kidson, 1973; Sainsbury, 1964), whereas others have found no differences between hypertensive and normal subjects (Cochrane, 1969, 1973; Costa, McCrae, Andres, & Tobin, 1980; Robinson, 1962).

Serum risk factors. In addition to blood pressure, we have correlated NEM and PEM with a number of other established risk factors for heart disease. For example, high serum cholesterol—particularly low density lipoprotein (LDL) cholesterol—is a well-known predictor of heart disease (Aberg et al., 1985; Keys et al., 1971; Steinberg, 1985). Premorbid serum triglyceride and uric acid levels are also strongly predictive of later heart disease, but their independent contributions to cardiac pathology (after controlling for the effect of other risk factors, such as serum cholesterol, hypertension, and obesity) have not yet been established (Aberg et al., 1985; Brand, McGee, Kannel, Stokes, & Castelli, 1985; Fessel, 1980; Grundy, 1984). Serum uric acid is an especially interesting cardiovascular marker, because it is highly responsive to transient stress (Kasl, Cobb, & Brooks, 1968; Rahe & Arthur, 1967; Rahe, Rubin, Arthur, & Clark, 1968). Kasl et al. (1968), for example, found that abnormally high uric acid levels in workers anticipating a plant shutdown returned to normal after the workers had found new jobs.

Blood chemistry data were collected from both Wellness samples as part of their participation in the Wellness Program. The blood samples were drawn in the morning after a minimum 12-hr fast and analyzed by a commercial laboratory. Complete data were available from 74 and 61 subjects, respectively. Table 5 presents correlations between NEM and PEM and the various serum markers. Generally speaking, the trait measures are unrelated to these coronary risk factors. The single exception is the low, but consistent, negative correlation between NEM and uric acid. Because high uric acid levels predict later coronary disease (e.g., Brand et al., 1985; Fessel, 1980), these data again

Table 5
Correlations Between Negative and Positive Emotionality
(NEM and PEM) and Serum Risk Factors
for Cardiovascular Disease

Serum marker	Correlation with NEM		Correlation with PEM	
	Wellness 1	Wellness 2	Wellness 1	Wellness 2
Uric acid	-.23**	-.22*	-.05	.07
Triglycerides	-.11	-.06	.00	.04
LDL cholesterol	-.09	-.11	.08	.03
Total cholesterol	-.09	-.11	.09	.03

Note. $n = 74$ for Wellness-1 sample and $n = 61$ for Wellness-2 sample.
LDL = low density lipoprotein.

* $p < .10$, two-tailed. ** $p < .05$, two-tailed.

suggest that high NA subjects, if anything, have a slightly better cardiac prognosis.

Coronary heart disease. The data concerning actual coronary disease are more complicated. Individual studies have generally indicated that trait NA is unrelated to objective indicators of cardiac pathology. Several major prospective studies, with follow-up periods ranging from 4½ to 20 years, have found that premorbid NA levels do not predict the occurrence of coronary heart disease (Brozek, Keys, & Blackburn, 1966; Costa et al., 1982), myocardial infarction (Ostfeld, Lebovits, Shekelle, & Paul, 1964), or heart-related mortality (Keehn, Goldberg, & Beebe, 1974; Shekelle et al., 1981). Moreover, heart patients tend to have slightly lower premorbid NA scores in some of these studies, paralleling our own data (Tables 4 and 5).

However, Booth-Kewley and Friedman's (1987) meta-analytic examination of the literature suggests that NA may be modestly related to the development of later coronary disease. It is difficult to integrate their results with the data we have presented here because their analyses include data obtained on a wide range of measures, some that clearly measure trait NA (e.g., the TMAS and STAI A-Trait), others that assess state NA (e.g., several scales from the Profile of Mood States; POMS; McNair, Lorr, & Droppleman, 1971), and still others whose relevance to the NA construct is unclear (e.g., various projective measures; see D. Watson & Clark, 1984, for a discussion of the measurement of trait and state NA). Nevertheless, it is interesting to note that their meta-analysis of the relevant prospective studies yielded low but significant correlations between various types of negative affect and the subsequent incidence of heart disease (for anxiety, $r = .14$; for depression, $r = .17$; for anger/hostility, $r = .07$; see Booth-Kewley & Friedman, 1987, Table 7).

In summary, the preponderance of the data we have reviewed indicates that although trait NA is correlated with complaints of angina and chest pain, it is unrelated to actual cardiac pathology. Booth-Kewley and Friedman's (1987) findings do suggest that trait NA may be weakly related to the development of coronary disease; however, the correlations are low, and the heterogeneity of the measures included in their meta-analysis precludes any firm conclusions. This is an issue that certainly warrants further study.

Cancer and the Immune System

The available evidence also indicates that high NA is not associated with either cancer or general immune system dysfunction. In fact, some data suggest that low NA individuals are more likely to develop cancer and to have lower survival rates once it has been diagnosed.

Cancer. Unfortunately, very few studies have examined the relation between premorbid NA levels and the eventual development of cancer. C. G. Watson and Schuld (1977) compared 21 male Veterans Administration (VA) patients with malignant neoplasms and a matched group of healthy control subjects. All of the subjects had completed the Minnesota Multiphasic Personality Inventory (MMPI; Hathaway & McKinley, 1943) at least 2 years prior to receiving any neoplastic diagnosis. The two groups did not differ significantly on any NA-related scale, although the cancer patients tended to have lower NA scores premorbidly.

More striking are the results reported by Dattore, Shontz, and Coyne (1980). They studied 200 male VA patients, 75 who had cancer and 125 hospitalized control subjects who had various diagnoses such as benign neoplasms, schizophrenia, and hypertension. Again, all of the subjects took the MMPI at least 1 year prior to receiving any physical or psychiatric diagnosis. Dattore et al. found that the cancer patients were significantly lower on NA premorbidly (most notably on the R-S scale). Given the unusual composition of the control group, it is difficult to ascertain whether the cancer patients were low NA premorbidly and the control patients were essentially normal or whether the control patients were high NA and the cancer patients were normal. Dattore et al. preferred the former interpretation and suggested that individuals who tend to repress and deny negative emotions (especially depression) are more likely to develop cancer. If this is so, then these results converge with other data demonstrating that emotional inhibition is associated with negative health consequences (Pennebaker, 1985; Pennebaker & Beall, 1986; Pennebaker & O'Heeron, 1984) and poorer immune function (Pennebaker, Kiecolt-Glaser, & Glaser, 1988). In any event, for our purposes the important point is that premorbid NA was negatively related to the development of cancer.

When patients who already have cancer are compared with normal control subjects, the results are essentially the same: NA is either unrelated to cancer (Bond & Pearson, 1969) or is negatively correlated with it (Kissen, 1964; Kissen & Eysenck, 1962). Other research indicates that NA is unrelated to deaths from cancer. For example, Shekelle et al. (1981) found that premorbid NA (measured by the MMPI) did not predict cancer-related deaths accruing over a 17-year follow-up period.²

² Shekelle et al. (1981) did find that premorbid scores on the Minnesota Multiphasic Personality Inventory (MMPI) Depression scale were significantly higher among those subjects who later died from cancer. It is important to note, however, that this scale is multifactorial in composition (Comrey, 1957). Because other scales that are purer negative affect (NA) markers (such as MMPI Psychasthenia) did not show any such effect, it seems reasonable to conclude that this finding does not reflect general differences in trait NA (see D. Watson & Clark, 1984).

Similarly, Keehn et al. (1974) reported that their neurotic and control groups did not differ in cancer-related mortality over a 24-year follow-up.

Kaplan and his colleagues (Kaplan & Camacho, 1983; Kaplan & Kotler, 1985; Kaplan & Reynolds, 1988) have investigated the relation between various measures of subjective well-being and cancer in a prospective study spanning 17 years. The results have been inconsistent and largely negative, but they do suggest that low PA may play some role in the development of cancer. Specifically, Reynolds, Kaplan, and Cohen (1988) found that low premorbid levels of life satisfaction and overall happiness (i.e., low PA) were associated with both cancer incidence and mortality among women. Among men, however, subjective well-being did not predict any cancer outcomes. Moreover, Kaplan and Reynolds (1988) reported that premorbid well-being scores were unrelated to cancer incidence and mortality in both sexes. The safest conclusion from these data is that premorbid NA is unrelated to the development of cancer; they do suggest a possible role for low PA, but more studies are clearly needed.

Researchers have also investigated how NA affects survival in cancer patients. In a widely cited study of breast cancer patients, Derogatis, Abelloff, and Melisaratos (1979) found that long-term survivors had significantly higher current NA levels (i.e., they reported more hostility, guilt, and general negative affect). Rogentine et al., 1979, reported similar findings for patients with melanoma, a serious malignancy. On the basis of these findings, Derogatis et al. (1979) suggested that the overt expression of negative affect promotes survival. It again appears that high NA may actually be beneficial, at least among cancer patients.

Immune function. Studies of immune system functioning have yielded inconsistent results, although the majority have found that immune function is unrelated to NA. For example, Levy and her associates (Levy, Herberman, Maluish, Schlien, & Lippman, 1985) investigated natural killer cell activity in breast cancer patients. Natural killer cells play an important role in arresting the spread of tumor cells and, thus, appear to be a vital component in the body's natural fight against cancer (Herberman, 1982; Herberman & Ortaldo, 1981). Levy et al. found that NA levels—as measured by the Symptom Checklist-90 (SCL-90; Derogatis, Rickels, & Rock, 1976), and various POMS scales—were unrelated to either natural killer cell activity or long-term prognosis. Similarly, Kiecolt-Glaser et al. (1984) reported that trait NA scales (from the MMPI) were unrelated to immunocompetence. One recent study, however, claims to have found a link between a salivary measure of immune system functioning and daily fluctuations in both state NA and state PA (Stone, Cox, Valdimarsdottir, Jandorf, & Neale, 1987).

Some of the cancer/immune findings we have considered suggest that a repressive/inhibited coping style has deleterious health consequences. Recently, several investigators directly examined an individual difference measure of repressive coping style that is defined by a combination of low NA (TMAS) and high social desirability (Marlowe-Crowne Social Desirability Scale; Crowne & Marlowe, 1964). In general, such individuals have greater cancer-related mortality (Jensen, 1984), and in laboratory studies, greater autonomic activity (Weinberger,

Schwartz, & Davidson, 1979) than do high NA subjects. As expected, however, health complaints and negative affect were highest among the high NA individuals. The use of NA measures in conjunction with the Marlowe-Crowne scale—although beyond the scope of this article—appears to be a very promising strategy in health psychology research.

Summarizing the relevant data, we see no evidence that high NA leads to the development of cancer. On the contrary, some findings suggest that low NA individuals (perhaps because of a repressive coping style) are more susceptible to cancer. Thus, these findings offer no support for the psychosomatic hypothesis. The data are inconsistent, however, and it is clear that many relevant factors have not yet been identified.

General Health Correlates of Negative Affect

Mortality. We have already seen that premorbid NA is largely unrelated to coronary disease and cancer, but is it associated with overall mortality rates? Good data are scarce on this point, but the available evidence suggests that trait NA is generally unrelated to mortality. Shekelle et al. (1981) found no relation between premorbid NA levels and deaths from any cause across their 17-year follow-up period. Similarly, Costa and McCrae (1987) reported that trait NA was unrelated to overall mortality (determined 7 to 26 years after the initial personality testing) in their large male sample. Kaplan and Reynolds (1988) did find that high premorbid depression scores were predictive of non-cancer-related deaths in a 17-year follow-up. An inspection of the item content of their scale, however, suggests that it assesses both high NA and low PA (e.g., it includes several items each from Bradburn's NA and PA scales; see Kaplan & Reynolds, Table 1); thus, it is unclear whether high NA, low PA, or both contribute to the observed effect.

Keehn et al. (1974), in their 24-year follow-up comparison of normal and neurotic subjects (who can be expected to be very high NA; see D. Watson & Clark, 1984, Table 10), reported a significantly higher mortality rate among the neurotic subjects. However, the bulk of this group difference was due to the greater incidence of suicide, homicide, and alcoholism among the neurotic subjects. Furthermore, the discrepancy in mortality rates declined sharply after the first few years and eventually disappeared altogether. Summarizing their results, Keehn et al. concluded: "We see little evidence that the anxiety and emotional conflicts noted at hospitalization . . . have led to chronic disturbance of physiological function and so to organic disease later in life" (p. 44).

Health-relevant behaviors. We can also evaluate the health consequences of high NA by examining how trait NA correlates with various health-related behaviors. For example, do high NA individuals make more physician or health-center visits, spend more time hospitalized, or miss more days of work or school because of illness? We have analyzed these relations in several of our samples. Table 6 presents correlations between NEM and PEM and number of physician or health-center visits (because of illness, injury, or other reasons), days hospitalized, and days of work or school missed because of illness during the past year. The data indicate that neither NA nor PA is strongly or consis-

Table 6
*Correlations Between Negative and Positive Emotionality (NEM and PEM)
 and Health Visits, Absences, and Hospitalizations*

Sample	<i>n</i>	Correlation with NEM			Correlation with PEM		
		Total health visits	No. of days in hospital	Health-related absences	Total health visits	No. of days in hospital	Health-related absences
Wellness 1	81	.12	—	—	-.04	—	—
Wellness 2	67	.15	—	-.17	.08	—	.03
Adult	54	.08	.00	.13	-.25*	.05	-.25*
Student 1	192	.11	.06	.13	.09	.04	.01
Student 2	125	.19	.09	.14	-.10	.17	-.15

* $p < .05$, two-tailed.

tently correlated with health-relevant visits or absences in these samples.

Other investigators have also studied the association between NA and health visits. E. D. Schroeder (1972) found that trait NA (STAI A-Trait) was uncorrelated with number of visits to a student health center. In a large sample ($n = 327$), Tessler, Mechanic, and Dimond (1976) obtained a significant but low ($r = .15$) correlation between NA (EPI-N short form) and visits made to a health maintenance organization. Similarly, Mechanic (1980) reported low but significant correlations between NA and physician visits ($r = .13$) and sick days ($r = .20$). In contrast, Byrne, Steinberg, and Schwartz (1968) found a significant relation between NA (R-S) and university health center visits, but only for men (we have not found a consistent sex effect in our data). Finally, Gayton, Bassett, Tavormina, and Ozmon (1978) reported that high NA prisoners made more sick-call visits (both medically justified and unjustified) than did those low or moderate in NA. Again, trait NA is not clearly or consistently related to physician/health center visits.

We have also examined the correlation between NEM and PEM and number of reported sick days in our Student-3 sample. Recall that these subjects completed a daily mood and health questionnaire every day for 6–7 weeks. At the bottom of the rating form, subjects noted whether they had been sick that day. Colds or flu were listed as the cause of almost all of the sick days (an average of 6.9 days per subject). Both NEM ($r = .00$) and PEM ($r = -.06$) were unrelated to the number of days the subject was sick with colds/flu. Overall, the data reveal an interesting pattern: High NA subjects reported more physical complaints (see Table 1), and physical complaints were strongly linked to the occurrence of illness (subjects who were sick more often had a higher mean level of health complaints), but NA was unrelated to illness. Consistent with our earlier discussion, this pattern of results suggests that health complaint measures contain at least two distinct components, one that is valid and health-relevant and another that is more subjective and psychological. Furthermore, trait NA scales largely assess this latter component. This is a recurrent pattern in health research, and we will return to it later.

Fitness and lifestyle variables. Finally, we have examined how trait NA and trait PA correlate with a number of indicators

of general fitness and health-related lifestyle. Table 7 presents correlations with gender, weight, height/weight ratio (a common index of obesity), exercise (number of times per week), sleep (average hours per night), smoking (whether the subject smokes), alcohol, coffee and total caffeine consumption (number of drinks per week), and the use of aspirin or aspirin substitutes (number of tablets per week). These results are congruent with the data we have already considered—neither trait NA nor trait PA has a strong or consistent correlation with any of these variables.

Summary

Across a broad range of data, we have found remarkably little support for a psychosomatic interpretation of the NA–health complaint relationship. Generally speaking, NA is unrelated to a diverse array of health indicators, including fitness and lifestyle variables; frequency of illness; health-related visits or absences; objective evidence of risk, dysfunction, or pathology; and overall mortality. Taken together, the data create a curious portrait of high NA individuals. They complain of angina but show no evidence of greater coronary risk or pathology. They complain of headaches but do not report any increased use of aspirin. They report all kinds of physical problems but are not especially likely to visit their doctor or to miss work or school. In general, they complain about their health but show no hard evidence of poorer health or increased mortality.

We cannot dismiss the psychosomatic hypothesis entirely, however. We have not considered the relation of NA to every possible kind of medical problem. For example, trait NA may be associated with a persistent low-grade biological dysfunction (perhaps through elevated stress hormone levels) that serves as a generalized precursor to minor disorders (Depue & Monroe, 1986). Moreover, in some areas the available data are inconsistent or unclear, rather than simply negative (e.g., the association between NA and hypertension; NA's status as a risk factor in coronary disease). Such inconsistencies suggest that additional factors may be involved or that nonlinear or interactive effects ought to be considered. Finally, in several instances it is impossible to disentangle the specific effects of high NA and low PA. For these reasons, we remain open to the possibility that trait

Table 7
*Correlations Between Negative and Positive Emotionality (NEM and PEM)
 and General Fitness and Health-Related Behaviors*

Health variable	Sample				
	Wellness 1	Wellness 2	Adult	Student 1	Student 2
Correlation with NEM					
Sex	-.05	.02	-.03	.14	.07
Weight	-.18	-.16	.20	-.10	-.16
Height/weight ratio	.19	.14	-.20	.09	.01
Frequency of exercise	—	-.12	-.25	-.05	-.02
Hours of sleep	—	-.12	-.14	.05	.04
Smoking	.00	-.02	.11	.01	.11
Aspirin use	.12	-.04	-.02	.11	.26*
Consumption of					
Alcohol	.06	-.05	.06	-.19*	.01
Coffee	.01	-.12	.06	.05	-.07
Caffeine (total)	.14	-.10	.11	.06	.00
Correlation with PEM					
Sex	.05	.01	-.04	.18*	.10
Weight	-.02	.10	-.01	-.04	.04
Height/weight ratio	.06	-.09	.03	.03	-.02
Frequency of exercise	—	.16	.21	.23*	.17
Hours of sleep	—	-.17	-.20	-.08	-.17
Smoking	.05	-.07	-.18	.05	-.15
Aspirin use	.19	.09	.12	.00	-.07
Consumption of					
Alcohol	.10	-.04	-.10	.06	-.08
Coffee	.08	.14	-.25	.07	-.01
Caffeine (total)	.05	.15	-.22	.08	-.03

Note. Wellness 1, $n_s = 77-81$; Wellness 2, $n_s = 61-67$; Adult, $n = 54$; Student 1, $n_s = 192-193$; Student 2, $n = 121-125$. Sex is coded 1 = men, 2 = women; therefore, a positive correlation indicates that women scored higher on NEM or PEM.

* $p < .05$, two-tailed.

NA may be causally implicated in some forms of illness, and we encourage further research on this issue. Nevertheless, until more systematic research suggests otherwise, the bulk of the current evidence either fails to support or directly contradicts the psychosomatic hypothesis. Thus, we feel that this model does not offer an acceptable explanation for observed correlations between NA and somatic complaints.

The Disability Hypothesis

The disability hypothesis proposes that health problems cause distress and dissatisfaction. Some problems with this hypothesis as a general explanatory model are already apparent given the evidence we have considered. Like the psychosomatic hypothesis, the disability model assumes that NA is related to individual differences in actual health problems. However, the data we have presented indicate that high NA is not consistently associated with any major or chronic health difficulties, at least in normal adult and student populations. Nevertheless, the correlation between NA and reported somatic problems remains strong in these samples. Thus, it follows that major health problems are not a significant cause of high NA levels in normal subjects, and that such problems cannot offer an acceptable

general explanation for the NA–health complaint correlations obtained from these subjects.

If health difficulties cause high NA in normal samples, they must clearly be the types of symptoms and complaints assessed by the PILL and other health complaint scales. In other words, it may be that people with more frequent headaches, indigestion, and so on develop high NA in response to their habitual pain and discomfort. This is a difficult issue to study empirically because most physical complaints are inherently subjective, offering little opportunity for objective verification or disconfirmation. Even if there is no demonstrable pathology, who can disprove a patient's complaint of headache or stomach pain?

We cannot rule out this explanation entirely, but the available data suggest that even this modified version of the disability hypothesis has its problems. For example, in our Student-3 sample we analyzed the within-subject association between daily state NA and PA factor scores and the 18-item physical complaint score (see also D. Watson, 1988a). It is not surprising that there was a weak tendency for increased somatic complaining to be associated with a somewhat worse mood. Thus, the average within-subject correlation between the physical complaint

score and state PA was $-.18$, whereas the corresponding value for NA was $+.14$. In other words, when subjects complained of more physical problems, they also tended to report a mildly unpleasant mood (higher NA and lower PA). Clark and Watson (1988) found an identical pattern in a 3-month study of 18 Japanese subjects. That is, days on which the subjects reported a physical problem were associated with both higher NA and lower PA. Finally, it is noteworthy that sick days in our Student-3 sample were associated with significantly lower state PA levels, but there was no effect on NA (see D. Watson, 1988a, for more details).

Generally speaking, then, when individuals complain of physical problems, they also report a diffusely unpleasant mood (higher NA and lower PA). Thus, if trait mood scores reflect accumulated pain and discomfort—as the disability model suggests—then one would expect that both trait NA and trait PA levels would be related to mean symptom scores. However, as Table 1 shows, this is not the case. Following the usual pattern, trait NA correlates significantly with the average physical complaint score, whereas trait PA does not. Clearly, trait NA scores do not simply reflect accumulated aches and pains.

As we have noted, there is little evidence to indicate that persistent health problems produce high trait NA in normal adult or college student samples. However, it is still possible that serious physical problems do lead to high NA in severely affected populations. To address this issue, we must examine NA levels in medical patient groups. A thorough examination of the relevant literature is beyond the scope of our article, but we can briefly summarize three important trends. First, patient groups do not have consistently high trait NA scores—they may be higher, lower, or no different than nonmedical control subjects (e.g., Cassileth et al., 1984; Kissen & Eysenck, 1962; Krug, Scheier, & Cattell, 1976; Sainsbury, 1964). Second, NA seems unrelated to the severity of the medical condition. Most notably, patients with severe health problems do not necessarily have elevated NA scores. We have already discussed that cancer patients tend to have lower-than-normal scores on trait NA tests (Kissen, 1964; Kissen & Eysenck, 1962). More generally, Sainsbury (1964) compared various patient groups with a healthy control sample. Negative affect scores were elevated among patients with various minor ailments (e.g., acne and other skin disorders) but were normal among many groups with more serious problems, such as those with peptic ulcers and coronary disease (see also Cassileth et al., 1984). Third, specific illness groups do not show consistent NA effects. For example, when hypertensive subjects are compared with normal subjects, they may be higher (Kidson, 1973; Sainsbury, 1964), lower (our Wellness-2 sample), or no different on trait NA (Cochrane, 1969, 1973; Costa et al., 1980; Robinson, 1962; our Wellness-1 sample).

Even when group differences are found, they are difficult to interpret. High NA patients are likely to be overdiagnosed for certain disorders because of their tendency to complain about physical symptoms (Costa et al., 1982; Costa & McCrae, 1985a). In addition, trait NA scores may be spuriously inflated in medical samples because of the health-related content included in many NA scales (see D. Watson & Kendall, 1983). Finally, no studies have examined corresponding trait PA levels

in medical patients. Given the within-subjects findings we discussed earlier, it seems plausible that some patient groups would show nonspecific mood effects; that is, they would generally report both higher trait NA and lower trait PA.

Summarizing the data, we find little evidence that health problems lead to generally higher trait NA levels, regardless of whether the subjects are normal adults, college students, or medical patients. Of course, this is not to say that health problems will not produce significant levels of distress and dysphoria in some individuals and under certain circumstances. Nevertheless, given the evidence, we feel it is unlikely that the disability hypothesis provides an acceptable general explanation for the relation between NA and symptom reporting.

The Symptom Perception Hypothesis

Neither the psychosomatic nor the disability model can fully explain the correlation between NA and reported physical problems. Both views assume that high NA subjects suffer from significantly poorer health, and given the data we have reviewed, this assumption seems questionable. At this point we must actively confront the distinction between health complaints and health per se because NA is strongly correlated with physical complaints, whereas it is not consistently related to objective, long-term health status. At the very least, one must conclude that subjective health complaint scales significantly overestimate the true association between NA and health. Thus, the data support at least a weak form of the symptom perception model, which assumes that high NA individuals are more likely to perceive, overreact to, and/or complain about minor physical problems and sensations. In this section, we first discuss issues in the measurement of health complaints and then explore pain sensitivity, attentional focus, and introspection as they relate to NA and symptom reporting.

Measurement of Health Complaints Versus Health

That NA correlates with subjective health complaints, but not with other health indicators, may suggest that these physical symptom scales are simply invalid. However, as we noted earlier, most self-report scales (e.g., the PILL, the HSQ, and various global self-ratings) have established validity and can, indeed, play a useful role in health research. Physical symptom scales correlate significantly with external measures of health status, including physicians' ratings, medical records, and documented health visits (e.g., LaRue, Bank, Jarvik, & Hetland, 1979; Linn & Linn, 1980; Maddox & Douglas, 1973; Meltzer & Hochstim, 1970; Pennebaker, 1982). Moreover, prospective studies have shown that self-report health measures are significant predictors of mortality from ischemic heart disease and other causes (e.g., Kaplan & Camacho, 1983; Kaplan & Kotler, 1985). It is noteworthy, however, that correlations between physical complaints and other types of health measures are usually only low-to-moderate in magnitude. Consequently, as we suggested earlier, health complaint scales likely assess at least two distinct sources of variance, one that is clearly health-relevant and another that is more subjective and psychological (Costa & McCrae, 1987; McCrae et al., 1976; Mechanic, 1979,

1980; Tessler & Mechanic, 1978; Wolinsky, Coe, Miller, & Prendergast, 1984).

Our findings suggest that NA scales largely or entirely assess this latter component. Indeed, studies by McCrae et al. (1976) and Tessler and Mechanic (1978) support this idea by revealing an intriguing pattern: NA correlates significantly with self-rated health, and self-rated health is significantly associated with physicians' ratings, but NA is itself unrelated to the physicians' ratings. Again, subjective health measures contain a psychologically important but organically suspect component that essentially represents the influence of trait NA.³

At this point, one might suspect that high NA individuals are simply hypochondriacs or "crocks" with a pattern of exaggerated somatic concern. One might even argue that the correlation between NA and somatic complaining reflects the extreme responses of a few disturbed individuals. However, the available data do not support either view. First, the relation between trait NA scores and somatic complaining is strongly linear and continuous. At any level of measured NA, higher NA is associated with increasing symptom scores (Costa & McCrae, 1985a). Second, high NA subjects do not exhibit the "doctor shopping" characteristic of the classic hypochondriac (American Psychiatric Association, 1987). Indeed, high NA individuals, despite their myriad physical complaints, show no increased frequency of physician or health-center visits (Table 6). Hypochondriacs may well be high NA, but it is inaccurate to characterize high NA subjects as hypochondriacs.

Given that the link between NA and self-reported health complaints is not simply the result of invalid scales or subtle methodological problems, we will examine evidence concerning other possible mechanisms.

Negative Affect, Anxiety, and Pain

One possible explanation for the pervasive NA-health complaint correlation is that high NA individuals are more sensitive to pain. Several investigators, for example, have reported that subjects experience painful stimuli more intensely when they are anxious (Barsky & Klerman, 1983; Beecher, 1966; Hill, Kornetsky, Flanary, & Wilder, 1952; Sternbach, 1978). Because high trait NA individuals experience generally higher levels of anxiety (in fact, anxiety and negative affect are virtually synonymous; see Tellegen, 1985; D. Watson & Clark, 1984), they may simply respond more strongly to sensations of pain and discomfort. Hence, high NA individuals may report more somatic problems in the absence of any increased physical dysfunction.

Unfortunately, the data directly relating trait NA to pain sensitivity are inconsistent and difficult to interpret. Some studies have found that high NA subjects (measured by such scales as the STAI A-Trait and EPI-N) report more pain in response to the same standardized stimuli (Lynn & Eysenck, 1961; Morgan & Horstman, 1978). However, these same studies found that trait PA (e.g., using the EPI Extraversion scale) is just as strongly related to pain sensitivity as trait NA. Given these results, it is difficult to explain why trait NA correlates with pain complaint scales, but trait PA does not (as in Table 1). Furthermore, other investigators have reported that trait NA (the R-S scale) is generally unrelated to pain threshold and tolerance measures (Da-

vidson & Bobey, 1970; Jamner & Schwartz, 1986). Thus, the data suggest that the pain-sensitivity notion may have some merit, but additional factors must be involved as well.

Vigilance or Scanning

Recent theory and research suggest that high NA subjects are hypervigilant and scan the world for signs of impending trouble. Tellegen (1985), for example, has argued that NA is generally related to an unsettled and future-oriented cognitive mode in which the individual scans the environment with uncertainty and apprehension.

Similarly, Gray (1981, 1982, 1985) has developed a comprehensive model based on extensive data from studies on the physiological, neurochemical, and behavioral correlates of anxiety. Gray postulates the existence of a Behavioral Inhibition System (BIS), which he locates in the septo-hippocampal system. According to Gray, the BIS generally functions to compare actual with expected stimuli. If there is a match (i.e., if the expected pattern occurs), the BIS takes no action. However, if the unexpected occurs, the BIS takes direct control over behavior. This process of checking stimuli requires neurotransmitter input and is associated with the subjective experience of anxiety or negative affect. Hence, increased checking leads to increasing amounts of anxiety or negative affect. Gray theorizes that the BIS identifies certain types of stimuli as particularly important and requiring especially careful checking. He argues that high trait anxious (i.e., high trait NA) people have an overactive BIS, one that tends to identify all stimuli as important and so requiring constant checking. Thus, according to Gray, high NA individuals will be hyper-vigilant, constantly scanning their environment for signs of trouble.

The hyper-vigilance of high NAs may help explain their increased somatic complaining in two ways. First, high NAs may be more likely to notice and attend to normal body sensations and minor aches and pains. Second, because their scanning is fraught with anxiety and uncertainty, high NAs may interpret normal symptoms as painful or pathological (see Barsky & Klerman, 1983; Costa & McCrae, 1985a). Indeed, several studies have shown that high NA subjects interpret ambiguous stimuli in a negative or threatening manner (Goodstein, 1954; Haney, 1973; Phares, 1961; see also D. Watson & Clark, 1984). This is a promising area for future research.

³ Across several samples, physical symptom scores correlate negatively with age. For example, aggregating across all of our relevant samples ($n = 509$), the Pennebaker Inventory of Limbic Languidness (PILL) has a significant negative correlation ($r = -.27$) with age. PILL scores are especially high among teenagers (predominantly 18- and 19-year-olds) and then gradually drop among subjects in their 20s; after that they stabilize. If the PILL were purely a measure of health, this pattern would make no sense because it would indicate that teenagers and young adults suffer from the poorest health. If we accept that the PILL (as well as other symptom scales) is partly a measure of NA-based subjective distress, however, then these data are no longer puzzling. In fact, they make good sense in that negative emotionality (NEM) has a similar negative correlation ($r = -.21$) with age in these samples. Once again, we find that somatic complaint scales have a significant negative-affect-based component that is uncorrelated with actual health status.

Negative Affect, Competition of Cues, and Introspection

High NAs tend to be more introspective and ruminative than low NAs (D. Watson & Clark, 1984). This suggests the possibility that high NA subjects report more physical problems simply because they are more internally focused. Recent research supports the idea that an internal orientation increases physical symptom reporting. This research derives from a model of physical symptom perception proposed by Pennebaker (1982; Pennebaker & Lightner, 1980).

On the assumption that people can process only a finite amount of information at a given time (e.g., Navon & Gopher, 1979), Pennebaker (1982) proposed that physical complaints will vary as a function of the relative availability of external stimuli. As the number and salience of external cues increase, attention to internal stimuli will necessarily decrease, and vice versa. Internal sensory stimuli and external environmental cues, then, compete for attention. When attention is focused internally, individuals are more likely to report a variety of physical symptoms and sensations. This model predicts, for example, that people will report more symptoms such as headaches and fatigue in a boring environment than in an interesting one.

Several studies have supported the competition of cues idea. Pennebaker and Lightner (1980), for example, found that joggers ran faster and reported less fatigue when their exercise environment was interesting (a wooded cross-country trail) than when it was boring (a track). Other studies demonstrated that subjects coughed more (Pennebaker, 1980), reported more extreme emotions (Pennebaker, 1982, chap. 4), and were more aware of feelings of fatigue (Pennebaker & Brittingham, 1982) when their environment was lacking in stimulation. Fillingim and Fine (1986) found that joggers reported more physical problems such as side cramps and shortness of breath when they focused internally (attending to their own heart and breathing rate) rather than externally (listening to verbal stimuli). Finally, manipulations forcing heightened self-attention through the use of a mirror also increase physical symptom reporting (Duval & Wicklund, 1972; Wegner & Vallacher, 1980; Wicklund, 1975). As would be predicted by the symptom perception hypothesis, no studies have found corresponding physiological effects during periods of self-focus.

Dispositional measures of self-focused attention also produce results that are consistent with the symptom perception hypothesis. The Private Self-Consciousness Scale (PSC; Fenigstein, Scheier, & Buss, 1975) measures the degree to which subjects report being aware of their thoughts and moods. Across several college student samples ($N = 1,431$ subjects), Pennebaker (1982) found that PSC scores were significantly correlated with the PILL ($r = .24$) but were unrelated to reports of health-center use, aspirin consumption, and class absences (see also Carver & Scheier, 1981).

Given the introspective style characteristic of high NAs, it again seems plausible that these subjects are more likely to notice and attend to normal body sensations and minor discomforts. Thus, the perceptual/attentional style of high NA individuals—introspective, apprehensive, negativistic, and vigilant—

may be largely responsible for their enhanced somatic complaining.

Implications and Conclusions

We have reviewed extensive evidence demonstrating that NA is associated with a broad range of subjective complaints and that NA correlates as highly with physical symptom measures as these symptom scales relate to one another. Accordingly, we must expand our conception of NA. Rather than solely a disposition of negative emotionality, NA is a more general trait of *somatopsychic distress*. In fact, the distinction between psychological and physical complaining is clearly arbitrary and inadequate. To a considerable extent, self-reported distress represents a single pervasive trait that is expressed through a broad range of negative affective states and somatic complaints.

To us, the pervasive link between mood and somatic complaints offers exciting prospects for future research. The greatest challenge is to identify the underlying psycho-biological mechanisms that give rise to individual differences in NA and account for the somatopsychic connection itself. Research along these lines will be especially interesting in that it will simultaneously elucidate the nature of both physical symptom reporting and negative emotionality, as well as the interrelations between the two.

Another intriguing aspect of the data is the complete lack of a relation between PA and somatic complaints. Among other things, this demonstrates that people who report numerous physical problems may nevertheless describe themselves as happy, enthusiastic, and excited about life. It has also proven important in ruling out various explanations for the NA–health relationship (especially the disability model) and points future studies toward mechanisms and structures that are NA-specific, such as Gray's BIS. Finally, these data again demonstrate the usefulness of including separate PA and NA scales in research.

Accumulating research indicates that PA and NA have strikingly different correlates. Moreover, they relate to generally different types of variables. Positive affect is associated with a wide range of specific events and activities—especially social activities (Bradburn, 1969; Clark & Watson, 1988)—as well as a number of biologically and socially determined factors. For example, researchers have found that PA fluctuates with the time of day (following the general circadian cycle; see Clark, Watson, & Leeka, 1988; Clements, Hafer, & Vermillion, 1976; Monk, Leng, Folkard, & Weitzman, 1983; Taub & Berger, 1974; Thayer, 1978; Watts, Cox, & Robson, 1983) and the season of the year (Smith, 1979). In contrast, NA is largely unrelated to these variables, but is instead strongly correlated with perceived stress and health complaints (e.g., Clark & Watson, 1988; D. Watson, 1988a; D. Watson, Pennebaker, & Folger, 1987).

Perhaps most important, the data reveal the need to re-evaluate much of the existing research in health psychology. Although trait NA is strongly correlated with health complaints, it is not strongly or consistently related to long-term, objective health status. Thus, NA can be expected to act as a general nuisance factor in health research, one that taps psychologically important but organically spurious variance in physical symptom measures. We must remain skeptical of any study that uses

Table 8
Hierarchical Multiple Regressions of Negative Emotionality (NEM) and Hassles on Health Complaints

Predictor	<i>R</i> ² change		<i>β</i> ^a
	NEM entered first	Hassles entered first	
Criterion: SMU-HQ Symptom scale			
NEM	.21	.12	.39*
Hassles frequency	.02	.11	.15*
Hassles intensity			.01
Criterion: PILL			
NEM	.18	.09	.35*
Hassles frequency	.02	.11	.17*
Hassles intensity			-.01
Criterion: HSCL Somatization			
NEM	.19	.07	.30*
Hassles frequency	.06	.18	.19*
Hassles intensity			.17*

Note. *n* = 164. SMU-HQ = Southern Methodist University Health Questionnaire; PILL = Pennebaker Inventory of Limbic Languidness; HSCL = Hopkins Symptom Checklist.

^a Standardized regression coefficient.

* *p* < .05, two-tailed.

a health complaint scale as its criterion for health and that includes, as a psychological predictor, a measure with a subjective distress component. The danger always exists that such a predictor is assessing—either partly or completely—variance that is uninteresting from an objective health standpoint (however interesting it may be psychologically).

An illustration of this problem can be seen by considering the frequently reported finding that measures of perceived stress (e.g., major life changes, chronic stresses or strains, minor hassles) correlate significantly with health complaints (e.g., Cohen, Kamarck, & Mermelstein, 1983; Delongis et al., 1982; Eckenrode, 1984; D. H. Schroeder & Costa, 1984). Do these results suggest that stress affects health? Generally speaking, perceived stress measures have a strong subjective distress component and correlate significantly with NA scales (Dohrenwend & Shrout, 1985; D. H. Schroeder & Costa, 1984; D. Watson, 1988a; D. Watson et al., 1987). It therefore seems likely that stress-symptom correlations partly or largely reflect their overlapping NA component.

To examine this possibility, we had 164 subjects in our Student-1 sample also complete the Hassles Scale (Kanner et al., 1981), a 117-item questionnaire reflecting a mixture of chronic concerns (e.g., financial problems, unsatisfactory personal relationships) and minor irritants (e.g., having to wait in line, the weather). On the scale, subjects are asked to check any hassle that has occurred during the last month and then to rate the severity of each checked problem on a 3-point scale. Two scores are derived: (a) frequency of hassles, which is simply the number of items checked, and (b) intensity of hassles, which reflects the average severity of the noted items.

Consistent with previous research (DeLongis et al., 1982),

both frequency and intensity of hassles were significantly correlated with the three health complaint scales assessed in this sample (for frequency, the *r*s ranged from .31 to .36; for intensity, the *r*s ranged from .17 to .34). As expected, both Hassles Scale measures were also significantly correlated with NEM (for frequency, *r* = .43; for intensity, *r* = .34). Finally, as we have already seen (Table 2), the physical symptom measures were also significantly related to NEM (average *r* = .42). This general pattern of relationships suggests that NA is common to (and perhaps accounts for much of the correlation between) reported hassles and health complaints.

To test this hypothesis, we performed hierarchical multiple regression analyses of NEM and the two Hassles Scale scores (which were entered as a single block) on all three health complaint scales. The results are shown in Table 8, and it is noteworthy that all three health criteria showed a similar pattern. When NEM was entered first, it accounted for the bulk of the variance (ranging from 18% to 21%), whereas the two Hassles scores contributed significantly but modestly to the regression equations (accounting for an additional 2% to 6% of the variance). Conversely, when the Hassles scores were entered first, they accounted for a larger proportion of the variance (11% to 18%). Note, however, that NEM makes a substantial contribution even when it is entered last (7% to 12% of the variance). These data are clearly consistent with our contention that trait NA is partly responsible for the observed correlations between hassles and health complaints.

To examine further the relationships among NA, hassles, and health, we subjected the personality (NEM, PEM), mood (state NA, state PA), stress (frequency and intensity of hassles), and health complaint measures (PILL, SMU-HQ, HSCL Somatization) to a principal components analysis. We also included three behavioral health measures (health visits, days hospitalized, and

Table 9
Rotated Factor Loadings of the Personality, Mood, Stress, Health Complaint, and Behavioral Measures in the Student-1 Sample

Variable	Loadings		
	Factor 1	Factor 2	Factor 3
State NA	.78	.05	.01
HSCL Somatization	.77	.00	-.10
PILL	.75	.09	.18
SMU-HQ Symptom scale	.69	.10	.04
NEM	.69	.09	-.35
Hassles frequency	.62	-.02	-.20
Hassles intensity	.44	.15	-.37
Total health visits	.08	.81	.02
Days hospitalized	-.09	.80	-.01
Health-related absences	.21	.69	.05
PEM	-.10	.03	.82
State PA	.02	.09	.81

Note. *n* = 164. NA = negative affect; HSCL = Hopkins Symptom Checklist; PILL = Pennebaker Inventory of Limbic Languidness; SMU-HQ = Southern Methodist University Health Questionnaire; NEM = negative emotionality; PEM = positive emotionality; PA = positive affect.

health-related absences) in this analysis. An inspection of the eigenvalues indicated three salient dimensions, so the first three factors were orthogonally rotated according to the varimax criterion.

The resulting factor loadings are shown in Table 9. The first factor is clearly an NA-centered dimension of somatopsychic distress, and indicates that the NA, health complaint, and stress scales all reflect a common underlying construct. Also, as expected, the PA scales define a separate (third) factor, again demonstrating that the positive emotions are largely independent of both negative affect and health complaints.

The behavioral health measures comprise an independent second dimension. It is noteworthy that the physical symptom scales do not load significantly on this dimension, suggesting that they were not substantially related to the health behaviors in this sample. In fact, these correlations were invariably low, ranging from .00 to .22. The only significant coefficients were between the SMU-HQ Symptom scale and health visits ($r = .18$) and absences ($r = .22$). These results are surprising. As we have already noted, considerable research suggests that the PILL and other self-report health measures are significantly correlated with health-related behaviors and other health status variables (e.g., LaRue et al., 1979; Meltzer & Hochstim, 1970; Pennebaker, 1982).

For the present purposes, however, the important finding is that health-related behaviors were uncorrelated with the general distress dimension defined by the NA scales, reported hassles, and health complaints. Given these results, it is likely that the hassles-health complaint correlations are subject to the same interpretive problems we have noted in connection with NA. Stress measures such as the Hassles Scale may well prove to be significantly correlated with health status (objectively defined), but health complaint scales undoubtedly overestimate this relationship to a considerable extent.

In general, the pervasive influence of NA will complicate the interpretation of any study using physical symptom measures as health criteria. Subjective complaint scales are indispensable for many types of health research in that they are easy to administer and, moreover, clearly contain a valid, health-related component. We are not advocating the abandonment of health complaint measures. However, we strongly suggest that physical symptom scales be used in conjunction with other indicators of health status, including biological markers (e.g., physiological levels, immune system functioning, serum risk factors), outcome variables (e.g., disease incidence and mortality), and health-related behaviors. Furthermore, it seems advisable to include an established trait NA marker in health research, so that its influence can be identified and isolated.

Having said this, we should also note the limitations of our review. Most important, our data were collected on college undergraduates and narrowly defined adult samples. Although we have reviewed findings from other sources that are consistent with our own conclusions (e.g., Costa & McCrae, 1985a, 1987), it is critical that these data be replicated with broader based, community samples. It is possible, for example, that the organically valid component in self-report health measures will be relatively stronger—and the psychological component weaker—in broader based samples that contain a wider range of more seri-

ous health problems. If so, NA may exert less influence as a nuisance factor in such samples. This is an important question for future research.

We also encourage more systematic research into the health correlates of both NA and PA. As we have noted, the data regarding NA are often inconsistent rather than completely negative. Furthermore, some of the research we have reviewed suggests that low PA may have important health implications of its own, especially in the development of health problems such as cancer. Future research in this area would benefit from the inclusion of clearly defined markers of both mood factors. As we have noted, some existing measures of constructs such as depression are complex combinations of NA and PA, making it impossible to isolate the specific health correlates of each factor.

The data we have reviewed suggest the necessity of a third force in health psychology research, one that is truly psychosomatic. Certainly, many studies purporting to show how stress or personality affects health must be re-examined in light of the findings we have considered. In addition to investigating how psychological factors influence health or, conversely, how health affects psychological adjustment, we need to explore the underlying communality of physical and psychological distress. The evidence regarding NA reminds us that psychological and somatic complaining are ultimately different reflections of the same integrated system.

References

- Aberg, H., Lithell, H., Selinus, I., & Hedstrand, H. (1985). Serum triglycerides are a risk factor for myocardial infarction but not for angina pectoris: Results from a 10-year followup of Uppsala Primary Preventive Study. *Atherosclerosis*, 54, 89-97.
- American Psychiatric Association. (1987). *Diagnostic and statistical manual of mental disorders* (3rd ed., rev.). Washington, DC: Author.
- Anderson, K. O., Bradley, L. A., Young, L. D., McDaniel, L. K., & Wise, C. M. (1985). Rheumatoid arthritis: Review of psychological factors related to etiology, effects, and treatment. *Psychological Bulletin*, 98, 358-387.
- Barr, M., Pennebaker, J. W., & Watson, D. (1988). Improving blood pressure estimation through internal and environmental feedback. *Psychosomatic Medicine*, 50, 37-45.
- Barsky, A. J., & Klerman, G. L. (1983). Overview: Hypochondriasis, bodily complaints, and somatic styles. *American Journal of Psychiatry*, 140, 273-283.
- Beecher, H. K. (1966). Relationship of significance of wound to pain experienced. *Journal of the American Medical Association*, 161, 1609-1613.
- Beiser, M. (1974). Components and correlates of mental well-being. *Journal of Health and Social Behavior*, 15, 320-327.
- Belloc, N. B., & Breslow, L. (1972). Relationship of physical health status and health practices. *Preventive Medicine*, 1, 409-421.
- Belloc, N. B., Breslow, L., & Hochstim, J. R. (1971). Measurement of physical health in a general population survey. *American Journal of Epidemiology*, 93, 328-336.
- Bond, M. R., & Pearson, I. B. (1969). Psychological aspects of pain in women with advanced cancer of the cervix. *Journal of Psychosomatic Research*, 13, 13-19.
- Booth-Kewley, S., & Friedman, H. S. (1987). Psychological predictors of heart disease: A quantitative review. *Psychological Bulletin*, 101, 343-362.

- Bradburn, N. M. (1969). *The structure of psychological well-being*. Chicago: Aldine.
- Bradburn, N. M., & Caplovitz, D. (1965). *Reports on happiness: A pilot study of behavior related to mental health*. Chicago: Aldine.
- Brand, F. N., McGee, D. L., Kannel, W. B., Stokes, J., III, & Castelli, W. P. (1985). Hyperuricemia as a risk factor of coronary heart disease: The Framingham study. *American Journal of Epidemiology*, 121, 11-18.
- Brodman, K., Erdmann, A. J., & Wolff, H. G. (1949). *Cornell Medical Index-Health Questionnaire*. New York: Cornell University Medical College.
- Brozek, J., Keys, A., & Blackburn, H. (1966). Personality differences between potential coronary and non-coronary subjects. *Annals of the New York Academy of Sciences*, 134, 1057-1064.
- Byrne, D. (1961). The Repression-Sensitization Scale: Rationale, reliability, and validity. *Journal of Personality*, 29, 334-349.
- Byrne, D., Steinberg, M. A., & Schwartz, M. S. (1968). Relationship between Repression-Sensitization and physical illness. *Journal of Abnormal Psychology*, 73, 154-155.
- Carver, C. S., & Scheier, M. F. (1981). *Attention and self-regulation: A control theory approach to human behavior*. New York: Springer-Verlag.
- Cassileth, B. R., Lusk, E. J., Strouse, T. B., Miller, D. S., Brown, L., Cross, P. A., & Tenaglia, A. N. (1984). Psychosocial status in chronic illness: A comparative analysis of six diagnostic groups. *New England Journal of Medicine*, 311, 506-511.
- Cattell, R. B., Eber, H. W., & Tatsuoka M. M. (1980). *Handbook for the Sixteen Personality Factor Questionnaire (16PF)*. Champaign, IL: Institute for Personality and Ability Testing.
- Clark, L. A., & Watson, D. (1988). Mood and the mundane: Relations between daily life events and self-reported mood. *Journal of Personality and Social Psychology*, 54, 296-308.
- Clark, L. A., Watson, D., & Leeka, J. (1988). *Diurnal variation in positive affect: A robust psychobiological phenomenon*. Manuscript submitted for publication.
- Clements, P. R., Hafer, M. D., & Vermillion, M. E. (1976). Psychometric, diurnal, and electrophysiological correlates of activation. *Journal of Personality and Social Psychology*, 33, 387-394.
- Cochrane, R. (1969). Neuroticism and the discovery of high blood pressure. *Journal of Psychosomatic Research*, 13, 21-25.
- Cochrane, R. (1973). Hostility and neuroticism among unselected essential hypertensives. *Journal of Psychosomatic Research*, 17, 215-218.
- Cohen, S., Kamarck, T., & Mermelstein, R. (1983). A global measure of perceived stress. *Journal of Health and Social Behavior*, 24, 385-396.
- Comrey, A. L. (1957). A factor analysis of items on the MMPI depression scale. *Educational and Psychological Measurement*, 17, 578-585.
- Costa, P. T., Jr., Fleg, J. L., McCrae, R. R., & Lakatta, E. G. (1982). Neuroticism, coronary artery disease, and chest pain complaints: Cross-sectional and longitudinal studies. *Experimental Aging Research*, 8, 37-44.
- Costa, P. T., Jr., & McCrae, R. R. (1980a). Influence of extraversion and neuroticism on subjective well-being: Happy and unhappy people. *Journal of Personality and Social Psychology*, 38, 668-678.
- Costa, P. T., Jr., & McCrae, R. R. (1980b). Somatic complaints in males as a function of age and neuroticism: A longitudinal analysis. *Journal of Behavioral Medicine*, 3, 245-257.
- Costa, P. T., Jr., & McCrae, R. R. (1985a). Hypochondriasis, neuroticism, and aging: When are somatic complaints unfounded? *American Psychologist*, 40, 19-28.
- Costa, P. T., Jr., & McCrae, R. R. (1985b). *The NEO Personality Inventory manual*. Odessa, FL: Psychological Assessment Resources.
- Costa, P. T., Jr., & McCrae, R. R. (1987). Neuroticism, somatic complaints, and disease: Is the bark worse than the bite? *Journal of Personality*, 55, 299-316.
- Costa, P. T., Jr., McCrae, R. R., Andres, R., & Tobin, J. D. (1980). Hypertension, somatic complaints, and personality. In M. F. Elias & D. Streeten (Eds.), *Hypertension and cognitive processes* (pp. 95-110). Mt. Desert, ME: Beech-Hill.
- Crowne, D. P., & Marlowe, D. (1964). *The approval motive: Studies in evaluative dependence*. New York: Wiley.
- Dattore, P. J., Shontz, F. C., & Coyne, L. (1980). Premorbid personality differentiation of cancer and noncancer groups: A test of the hypothesis of cancer proneness. *Journal of Consulting and Clinical Psychology*, 48, 388-394.
- Davidson, P. O., & Bobey, M. J. (1970). Repressor-sensitizer differences on repeated exposure to pain. *Perceptual and Motor Skills*, 31, 711-714.
- Davies, M. (1970). Blood pressure and personality. *Journal of Psychosomatic Research*, 14, 89-104.
- DeLongis, A., Coyne, J. C., Dakof, G., Folkman, S., & Lazarus, R. S. (1982). Relationship of daily hassles, uplifts, and major life events to health status. *Health Psychology*, 1, 119-136.
- Dembroski, T., Weiss, S., Shields, J., Haynes, S., & Feinleib, M. (Eds.) (1978). *Coronary-prone behavior*. New York: Springer-Verlag.
- Depue, R. A., & Monroe, S. M. (1986). Conceptualization and measurement of human disorder in life stress research: The problem of chronic disturbance. *Psychological Bulletin*, 99, 36-51.
- Derogatis, L. R., Abeloff, M., & Melisaratos, N. (1979). Psychological coping mechanisms and survival time in metastatic breast cancer. *Journal of the American Medical Association*, 242, 1504-1508.
- Derogatis, L. R., Lipman, R. S., Rickels, K., Uhlenhuth, E. H., & Covi, L. (1974). The Hopkins Symptom Checklist (HSCL): A self-report symptom inventory. *Behavioral Science*, 19, 1-15.
- Derogatis, L. R., Rickels, K., & Rock, A. (1976). The SCL-90 and the MMPI: A step in the validation of a new self-report scale. *British Journal of Psychiatry*, 128, 280-289.
- Diamond, E. L. (1982). The role of anger and hostility in essential hypertension and coronary heart disease. *Psychological Bulletin*, 92, 410-433.
- Diener, E., & Emmons, R. A. (1984). The independence of positive and negative affect. *Journal of Personality and Social Psychology*, 47, 1105-1117.
- Dohrenwend, B. P., & Shrout, P. E. (1985). "Hassles" in the conceptualization and measurement of life stress variables. *American Psychologist*, 40, 780-785.
- Duval, S., & Wicklund, R. A. (1972). *A theory of objective self-awareness*. New York: Academic Press.
- Eckenrode, J. (1984). Impact of chronic and acute stressors on daily reports of mood. *Journal of Personality and Social Psychology*, 46, 907-918.
- Elias, M. F., Robbins, M. A., Blow, F. C., Rice, A. P., & Edgecomb, J. L. (1982). Symptom reporting, anxiety, and depression in arteriographically classified middle-aged chest pain patients. *Experimental Aging Research*, 8, 45-51.
- Eysenck, H. J., & Eysenck, S. B. G. (1968). *Eysenck Personality Questionnaire manual*. San Diego, CA: Educational and Industrial Testing Service.
- Fenigstein, A., Scheier, M. F., & Buss, A. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology*, 43, 522-527.
- Fessel, W. J. (1980). High uric acid as an indicator of cardiovascular disease. *American Journal of Medicine*, 68, 401-404.

- Filligim, R. B., & Fine, M. A. (1986). The effects of internal versus external information processing on symptom perception in an exercise setting. *Health Psychology, 5*, 115-123.
- Friedman, H. S., & Booth-Kewley, S. (1987). The "disease-prone personality": A meta-analytic view of the construct. *American Psychologist, 42*, 539-555.
- Gayton, W. F., Bassett, J. E., Tavormina, J., & Ozmon, K. L. (1978). Repression-sensitization and health behavior. *Journal of Consulting and Clinical Psychology, 46*, 1542-1544.
- Goodstein, L. D. (1954). Interrelationships among several measures of anxiety and hostility. *Journal of Consulting Psychology, 18*, 35-39.
- Gray, J. A. (1981). The psychophysiology of anxiety. In R. Lynn (Ed.), *Dimensions of personality: Papers in honour of H. J. Eysenck* (pp. 233-252). New York: Pergamon Press.
- Gray, J. A. (1982). *The neuropsychology of anxiety: An enquiry into the functions of the septo-hippocampal system*. New York: Oxford University Press.
- Gray, J. A. (1985). Issues in the neuropsychology of anxiety. In A. H. Tuma & J. D. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 5-25). Hillsdale, NJ: Erlbaum.
- Grundy, S. M. (Chair). (1984). Treatment of hypertriglyceridemia: NIH Consensus Development Conference summary. *Arteriosclerosis, 4*, 296-301.
- Haney, J. N. (1973). Approach-avoidance reactions by repressors and sensitizers to ambiguity in a structured free-association task. *Psychological Reports, 33*, 97-98.
- Harburg, E., Julius, S., McGinn, N. F., McLeod, J., & Hoobler, S. W. (1964). Personality traits and behavioral patterns associated with systolic blood pressure levels in college males. *Journal of Chronic Diseases, 17*, 405-414.
- Harding, S. D. (1982). Psychological well-being in Great Britain: An evaluation of the Bradburn Affect Balance Scale. *Personality and Individual Differences, 3*, 167-175.
- Harrell, J. P. (1980). Psychological factors and hypertension: A status report. *Psychological Bulletin, 87*, 482-501.
- Hathaway, S. R., & McKinley, J. C. (1943). *The Minnesota Multiphasic Personality Inventory* (Rev. ed.). Minneapolis: University of Minnesota Press.
- Herberman, R. (Ed.). (1982). *NK cells and other natural effector cells*. New York: Academic Press.
- Herberman, R., & Ortaldo, J. (1981). Natural killer cells: Their role in defenses against disease. *Science, 214*, 24-30.
- Hill, H. E., Kornetsky, C. G., Flanary, H. G., & Wilder, A. (1952). Effects of anxiety and morphine on the discriminations of intensities of pain. *Journal of Clinical Investigation, 31*, 471-480.
- Holmes, T. H., & Rahe, R. H. (1967). The Social Readjustment Rating Scale. *Journal of Psychosomatic Research, 11*, 213-218.
- Jamner, L. D., & Schwartz, G. E. (1986). Self-deception predicts self-report and endurance of pain. *Psychosomatic Medicine, 48*, 211-223.
- Jensen, M. R. (1984). *Psychobiological factors in the prognosis and treatment of neoplastic disorders*. Unpublished doctoral dissertation, Yale University.
- Kanner, A. D., Coyne, J. C., Schaefer, C., & Lazarus, R. S. (1981). Comparison of two modes of stress measurement: Daily hassles and uplifts versus major life events. *Journal of Behavioral Medicine, 1*, 1-39.
- Kaplan, G. A., & Camacho, T. (1983). Perceived health and mortality: A nine-year follow-up of the Human Population Laboratory cohort. *American Journal of Epidemiology, 117*, 292-304.
- Kaplan, G. A., & Kotler, P. L. (1985). Self-reports predictive of mortality from ischemic heart disease: A nine-year follow-up of the Human Population Laboratory cohort. *Journal of Chronic Diseases, 38*, 195-201.
- Kaplan, G. A., & Reynolds, P. (1988). Depression and cancer mortality and morbidity: Prospective evidence from the Alameda County Study. *Journal of Behavioral Medicine, 11*, 1-13.
- Kasl, S. V., Cobb, S., & Brooks, G. W. (1968). Changes in serum uric acid and cholesterol level in men undergoing job stress. *Journal of the American Medical Association, 206*, 1500-1507.
- Keehn, R. J., Goldberg, I. D., & Beebe, G. W. (1974). Twenty-four year mortality follow-up of army veterans with disability separations for psychoneurosis in 1944. *Psychosomatic Medicine, 36*, 27-46.
- Keys, A., Taylor, H. L., Blackburn, H., Brozek, J., Anderson, J. T., & Simonson, E. (1971). Mortality and coronary heart disease among men studied for 23 years. *Archives of Internal Medicine, 128*, 201-214.
- Kidson, M. A. (1973). Personality and hypertension. *Journal of Psychosomatic Research, 17*, 35-41.
- Kiecolt-Glaser, J. K., Ricker, D., George, J., Messick, G., Speicher, C. E., Garner, W., & Glaser, R. (1984). Urinary cortisol levels, cellular immunocompetency, and loneliness in psychiatric inpatients. *Psychosomatic Medicine, 46*, 15-23.
- Kissen, D. M. (1964). Relationship between lung cancer, cigarette smoking, inhalation, and personality. *British Journal of Medical Psychology, 37*, 203-216.
- Kissen, D. M., & Eysenck, H. J. (1962). Personality in male lung cancer patients. *Journal of Psychosomatic Research, 6*, 123-127.
- Kobasa, S. C., Maddi, S. R., & Kahin, S. (1982). Hardiness and health: A prospective study. *Journal of Personality and Social Psychology, 42*, 168-177.
- Krantz, D. S., & Durel, L. A. (1983). Psychobiological substrates of the Type A behavior pattern. *Health Psychology, 2*, 393-411.
- Krug, S. E., Scheier, I. H., & Cattell, R. B. (1976). *Handbook for the IPAT Anxiety Scale* (Rev. ed.). Champaign, IL: Institute of Personality and Ability Testing.
- LaRue, A., Bank, L., Jarvik, L., & Hetland, M. (1979). Health in old age: How do physicians' ratings and self-ratings compare? *Journal of Gerontology, 34*, 687-691.
- Laudenslager, M., Ryan, S., Drugan, R., Hyson, R., & Maier, S. (1983). Coping and immunosuppression: Inescapable but not escapable shock suppresses lymphocyte proliferation. *Science, 221*, 568-570.
- Leventhal, H. (1975). The consequences of depersonalization during illness and treatment. In J. Howard & A. Strauss (Eds.), *Humanizing health care* (pp. 119-161). New York: Wiley.
- Levy, S. M., Herberman, R. B., Maluish, A. M., Schlien, B., & Lippman, M. (1985). *Health Psychology, 4*, 99-113.
- Linden, W., Paulhus, D. L., & Dobson, K. S. (1986). Effects of response styles on the report of psychological and somatic distress. *Journal of Consulting and Clinical Psychology, 54*, 309-313.
- Linn, B. S., & Linn, M. W. (1980). Objective and self-assessed health in the old and very old. *Social Science and Medicine, 14*, 311-315.
- Lynn, R., & Eysenck, H. J. (1961). Tolerance for pain, extraversion and neuroticism. *Perceptual and Motor Skills, 12*, 161-162.
- Maddox, G. L., & Douglas, E. B. (1973). Self-assessment of health: A longitudinal study of elderly subjects. *Journal of Health and Social Behavior, 14*, 87-93.
- Matarazzo, R. G., Matarazzo, J. D., & Saslow, G. (1961). The relationship between medical and psychiatric symptoms. *Journal of Abnormal and Social Psychology, 62*, 55-61.
- Matthews, K. A. (1982). Psychological perspectives on the Type A behavior pattern. *Psychological Bulletin, 91*, 293-323.
- McCrae, R. R., Bartone, P. T., & Costa, P. T., Jr. (1976). Age, anxiety, and self-reported health. *Aging and Human Development, 7*, 49-58.
- McCrae, R. R., & Costa, P. T., Jr. (1987). Validation of the five-factor model of personality across instruments and observers. *Journal of Personality and Social Psychology, 52*, 81-90.
- McNair, D., Lorr, M., & Droppleman, L. (1971). *Manual: Profile of*

- Mood States*. San Diego, CA: Educational and Industrial Testing Service.
- Mechanic, D. (1979). Correlates of physician utilization: Why do major multivariate studies of physician utilization find trivial psychosocial and organizational effects? *Journal of Health and Social Behavior*, 20, 387-396.
- Mechanic, D. (1980). The experience and reporting of common physical complaints. *Journal of Health and Social Behavior*, 21, 146-155.
- Meltzer, J., & Hochstim, J. (1970). Reliability and validity of survey data on physical health. *Public Health Reports*, 85, 1075-1086.
- Monk, T. H., Leng, V. C., Folkard, S., & Weitzman, E. D. (1983). Circadian rhythms in subjective alertness and core body temperature. *Chronobiologia*, 10, 49-55.
- Morgan, W. P., & Horstman, D. H. (1978). Psychometric correlates of pain perception. *Perceptual and Motor Skills*, 47, 27-39.
- Navon, D., & Gopher, D. (1979). On the economy of the human-processing system. *Psychological Review*, 86, 214-255.
- Newman, W. P., III, Freedman, D. S., Voors, A. W., Gard, P. D., Srinivasan, S. R., Cresanta, J. L., Williamson, G. D., Webber, L. S., & Berenson, G. S. (1986). Relation of serum lipoprotein levels and systolic blood pressure to early atherosclerosis: The Bogalusa Heart Study. *New England Journal of Medicine*, 314, 138-144.
- Ostfeld, A. M., Lebovits, B. Z., Shekelle, R. B., & Paul, O. (1964). A prospective study of the relationship between personality and coronary heart disease. *Journal of Chronic Diseases*, 17, 265-276.
- Pearlin, L. I., Lieberman, M. A., Menaghan, E. G., & Mullan, J. T. (1981). The stress process. *Journal of Health and Social Behavior*, 22, 337-356.
- Pennebaker, J. W. (1980). Perceptual and environmental determinants of coughing. *Basic and Applied Social Psychology*, 1, 83-91.
- Pennebaker, J. W. (1982). *The psychology of physical symptoms*. New York: Springer-Verlag.
- Pennebaker, J. W. (1985). Traumatic experience and psychosomatic disease: Exploring the roles of behavioral inhibition, obsession, and confiding. *Canadian Psychology*, 26, 82-95.
- Pennebaker, J. W., & Beall, S. (1986). Confronting a traumatic event: Toward an understanding of inhibition and disease. *Journal of Abnormal Psychology*, 95, 274-281.
- Pennebaker, J. W., & Brittingham, G. L. (1982). Environmental and sensory cues affecting the perception of physical symptoms. In A. Baum & J. Singer (Eds.), *Advances in environmental psychology* (Vol. 4, pp. 115-136). Hillsdale, NJ: Erlbaum.
- Pennebaker, J. W., Kiecolt-Glaser, J. K., & Glaser, R. (1988). Disclosure of traumas and immune function: Health implications for psychotherapy. *Journal of Consulting and Clinical Psychology*, 56, 239-245.
- Pennebaker, J. W., & Lightner, J. M. (1980). Competition of internal and external information in an exercise setting. *Journal of Personality and Social Psychology*, 39, 165-174.
- Pennebaker, J. W., & O'Heeron, R. C. (1984). Confiding in others and illness rate among spouses of suicide and accidental death victims. *Journal of Abnormal Psychology*, 93, 473-476.
- Pennebaker, J. W., & Watson, D. (1988). Blood pressure estimation and beliefs among normotensives and hypertensives. *Health Psychology*, 7, 309-328.
- Phares, E. J. (1961). TAT performance as a function of anxiety and coping-avoiding behavior. *Journal of Consulting Psychology*, 25, 257-259.
- Rahe, R. H., & Arthur, R. J. (1967). Stressful underwater demolition training: Serum urate and cholesterol variability. *Journal of the American Medical Association*, 202, 1052-1054.
- Rahe, R. H., Rubin, R. T., Arthur, R. J., & Clark, B. R. (1968). Serum uric acid and cholesterol variability. *Journal of the American Medical Association*, 206, 2875-2880.
- Reynolds, P., Kaplan, G. A., & Cohen, R. D. (1988). *Psychological well-being and cancer risk: Prospective evidence from the Alameda County Study*. Manuscript submitted for publication.
- Rickels, K., Lipman, R. S., Garcia, C. R., & Fisher, E. (1972). Evaluating clinical improvement in anxious outpatients. *American Journal of Psychiatry*, 128, 119-123.
- Robinson, J. O. (1962). A study of neuroticism and casual arterial blood pressure. *British Journal of Social and Clinical Psychology*, 2, 56-61.
- Rogentine, G. N., Fox, B. H., VanKammen, D. P., Rosenblatt, J., Docherty, J. P., & Bunney, W. E. (1979). Psychological and biological factors in the short-term prognosis of malignant melanoma. *Psychosomatic Medicine*, 41, 647-655.
- Sainsbury, P. (1964). Neuroticism and hypertension in an out-patient population. *Journal of Psychosomatic Research*, 8, 235-238.
- Schroeder, D. H., & Costa, P. T., Jr. (1984). Influence of life event stress on physical illness: Substantive effects or methodological flaws? *Journal of Personality and Social Psychology*, 46, 853-863.
- Schroeder, E. D. (1972). Relationship between A-Trait scores and use of a student health center. *Dissertation Abstracts International*, 33, 921B-922B.
- Schwartz, G. E., Davidson, R. J., & Goleman, D. J. (1978). Patterning of cognitive and somatic processes in the self-regulation of anxiety: Effects of meditation versus exercise. *Psychosomatic Medicine*, 40, 321-328.
- Shekelle, R. B., Raynor, W. J., Jr., Ostfeld, A. M., Garron, D. C., Bieliaskas, L. A., Liu, S. C., Maliza, C., & Paul, O. (1981). Psychological depression and 17-year risk of death from cancer. *Psychosomatic Medicine*, 43, 117-125.
- Smith, T. W. (1979). Happiness: Time trends, seasonal variations, intersurvey differences, and other mysteries. *Social Psychology Quarterly*, 42, 18-30.
- Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manual for the State-Trait Anxiety Inventory*. Palo Alto, CA: Consulting Psychologists Press.
- Steinberg, D. (Chair). (1985). Statement on lowering blood cholesterol to reduce coronary heart disease. *Journal of the American Medical Association*, 253, 2080-2086.
- Sternbach, R. A. (Ed.). (1978). *The psychology of pain*. New York: Raven Press.
- Stone, A. A., Cox, D. S., Valdimarsdottir, H., Jandorf, L., & Neale, J. M. (1987). Evidence that secretory IgA antibody is associated with daily mood. *Journal of Personality and Social Psychology*, 52, 988-993.
- Taub, J. M., & Berger, R. J. (1974). Diurnal variations in mood as asserted by self-report and verbal content analysis. *Journal of Psychometric Research*, 10, 83-88.
- Taylor, J. A. (1953). A personality scale of manifest anxiety. *Journal of Abnormal and Social Psychology*, 48, 285-290.
- Tellegen, A. (1982). *Brief manual for the Differential Personality Questionnaire*. Unpublished manuscript, University of Minnesota.
- Tellegen, A. (1985). Structures of mood and personality and their relevance to assessing anxiety, with an emphasis on self-report. In A. H. Tuma & J. D. Maser (Eds.), *Anxiety and the anxiety disorders* (pp. 681-706). Hillsdale, NJ: Erlbaum.
- Tessler, R., & Mechanic, D. (1978). Psychological distress and perceived health status. *Journal of Health and Social Behavior*, 19, 254-262.
- Tessler, R., Mechanic, D., & Dimond, M. (1976). The effect of psychological distress on physician utilization: A prospective study. *Journal of Health and Social Behavior*, 17, 353-364.
- Thayer, R. E. (1978). Toward a psychological theory of multidimensional activation (arousal). *Motivation and Emotion*, 2, 1-34.
- Uhlenhuth, E. H., Lipman, R. S., Balter, M. B., & Stern, M. (1974).

- Symptom intensity and life stress in the city. *Archives of General Psychiatry*, 31, 759-764.
- Watson, C. G., & Schuld, D. (1977). Psychosomatic factors in the etiology of neoplasms. *Journal of Consulting and Clinical Psychology*, 45, 455-461.
- Watson, D. (1988a). Intraindividual and interindividual analyses of positive and negative affect: Their relation to health complaints, perceived stress, and daily activities. *Journal of Personality and Social Psychology*, 54, 1020-1030.
- Watson, D. (1988b). The vicissitudes of mood measurement: Effects of varying descriptors, time frames, and response formats on measures of positive and negative affect. *Journal of Personality and Social Psychology*, 55, 128-141.
- Watson, D., & Clark, L. A. (1984). Negative affectivity: The disposition to experience aversive emotional states. *Psychological Bulletin*, 96, 465-490.
- Watson, D., Clark, L. A., & Carey, G. (1988). Positive and negative affectivity and their relation to anxiety and depressive disorders. *Journal of Abnormal Psychology*, 97, 346-353.
- Watson, D., Clark, L. A., & Tellegen, A. (1984). Cross-cultural convergence in the structure of mood: A Japanese replication and a comparison with U.S. findings. *Journal of Personality and Social Psychology*, 47, 127-144.
- Watson, D., & Kendall, P. C. (1983). Methodological issues in research on coping with chronic disease. In T. G. Burish & L. A. Bradley (Eds.), *Coping with chronic disease: Research and applications* (pp. 39-81). New York: Academic Press.
- Watson, D., Pennebaker, J. W., & Folger, R. (1987). Beyond negative affectivity: Measuring stress and satisfaction in the workplace. *Journal of Organizational Behavior Management*, 8, 141-157.
- Watson, D., & Tellegen, A. (1985). Toward a consensual structure of mood. *Psychological Bulletin*, 98, 219-235.
- Watts, C., Cox, T., & Robson, J. (1983). Morningness-eveningness and diurnal variations in self-reported mood. *Journal of Psychology*, 113, 251-256.
- Wegner, D. M., & Vallacher, R. (Eds.). (1980). *The self in social psychology*. New York: Oxford University Press.
- Weinberger, D. A., Schwartz, G. E., & Davidson, R. J. (1979). Low-anxious, high-anxious, and repressive coping styles: Psychometric patterns of behavioral and physiological responses to stress. *Journal of Abnormal Psychology*, 88, 369-380.
- Weiss, S. M. (1969). Psychosomatic aspects of symptom patterns among major surgery patients. *Journal of Psychosomatic Research*, 13, 109-112.
- Wicklund, R. A. (1975). Objective self-awareness. In L. Berkowitz (Ed.), *Advances in experimental social psychology* (Vol. 8, pp. 233-275). New York: Academic Press.
- Wolinsky, F. D., Coe, R. M., Miller, D. K., & Prendergast, J. M. (1984). Measurement of the global and functional dimensions of health status in the elderly. *Journal of Gerontology*, 39, 88-92.
- Zarski, J. J. (1984). Hassles and health: A replication. *Health Psychology*, 3, 243-251.
- Zevon, M. A., & Tellegen, A. (1982). The structure of mood change: An idiographic/nomothetic analysis. *Journal of Personality and Social Psychology*, 43, 111-122.

Received February 10, 1987

Revision received May 20, 1988

Accepted June 14, 1988 ■

Hunt Appointed Editor of *JEP: General*, 1990-1995

The Publications and Communications Board of the American Psychological Association announces the appointment of Earl B. Hunt, University of Washington, as editor of the *Journal of Experimental Psychology: General* for a 6-year term beginning in 1990. As of January 1, 1989, manuscripts should be directed to

Earl B. Hunt
Department of Psychology NI-25
University of Washington
Seattle, Washington 98195