Humor, Laughter, and Physical Health: Methodological Issues and Research Findings

Rod A. Martin
University of Western Ontario

All published research examining effects of humor and laughter on physical health is reviewed. Potential causal mechanisms and methodological issues are discussed. Laboratory experiments have shown some effects of exposure to comedy on several components of immunity, although the findings are inconsistent and most of the studies have methodological problems. There is also some evidence of analgesic effects of exposure to comedy, although similar findings are obtained with negative emotions. Few significant correlations have been found between trait measures of humor and immunity, pain tolerance, or self-reported illness symptoms. There is also little evidence of stress-moderating effects of humor on physical health variables and no evidence of increased longevity with greater humor. More rigorous and theoretically informed research is needed before firm conclusions can be drawn about possible health benefits of humor and laughter.

The idea that humor and laughter have positive health benefits has become increasingly popular in recent years, among health care providers as well as the general public. Articles on the health-enhancing effects of humor and laughter frequently appear in the media, and there is a burgeoning “humor and health” movement whose practitioners promote therapeutic humor through seminars, workshops, videotapes, and Internet web sites. Several professional associations dedicated to the study and promotion of humor in health care have been organized, including the American Association for Therapeutic Humor. In recent years, news articles on the putative health benefits of humor have appeared in such mainstream professional periodicals as the APA Monitor (Clay, 1997; McGuire, 1999) and the Journal of the National Cancer Institute (Ziegler, 1995).

As just one example of the enthusiastic claims being made for the health benefits of laughter, the following excerpt is from a recent popular book on complementary approaches to medicine by Zand, Spreen, and LaValle (1999):

New research shows that laughter really is good medicine. . . . Investigation of the effects [that] laughter has on the workings of the brain and body shows that humor that provokes laughter has both psychological and physiological effects. It not only reduces levels of stress hormones, but lessens depression and improves mood. Even more important, research shows that laughter stimulates an increase in the activity of defensive immune cells, including T-cells, that attack and kill tumor cells and viruses. It also boosts the activity of the antibodies that defend the body against harmful organisms, and it steps up the production of interferon, a hormone that fights viruses and regulates cell growth. These solidly documented findings are being taken so seriously that there is a software program in the works designed to help doctors create “laughter prescriptions” tailored to specific individuals. (pp. 600–601)

The notion that laughter has salutary properties is a very old one, dating at least to the biblical proverb that “a merry heart doeth good like a medicine” (Proverbs 17:22; King James Bible). Goldstein (1982) traced the historical origins of this idea in the writings of a number of physicians and philosophers beginning in the 13th century. According to these writers, laughter benefits health through a variety of mechanisms, including providing physical exercise to the muscles, lungs, and inner organs of the body, enriching the blood, increasing respiration and blood circulation, improving digestion, and providing emotional catharsis.

In recent decades, a major impetus for the increased popularity of humor and health was the publication of Norman Cousins’s (1976) article “Anatomy of an Illness” in the New England Journal of Medicine, which was expanded into a best-selling book (Cousins, 1979). The story of how Cousins recovered from ankylosing spondylitis, a progressive and painful rheumatoid disease involving inflammation of the spine, through laughter (and massive doses of Vitamin C), has become part of contemporary folklore. Cousins claimed that 10 min of hearty laughter had a reliable analgesic effect, providing 2 hr of pain-free sleep. In addition, he reported that episodes of laughter reliably resulted in reductions in the sedimentation rate, the rate at which red blood cells descend in a test tube, which is a measure of inflammation. These observations have given rise in particular to the idea that laughter reduces pain, perhaps by stimulating the production of endogenous opioids such as beta-endorphin, and also enhances immune system functioning. Although the case of Norman Cousins is widely cited as evidence for the health benefits of laughter, it is of course only anecdotal and suggestive at best. It is unknown whether Cousins’ recovery can be attributed to the laughter, or to the Vitamin C, or to particular personality traits such as optimism or a will to live, or to some totally unrelated factor, or indeed whether the disease may have been misdiagnosed in the first place.

What is the evidence that humor and laughter are beneficial to one’s health? Is the current popularity of this idea just another manifestation of old folklore, substituting modern scientific concepts such as lymphocytes, natural killer (NK) cells, endorphins,
and cytokines in the place of old ideas about healthy blood and jostled spleen? Or is there empirical support for these ideas? The purpose of this article is to critically review the published empirical research on this topic, focusing on studies on the effects of humor and laughter on the immune system, pain tolerance, blood pressure, longevity, and illness symptoms. This review is based on a search of PsycLIT to locate all articles published since 1960 reporting original empirical research relating to humor or laughter and various aspects of physical health. Forty-one relevant publications were found. The effects of humor on emotional and mental health are not the main focus here. First, however, I discuss several preliminary issues, including definitions of humor, theoretical models of the mechanisms involved, and methodological issues. Although the methodological issues are ones familiar to most psychological researchers, they merit some discussion in view of the methodological weaknesses evident in much of the research to be reviewed.

Definitions of Humor

_Humor_ is defined by *The Oxford English Dictionary* as “that quality of action, speech, or writing which excites amusement; oddity, jocularity, facetiousness, comicality, fun” (Simpson & Weiner, 1989). From a psychological perspective, humor is a rather broad and multifaceted concept, which can be theoretically and operationally defined in a number of ways. It involves cognitive, emotional, behavioral, psychophysiological, and social aspects (Martin, 2000). The term _humor_ can be used to refer to a stimulus (e.g., a comedy film), a mental process (e.g., perception or creation of amusing incongruities), or a response (e.g., laughter, exhilaration). Laughter, the most common behavioral expression of humorous experience, involves a distinctive respiratory–vocal–behavioral pattern that also has distinct psychophysiological correlates (Provine & Yong, 1991; Ruch & Ekman, 2001). Humor and laughter are also typically associated with a pleasant emotional state that has been described by Ruch (1993) in terms of exhilaration. Cognitively, humor involves the perception of incongruity or paradox in a playful context (Forabosco, 1992). As social phenomena, humor and laughter play an important role in interpersonal communication and attraction (Murstein & Brust, 1985), and a sense of humor may be an important component of social competence (Bell, McGhee, & Duffey, 1986; Masten, 1986).

The term _sense of humor_ is generally used by psychological researchers to refer to a personality trait or individual-differences variable (or, more likely, a family of related traits or variables; Ruch, 1998). Thus, _sense of humor_ refers to “habitual individual differences in all sorts of behaviors, experiences, affects, attitudes, and abilities relating to amusement, laughter, jocularity, and so on” (Martin, 1998, p. 17). Not surprisingly, many different approaches have been taken to conceptualizing and measuring sense of humor. One measurement approach, relating to humor appreciation, involves obtaining funniness ratings of jokes and cartoons that are categorized in various ways to assess the particular types or styles of humor that people prefer (e.g., Ruch & Hehl, 1998). In the research on humor and health, however, researchers have generally been more interested in quantitative rather than qualitative conceptions of sense of humor, using self-report scales that assess the degree to which individuals tend to laugh and smile in a wide variety of situations (Situational Humor Response Questionnaire; SHRQ; Martin & Lefcourt, 1984; see also Martin, 1996), use humor in coping with stress (Coping Humor Scale; CHS; Martin & Lefcourt, 1983; see also Martin, 1996), notice and like humor (Sense of Humor Questionnaire; SHQ; Svebak, 1974), produce and enjoy humor (Production and Appreciation Scale of Humor; Ziv, 1981), and so on.

In view of the multifaceted nature of humor and sense of humor, and the variety of ways they can be operationalized, it is often difficult to know exactly what is meant when one speaks of potential health benefits of humor. Indeed, researchers examining humor and health have conceptualized humor in a variety of different ways, seeing it variously as a personality trait, a situational stimulus variable, an emotional response, a mental process, or a therapeutic intervention. The conceptualization of humor adopted by a researcher also impacts the choice of research design. For example, if humor is viewed as a stable personality trait, it is typically measured with self-report scales used in a correlational study, whereas if it is seen as a stimulus variable, it will likely be manipulated using an experimental design. In evaluating the existing research, it is important to bear in mind the aspects or models of humor that are implicit in the methodologies chosen by researchers.

Theoretical Mechanisms of Effects of Humor on Health

There are several possible mechanisms by which humor and laughter may be thought to impact physical health. Each of these models of causality focuses on a different aspect or component of humor and a different conceptualization of sense of humor. First, physiological changes in musculoskeletal, cardiovascular, endocrine, immunological, and/or neural systems associated with laughter may have beneficial effects on health (W. F. Fry, 1994). Thus, for example, laughter may be associated with changes in circulating catecholamines and cortisol levels (Hubert & de Jong-Meyer, 1991; Hubert, Möller, & de Jong-Meyer, 1993; Levi, 1965), which in turn may have an impact on various components of the immune system (Dantzer & Mormede, 1995; O'Leary, 1990). Similarly, hypotheses have been proposed about possible beneficial effects of vigorous laughter attributed to reduced muscle tension, increased oxygenation of blood, exercising of the heart, endorphin production, and so on (W. F. Fry, 1977, 1994). In this view, laughter is the crucial component, and health benefits would not be expected with perceived humor or amusement in the absence of actual laughter. Indeed, laughter might arguably have beneficial effects on health even in the absence of humor (e.g., feigned or forced laughter), as maintained by advocates of certain yogic laughter exercises (e.g., Kataria, Wilson, & Buxman, 1999).

In this model, sense of humor as a personality trait would be relevant to the degree that it relates to habitual tendencies to engage in laughter, rather than tendencies to amuse others, perceive humor in situations, and so on.

A second possible mechanism by which humor may affect health is through the positive emotional states accompanying laughter and humor (Argyle, 1997; Edwards & Cooper, 1988). Thus, positive emotions, regardless of how they are generated, may have analgesic (Bruehl, Carlson, & McCubbin, 1993) or immuno-enhancing effects (Stone, Cox, Valdimarsdottir, Jandorf, & Neale, 1987; Stone et al., 1994; Valdimarsdottir & Bovbjerg, 1997) or may have an “undoing” effect on the cardiovascular
sequelae of negative emotions (Fredrickson, 1998; Fredrickson & Levenson, 1998). Humor and laughter may be only one means to this end, along with other positive emotions such as love, contentment, hope, joy, and happiness. In this view, humor and laughter confer health benefits only to the degree that they enhance positive moods, which may not require overt laughter. In this model, sense of humor as a personality trait might be best conceptualized in terms of habitual amusement-related positive emotions or moods as in the construct of trait cheerfulness (Ruch & Carroll, 1998).

A third potential mechanism has to do with hypothesized stress-moderating effects of humor. Here, the health benefits of humor are seen to accrue from more effective coping with stress due to the cognitive appraisals and attributions associated with a humorous outlook on life (Dixon, 1980; Lefcourt & Martin, 1986; Martin, Kuiper, Olinger, & Danee, 1993). In this view, rather than having direct effects on physiological health variables, humor has an indirect effect, interacting with stress levels in reducing the degree to which stress would normally adversely affect health. There is considerable evidence that stressful life experiences can have adverse effects on various aspects of health, including suppression of the immune system (Adler & Hillhouse, 1996; O'Leary, 1990) and increased risk of infectious disease (Cohen et al., 1998; Cohen & Williamson, 1991, heart disease (Esler, 1998), and so on, through activation of the hypothalamic-pituitary-adrenal (HPA) axis and sympathetic-adrenomedullary (SAM) system. A substantial amount of research has examined personality variables and coping strategies that serve to moderate the degree to which individuals appraise situations as threatening and stressful and consequently experience the health-imparing activation of stress-related physiological processes (Carver, Sheier, & Weintraub, 1989; Cohen & Edwards, 1989).

Sense of humor may be such a stress-moderating variable, in that a humorous perspective in an otherwise stressful situation may serve as an adaptive appraisal-focused coping strategy similar to positive reinterpretation or perspective-taking (Kuiper, Martin, Olinger, 1993; Lefcourt et al., 1995). In this view, the important element is the cognitive component of humor rather than laughter, and sense of humor would relate to the tendency to use humor as a coping strategy in daily life. Of importance also is the ability to maintain a humorous outlook during times of stress and adversity, whereas humor in nonstressful circumstances would be less relevant to health. This view also introduces the possibility that certain forms or styles of humor may be more adaptive and health-enhancing than others. For example, sarcastic or cynical humor or humor that serves as a defense mechanism such as avoidance or denial may be less conducive to effective coping with stress than more benign forms of humor that involve perspective-taking or self-accepting self-deprecation.

Finally, the hypothesized health benefits of humor may be mediated by social support. Thus, individuals with a greater sense of humor may be more socially competent and interpersonally attractive (Bell et al., 1986; Masten, 1986), resulting in greater intimacy (Hampes, 1992) and potentially more numerous and more satisfying social relationships. In turn, the greater levels of social support resulting from these relationships may confer stress-buffering and health-enhancing effects (Cohen, 1988; Cohen & Wills, 1985; Orth-Gomer, 1994). In this model, the focus is on interpersonal aspects of humor and the social competence with which the individual expresses humor in relational contexts, rather than simply the response of laughter or the stimulus aspects of comedy. With regard to sense of humor as a personality trait, this view focuses on tendencies to use humor in a socially facilitative manner. Again, this model would emphasize the importance of distinguishing styles of humor that are potentially socially maladaptive (e.g., aggressive, manipulative, or sarcastic humor) from humor that facilitates relationships and enhances interpersonal attraction and social support.

Empirical investigation of these different theoretical models of the mechanisms by which humor may affect health requires particular operationalizations of humor and methodological approaches. For example, a laboratory study in which individuals are exposed to comedy videotapes does not test the hypothesis that health benefits of humor are mediated by enhanced social support. As discussed below, the research to date has generally not adequately explored these possible alternative causal mechanisms.

Methodological Issues

Along with the different theoretical approaches to conceptualizing the effects of humor on health, researchers have taken different methodological approaches to investigating these effects, including experimental, simple correlational, and stress-moderating approaches. In the experimental approach, participants are typically exposed to comedy audio- or videotapes either alone or in small groups in a laboratory, and physiological measures such as components of the immune system or pain tolerance are assessed before and after the exposure to humorous stimuli. Such research should include an emotionally neutral but interesting videotape control to control for such factors as diurnal variations, passage of time, presence of other people, and factors associated with watching an interesting videotape such as absorption and distraction. To explore the specificity of any observed effects of humor, researchers should also include additional control conditions. For example, a negative emotion videotape condition, evoking such emotions as fear, sadness, or anger, could be included to control for the possible effects of general emotional arousal regardless of valence. In addition, a positive emotion control condition could be included, inducing such emotions as joy, pride, or happiness, to determine whether effects are specific to humor, laughter, and amusement as distinct from other positive emotions. Finally, to examine whether overt laughter is essential to any observed effects, experimenters could include conditions in which some participants are instructed to laugh aloud and others are instructed to inhibit overt laughter while watching a comedy videotape.

In addition, manipulation checks should be included, having participants rate the stimuli for funniness, interest, boredom, enjoyableness, sadness, and so on, to ensure that the videotapes differ as intended in funniness and in the specific emotions elicited but do not differ on other dimensions such as interest. Finally, it is advisable to monitor participants’ laughter while watching the videotapes and then examine the correlations between frequency of laughter and the dependent variables. If laughter is indeed the active component, significant correlations should be observed within the humorous videotape condition. As discussed below, many of the studies to date have not included such control groups and manipulation checks, making the results rather inconclusive.
As an alternative to the laboratory method, which is likely to produce only short-term effects with unknown clinical significance, experimental designs may also be used in intervention studies, in which humor is included as a therapeutic intervention repeated over a series of sessions, with either healthy participants or medical patients, and more long-term health outcomes may be assessed. Again, appropriate control groups and manipulation checks are needed in such approaches.

In the second, correlational, approach to the research, participants typically complete self-report measures of sense of humor, and correlations are computed with various measures of health, such as illness symptom checklists, as well as physiological measures such as aspects of immunity and pain tolerance. As noted earlier, there are a number of self-report measures available for assessing different aspects of sense of humor. These measures vary, however, in their reliability and validity, and researchers should be careful to select humor scales with well-established psychometric properties (for reviews of current measures of sense of humor, see Ruch, 1996, 1998). In correlational studies, researchers could explore further the nature of any observed correlations by controlling for variables such as extraversion or optimism, which may be related to sense of humor (Kohler & Ruch, 1996). Correlational studies relating sense of humor measures and self-report illness symptom checklists should also control for neuroticism or negative affectivity, which tends to confound symptom reports (Watson & Pennebaker, 1989).

Although the correlational approach does not allow for inferences of causal relationships, its strength lies in the fact that it has greater ecological validity, allowing for the examination of more long-term health factors than the shorter-term physiological changes studied in the laboratory experimental approach. In addition, it permits the researcher to examine, using self-report measures, various components and facets of sense of humor besides simply exposure to comedy videotapes, such as the cognitive processes involved in perception of humor in daily life, use of humor in coping with stress, and humor production. The hypothesis that health benefits of humor are mediated by social support may also be more easily tested by correlational methods than laboratory experiments.

Finally, the stress-moderating approach seeks an interaction between humor and stressors in predicting aspects of health. In this approach, three types of variables have to be measured or manipulated: humor, stress, and some indicator of health (Martin, 1989). Stress has generally been assessed using self-reported major life events or minor hassles, or, alternatively, analogue studies have been conducted in which participants are exposed to a laboratory stressor. Humor is typically measured as a stable personality trait using self-report measures, but a laboratory manipulation could also be used by providing humorous stimuli or by having participants generate humorous responses to a laboratory stressor (e.g., Newman & Stone, 1996). A number of outcome measures have been assessed, including frequency of self-reported illness symptoms over a period of time, immune measures, blood pressure, and so on.

The following review of the research focuses on five broad areas of health that have received the most empirical attention: immunity, pain tolerance, blood pressure, longevity, and self-reported illness symptoms. Within each area, I summarize studies that have taken the experimental, simple correlational, and stress-moderating approaches (to the extent that the various approaches have been taken with a given health outcome). Because some studies have included several components of health or have combined more than one research approach, different aspects of these studies are presented in different sections of the review.

Humor, Laughter, and Immunity

Experimental Studies

Secretory IgA (S-IgA). A number of experimental studies have examined effects of exposure to humorous stimuli on various aspects of immunity. The majority of these studies examined only S-IgA, a component of the humoral immune system found in saliva that is involved in the body’s defense against upper respiratory infections (Tomasi, 1971). In the earliest published study of humor and immunity, Dillon, Minchoff, and Baker (1985) had a small sample of 9 college students individually watch a 30-min comedy videotape of Richard Pryor and a 30-min educational videotape in counterbalanced order, with a 10-min break between videotapes. S-IgA was measured in saliva samples taken before and after each videotape. Funniness ratings of the videotapes were obtained, although laughter was not assessed. The results showed a significant increase in S-IgA above baseline with the comedy film, but no pre–post change with the control film, although direct comparisons were not made between the two conditions.

Stimulated by the findings of Dillon et al. (1985), Lefcourt and colleagues (Lefcourt, Davidson-Katz, & Kueneman, 1990) conducted three studies examining effects of exposure to comedy on S-IgA. Two of these studies (with 45 female undergraduates as participants in one and 41 male and female undergraduates in the other) used a 30-min comedy audiotape of a skit by Mel Brooks and Carl Reiner, and the third (involving 34 female students) used a 30-min comedy videotape of Bill Cosby. Participants were tested in small groups. All three studies showed significant increases in S-IgA following exposure to comedy relative to a baseline measure. However, in two of the studies, the baselines were taken on different days (in one study in a different room) at least a week earlier, often at different times of day. In addition, these studies did not include control groups, although a separate “control study” was reported in which 12 undergraduate students (sex unspecified) were shown to have no change in S-IgA over the course of a 1-hr classroom lecture. The participants were asked to rate the funniness of the comedy stimuli in each study, and these were found to be quite low, particularly in two of the studies. Laughter was not monitored. Thus, although these studies provide some evidence of increases in S-IgA following exposure to comedy materials, the lack of adequate controls and methodological problems with baseline measurement make it difficult to conclude that the observed effects were due to humor and laughter per se.

Better controls were used by McClelland and Cheriff (1997) in a series of three studies in which participants were shown either a comedy videotape (a W. C. Fields film or standup comedy by Billy Crystal) or a documentary videotape (about either World War II or how to complete a financial aid form). No pre- to postv videotape increases in S-IgA were observed in the documentary videotape control conditions, whereas increases were observed in the comedy videotape conditions. However, these increases were significant using parametric statistics only in one of the studies. In all three
studies, though, nonparametric chi-square tests showed a greater proportion of participants increasing rather than decreasing in pre-
to posttreatment S-IgA in the comedy conditions as compared with
the control conditions. Thus, although the effects were fairly weak,
they were consistent across the three studies. No manipulation
checks were used in one study, whereas mood ratings were in-
cluded in one and funniness ratings in the other. Frequency of
laughter was not assessed in any of the studies.

In a similar research design, Lambert and Lambert (1995) as-
signed 39 male and female fifth-grade students to either a humor
condition (10 min of live comedy followed by a 15-min segment of
a popular TV program featuring funny home videos) or a
25-min nonhumorous condition (a 10-min lecture on proper hand-
washing and a 15-min videotape about the weather). Surprisingly,
participants in the humorous condition had lower S-IgA than did
those in the control condition, both at baseline and following the
videotapes. However, a comparison controlling for baseline level
did show greater pre- to posttreatment increases in S-IgA in the
humorous than in the nonhumorous condition. No manipulation
checks were included, and laughter was not assessed.

Several of the preceding studies included emotionally neutral
documentary videotape control groups, but no positive or negative
emotion controls, and they therefore were unable to control for the
effects of emotional arousal apart from humor. In a study using a
negative emotion control condition (Labott, Ahleman, Wolever, &
Martin, 1990): 32 female college students individually watched both
a 28-min comedy videotape of Bill Cosby and a 28-min sadness-inducing video in counterbalanced order. Half of the par-
ticipants were instructed to inhibit their emotions while watching the
films, whereas the other half were instructed to express their emotions (laughing and weeping). Unfortunately, data for 16
(50%) of the participants were dropped from the analyses because
of failure to conform to these instructions. In addition, a neutral
control group of 7 women watched two 28-min documentary
videotapes. The results showed significantly lower S-IgA levels
(covarying baseline levels) following the sad emotion expression
(weeping) condition as compared with the sad emotion inhibition,
humorous emotion expression (laughing), and humorous emotion
inhibition conditions. No differences were found between the two
humor conditions. No changes from baseline S-IgA were found for
the neutral control participants following either of the document-
ary videotapes. Although the authors interpreted these findings as
indicating immuno-enhancing effects of humor (with or without
laughter) and immunosuppressive effects of overt weeping, the
results may also be interpreted as indicating only an immunosup-
pressive effect of weeping. Unfortunately, statistical comparisons
between the neutral control group and the sad and humorous
groups, which might have clarified these effects, were not re-
ported. Finally, although laughter was monitored, correlations
were not reported between frequency of laughter and changes in
S-IgA.

Finally, another study using a negative emotion control condi-
tion failed to show significant effects of humor. Njus, Nitschke,
and Bryant (1996), in a study involving 50 male and female
college students, found no significant difference in S-IgA levels
between a group of participants who watched a 35-min comedy
videotape of Bill Cosby and a group who watched a 35-min “negative affect” videotape (a documentary about a child who died
of physical abuse), either immediately after the videotape, 1 hr
later, or 24 hr later. This study was also designed to examine the
effects of emotional writing, and it was found that participants who
wrote essays about the film subsequently showed higher levels of
S-IgA than did those who wrote about their shoes, regardless of
whether they had watched the comedy or negative affect film.

In sum, although the effects have not always been replicated, a
number of experimental studies have found increases in S-IgA in
participants exposed to humorous stimuli. However, there are
several methodological problems that weaken the conclusions.
Three of nine studies reporting significant results did not have
control groups, five had only documentary videotape control condi-
tions with no evidence that they controlled for interest level, and
only one had a negative affect control group. Only one of the
studies monitored the occurrence of laughter in the humor condi-
tion, although the correlation between frequency of laughter and
change in S-IgA was not examined. Thus, although the findings
are somewhat encouraging, it is premature to conclude on the basis
of the existing studies that the observed changes in S-IgA were due
to humor or laughter per se rather than to other uncontrolled
factors such as diurnal variations, distraction, positive emotion, or
general emotional arousal regardless of affective valence.

Other components of immunity. Five additional experimental
studies have examined effects of exposure to comedy videotapes
on a variety of immunological and endocrinological variables as-
sayed in blood samples. One of these, conducted by Berk and
colleagues, has received a great deal of attention in the media and
is frequently cited in the humor and health literature. Some of the
results of this study were reported in a journal article (Berk, Tan,
Fry, et al., 1989), and the remaining analyses were presented in
conference papers, only the abstracts of which have been published
(Berk, Tan, & Fry, 1993; Berk, Tan, Napier, & Eby, 1989; Berk et
al., 1988). The participants were 10 male medical personnel, 5 of
whom were assigned as a single group to watch a 60-min comedy
videotape of a standup comedian; the other 5 sat quietly in a room
together for 60 min. Blood was collected via IV catheters in the
forearm at a number of intervals before, during, and after the
stimulus conditions. Of 19 immunity- and endocrine-related vari-
ables assayed, significant experimental effects were found for 9
variables. Participants in the humorous videotape group had sig-
nificantly lower levels of cortisol and dopac and higher levels of
growth hormone following the videotape as compared with the
control participants. In addition, in the experimental group, assays
taken after the videotape revealed significant increases from base-
line in the T-cell helper–suppressor ratio, blastogenesis, IgG, IgM,
NK cell activity, and complement (C3), suggesting immuno-
enhancing effects of humor. However, comparisons with the con-
trol group were not reported, raising questions about whether these
effects were specific to the comedy condition. No effects were
found with a number of other variables, including norepinephrine,
prolactin, beta-endorphin, IgA, and gamma-interferon levels.

Although some promising results were obtained in this study,
there are a number of methodological limitations that cast doubt on
the findings. Besides the very small sample size of males only, the
participants were informed several days beforehand which condi-
tion they would be in, resulting in evident differences in their
mood states on arrival and significant baseline differences in two
of the physiological variables (lower epinephrine and higher
growth hormone in the experimental as compared with the control
group). It is not reported whether the participants were randomly
assigned to groups, and there was an age difference between the
two groups \((p < .10\)). In addition, the no-videotape control group
did not adequately control for a variety of factors, such as the
diversion of watching a videotape or general emotional arousal,
that might account for the findings. Manipulation checks were not
included, and laughter was not monitored. The large number of
dependent variables and statistical tests conducted, resulting in an
inflated Type I error rate, casts further doubt on the reliability of
the significant results reported. Finally, the fact that most of the
results have been published only in brief abstracts of conference
papers leaves many details of the methodology and analyses
unknown and therefore difficult to evaluate. Thus, although these
findings seem encouraging, they do not provide conclusive evi-
dence of immuno-enhancing effects of laughter.

Similar methodological limitations are evident in a study by
Kamei, Kumano, and Masumura (1997), who took blood samples
before and after a group of 8 male medical students watched a
comedy videotape (no details given). Blood samples were also
taken from the same participants 2 hr before and 1 week after
writing a stressful physics examination. No effects of stress or
comedy were found on percentages of helper–inducer (CD4)
or suppressor–cytotoxic (CD8) T cells or CD4–CD8 ratio. However,
contrary to the Berk, Tan, Napier, and Eby (1989) study, NK cell
activity decreased significantly from before to after the comedy
videotape. This finding was opposite to predictions in that it
suggests an immunosuppressive effect of humor.

Iiami, Nobori, and Teshima (1994) took blood samples from 19
volunteer participants immediately before and after a 3-hr
comedy–variety theater performance. Beta-endorphin, NK cell
activity, and CD4–CD8 (helper–suppressor T-cell) ratio were as-
essed. No significant pre- to postperformance changes on any of
these variables were found overall. However, when the partici-
pants were divided on the basis of preperformance levels that were
above or below a standard range, the 5 participants with the lowest
NK cell activity levels before the performance showed significant
increase in NK cell activity and CD4–CD8 ratio afterward,
whereas the 4 participants with the highest CD4–CD8 ratios
before the performance showed a significant decrease in this
variable afterward. The authors interpreted the findings as indicat-
ing a sort of "normalizing" effect of laughter on immunity, al-
though the findings may simply be due to regression toward the
mean. There were no control groups or manipulation checks, and
laughter was not assessed.

Using a negative emotion control group and a larger sample
size, Mittwoch-Jaffe, Shalit, Srendi, and Yehuda (1995) took
blood samples from 59 male and 64 female undergraduates before
and after watching either a 45-min humorous or a 45-min horror
videotape (no details given). They assayed the blood samples for
tumor necrosis factor (TNF\(\alpha\)), as well as four interleukins (IL-1\(\beta\),
IL-2, IL-3, and IL-6), protein molecules that regulate and coordi-
nate the activity of various types of immune cells. Of these five
cytokines assayed, the researchers reported a pre- to postvideotape
decrease in TNF\(\alpha\) and increases in IL-2 and IL-3 in participants
watching the humorous videotape, and changes in the opposite
direction in participants watching the horror videotape. However,
no statistical tests were reported, so it is unclear whether these
effects were statistically significant.

Finally, Yoshino, Fujimori, and Kohda (1996) took blood sam-
plies from 26 female patients with rheumatoid arthritis and 31
healthy women before and after they watched a 1-hr performance
of rakugo, a traditional form of Japanese comedy storytelling.
Of 14 endocrine and immune variables assayed (including beta-
endorphin, methionine enkephalin, Substance P, epinephrine, do-
pamine, T-cell helper–suppressor ratio, and NK cell activity), the
arthritis patients showed only significant pre- to postperformance
decreases in cortisol, IL-6, and interferon-gamma (IFN-\(\gamma\)),
whereas the healthy participants showed significant decreases only
in IFN-\(\gamma\). This suggests a possible immunosuppressive effect of
humor. No control groups were included in the study, and, al-
though pre- and postperformance mood ratings were obtained,
laughter was not assessed.

In conclusion, of more than 40 immunological and endocrino-
logic variables assayed in blood samples in these five experimental
studies, significant effects were found for 18 variables. However,
some of these were in the opposite direction to predictions, and the
results were inconsistent across the studies, with significant effects
found in one study often not replicated with the same variable in
another study. For example, whereas Berk and associates (Berk,
Tan, Napier, & Eby 1989; Berk et al., 1993) found increases in
T-cell helper–suppressor ratio and NK cell activity with exposure to
comedy, Kamei et al. (1997) did not replicate the T-cell ratio
finding and found a decrease in NK cell activity. None of the
studies had adequate control groups or manipulation checks, and
laughter was not monitored, and correlations between laughter
frequency and the dependent variables were not examined. The
large number of statistical tests performed in most of these studies
also raises concerns about inflated Type I error rates. Thus, al-
though some of the findings appear suggestive, further studies are
needed with more adequate controls and sample sizes before firm
conclusions may be drawn about the immunological effects of
humor and laughter.

**Correlational Studies**

Several studies have examined correlations between trait mea-
sures of sense of humor and levels of S-IgA, including some of the
experimental studies described above. With a very small sample
of 9 participants, Dillon et al. (1985) found significant correlations
in the neighborhood of .75 between the CHS and four assays of
S-IgA. Similarly, using a sample of 17 new mothers, Dillon and
Totten (1989) found a significant correlation \((r = .61)\) between
scores on the CHS and S-IgA measured in the mothers’ saliva, but
no correlation with S-IgA measured in their breast milk.

However, these findings with S-IgA have not been replicated in
several more recent studies using larger sample sizes. In the three
studies reported by Lefcourt and colleagues (Lefcourt et al., 1990),
with a total of 120 participants, no significant correlations were
observed between either the CHS or the SHRQ and measures of
S-IgA at baseline or following exposure to comedy stimuli. Simi-
larly, Labott et al. (1990) failed to find significant correlations
between S-IgA and the CHS in a sample of 39 female students. In
addition, in a sample of 40 university students, Martin and Dobbin
(1988) found no significant correlations between S-IgA measured
on two occasions 1½ months apart and scores on either the CHS
or subscales of Svebak’s (1974) SHO. A significant correlation of
.30 was found between the SHRQ and S-IgA levels at Time 2, but
the correlation at Time 1 was nonsignificant. Using the CHS as
well as self-report measures of humor appreciation and production,
McClelland and Cheriff (1997) found only one significant correlation with baseline S-IgA ($r = .24$ with humor production) in a study of 71 college students. However, a chi-square analysis revealed that participants who were above the median on either the humor production or appreciation measure, as compared with those below the median, had a greater likelihood of showing an increase in S-IgA after watching a humorous videotape.

In conclusion, correlational studies examining sense of humor and immunity have been conducted only with S-IgA as the measure of immunity. Although some correlations between sense of humor and S-IgA have been found, these findings have generally not been replicated in studies with larger sample sizes, using a variety of self-report humor measures. It should be noted, however, that immunity levels are likely to fluctuate considerably over time, so that levels obtained in a single assay may be too unreliable to expect significant correlations with a trait measure of humor. A more reliable approach would be to aggregate immune measures across a number of assays over a period of time and examine correlations with sense of humor scores. Unfortunately, this approach has not been taken in the research.

**Stress-Moderator Studies**

One study has examined stress-moderating effects of sense of humor on S-IgA. Martin and Dobbin (1988) administered the Daily Hassles Scale (Kanner, Coyne, Schaeffer, & Lazarus, 1981) as a measure of stress and assayed S-IgA levels in saliva samples on two occasions 1½ months apart with a sample of 40 students. Sense of humor was assessed using the CHS, SHRQ, and two subscales of Svebak's (1974) SHQ. Daily hassles scores at Time 1 were negatively related to S-IgA levels at Time 2 ($r = -.32, p < .05$), indicating an immunosuppressive effect of hassles. More important, significant interactions were found between daily hassles at Time 1 and three of the four sense of humor measures (the CHS, the SHRQ, and the Metamessage Sensitivity scale of the SHQ, but not the SHQ Liking of Humor scale) in predicting S-IgA at Time 2. In each case, participants with low humor scores showed strong negative relations between hassles and immunoglobulins, whereas this relationship was much weaker or even nonexistent among those with high humor scores. Thus, a stress-moderating effect of sense of humor on S-IgA was supported. However, this study did not include measures that might address possible mediating mechanisms, such as the role of laughter, cognitive appraisals, positive emotions, or social support. Further research is needed to replicate and extend these findings.

**Humor, Laughter, and Pain**

**Experimental Studies**

As noted earlier, the case of Norman Cousins suggested potential analgesic effects of humor and laughter. A number of experimental laboratory studies have examined the effects of exposure to humorous videotapes on pain threshold or tolerance. Studies that assessed pain perception while participants were watching the videotapes, rather than afterward, have generally shown nonsignificant or inconclusive effects. Thus, Nevo, Keinan, and Teshimovsky-Arditi (1993) assigned 72 male and female undergraduate students to either a humorous film (Israeli comedy group), a documentary film (life of dinosaurs), or a no-film control group and assessed pain tolerance using the cold-pressor task during the treatments. No significant differences were found among the groups on participants' duration of arm immersion in the cold pressor or on their pain ratings or estimates of duration. However, funniness ratings of the film were significantly correlated with pain tolerance duration ($r = .38$) among participants in the humorous film condition, although this finding may have been due to greater pain tolerance resulting in greater enjoyment of the film.

Hudak, Dale, Hudak, and DeGood (1991) examined discomfort thresholds using transcutaneous end nerve stimulation, in which a mild electric current was applied to participants' forearms. Thirty-one college students were assigned to watch either a comedy videotape of Bill Cosby or a documentary videotape about growing flowers. Smiling and laughter were monitored using electromyograph (EMG) measures of zygomatic muscle tension. Discomfort thresholds (defined as the voltage level at which participants found the procedure to be too uncomfortable) were assessed at baseline and while participants were watching the videotapes, and change scores were computed. Those in the comedy condition showed significantly greater change scores than did those in the documentary condition. However, these findings were due to a large decrease in thresholds among participants in the documentary videotape control group, particularly those with low scores on the SHRQ, rather than an actual increase in threshold among participants in the comedy condition.

More promising findings have been obtained in several studies when pain tolerance or threshold were measured after termination of the comedy stimuli. Cogan, Cogan, Waltz, and McCue (1987) reported two studies using discomfort threshold with ischemic pain induced by a blood-pressure cuff. In the first study, 40 college students were randomly assigned to either laughter (20-min comedy audiotorpe of Lily Tomlin), relaxation (20-min progressive muscle relaxation audiotorpe), dull narrative (20-min audiotorpe on ethics), or no-treatment conditions. One participant's data in the laughter condition were discarded because of failure to laugh. The results showed no difference between the laughter and relaxation groups on discomfort thresholds obtained following the manipulations; however, thresholds for both the laughter and relaxation conditions were significantly higher than those for the dull narrative and no-treatment conditions. These results suggest possible analgesic effects of laughter equivalent to the effects of muscle relaxation. Fredrickson (2000) argued that muscle relaxation effects may be due to elicitation of positive emotion, which would suggest that the analgesic effects found for both humor and relaxation in this study may have been due to a general effect of positive emotion.

In their second study, Cogan et al. (1987) compared pre- to posttreatment changes in discomfort threshold in 40 female college students assigned to either laughter (10-min comedy audiotorpe of Bill Cosby), interesting narrative (Edgar Allen Poe story), dull narrative (ethics lecture), active distraction (multiplication task), or no-treatment conditions. Again, data from 1 participant in the laughter group were discarded because of failure to laugh aloud. Increases in discomfort threshold to blood-pressure cuff inflation were significantly greater in the laughter condition than in the interesting narrative, active distraction, and no-treatment groups, and marginally greater ($p < .07$) than in the dull narrative group.
These findings suggest that analgesic effects of laughter are not simply due to either active or passive distraction.

The preceding studies indicate analgesic effects of humor when pain perception is measured after exposure to humor. However, studies that have included negative emotion control conditions suggest that the effects on pain tolerance may be due to general emotional arousal regardless of affective valence, rather than being specifically caused by humor and laughter. Thus, Zillmann, Rockwell, Schweitzer, and Sundar (1993) assigned 100 male and female college students to either stand-up comedy, situation comedy, drama, instruction, or tragedy videotape conditions, all lasting 22 min. Pain thresholds were assessed using a blood-pressure cuff before and after the videotapes. Manipulation checks using a number of participant ratings revealed that the videotapes differed as desired on funniness and positive and negative emotional arousal but were comparable on interest. The results showed significant pre- to postfilm increases in pain threshold in both the stand-up comedy and tragedy conditions ($p < .05$) and a borderline increase in the situation comedy condition ($p < .10$). No change in threshold was observed in the other conditions. Compared across the conditions, the two comedy films and the tragedy film were all shown to produce equivalent increases in pain threshold relative to the other conditions. Thus, the results of this well-controlled study indicate that analgesic effects may result from either positive (comedy) or negative (tragedy) emotional arousal (although it is unclear whether the same mechanisms are involved).

Similarly, Weaver and Zillman (1994) assigned 72 male and female students to either stand-up comedy (an HBO program), tragedy (a sad segment from a dramatic movie), or documentary control (a National Geographic film) 10-min videotape conditions. Pain threshold using the cold-pressor task was assessed before and after the videotapes. Manipulation checks were again performed using participant ratings of the videotapes. Among female participants, no significant pain threshold changes were observed in any of the three conditions. However, for male participants, both the tragedy and comedy videotapes resulted in equal increases in pain threshold, both of which were significantly greater than in the control condition.

Similar findings were also obtained in a study by Weisenberg, Tepper, and Schwarzwald (1995), this time using pain tolerance with the cold-pressor task assessed during rather than after the stimuli. Eighty male and female participants were assigned to either humorous film (a slapstick comedy from a popular Israeli TV series), repulsive film (a segment of a horror movie), neutral film (a segment of a popular science TV series), or no-film control conditions, all 7 min in duration. Ratings of the films were obtained for manipulation checks. The results revealed equal increases in pain tolerance in the humorous and horror film conditions, both of which were significantly greater than those in the neutral film and no-film conditions.

Finally, a study by Weisenberg, Raz, and Hener (1998) suggests that analgesic effects of humor may be greater than those of negative emotional arousal, but only after a period of delay. These researchers assigned 200 male and female participants to either a humorous film (no details given), a negative mood film (about the Holocaust), a neutral film (about alligators), or a no-film control condition. The three film conditions were further divided into three film durations: 15, 30, or 45 min. Pain tolerance was measured using the cold-pressor task before, immediately after, and 30 min after the films. Manipulation checks were used to ensure that moods were induced as planned, although mood differences among the groups that were observed immediately after the films had dissipated after the 30-min waiting period. Surprisingly (and contrary to the results of earlier studies), no increases in pain tolerance were found in any conditions from baseline to immediately after the films. However, participants who viewed the humorous film, regardless of film duration, showed greater increases in pain tolerance after the 30-min waiting period than did those viewing the negative mood or neutral mood films or those in the no-film condition, despite the fact that self-reported moods did not differ by this time. The authors argued from these results that humor and laughter may induce physiological changes that affect the sensory components of pain, rather than simply altering the cognitive-affective-motivational components of pain, and that these physiological changes take some time to develop and continue even after initial mood changes have dissipated. However, the findings are qualified by the fact that participants who watched a longer (45-min) film, regardless of the topic (humor, negative mood, or neutral), also showed significantly greater increases in pain tolerance after the 30-min wait than did those who watched the shorter (15- or 30-min) films. In addition, the failure to replicate previous findings of increased pain tolerance immediately following film presentation raises questions about the reliability of these findings.

In sum, the experimental laboratory studies of humor and pain tolerance have generally been more carefully controlled and methodologically rigorous than those on humor and immunity. Most of the studies have had several control groups, including negative emotion controls in several, and manipulation checks have been included. However, none of the studies have examined correlations between laughter frequency and pain tolerance to determine whether laughter is the important ingredient in the effects. Overall, these laboratory experiments provide evidence that exposure to comedy results in subsequent increases in pain threshold and tolerance that do not appear to be simply due to distraction. However, in studies using negative emotion control conditions, similar increases in pain threshold and tolerance occurred in these conditions, suggesting that analgesic effects may be due to emotional arousal regardless of affective valence and not specifically to positive emotions associated with humor and laughter.

In addition to the laboratory experiments described above, some quasi-experimental field studies of humor and pain control have been conducted with medical patients. In the study by Yoshino et al. (1996), described earlier, these researchers found a significant decrease in self-reported pain ratings in 26 female patients with rheumatoid arthritis before and after they watched a 1-hr performance of rakugo. However, this study did not have a control group. Adams and McGuire (1986) randomly assigned 13 elderly residents of a long-term care facility with chronic pain to watch either comedy movies or nonhumorous drama films every day for 6 weeks. As-needed analgesic medication usage was the dependent measure. Unfortunately, no statistical analyses were reported, although graphs of medication usage of 10 participants seem to suggest reduced usage of analgesics in the comedy film group relative to the nonhumorous film group.

In a more carefully conducted field experiment, Rotten and Shats (1996) assigned 79 male and female hospitalized orthopedic
surgery patients to one of three conditions: a humorous movie group, who watched four feature-length comedy movies during the 2 days postsurgery; a nonhumorous movie group, who watched four drama movies; or a no-movie control group. Within the two movie groups, further manipulations were implemented on the degree of choice that participants had over the films and expectancies of the effectiveness of the films in reducing pain. Manipulation checks were used to ensure that the movies differed on funniness but not on interest and entertainment value. The results showed lower levels of minor analgesic (e.g., aspirin) usage during the 2 days postsurgery in participants watching the humorous movies than in those watching the nonhumorous movies or those not watching any movies, providing support for pain-reduction effects of comedy. However, when major analgesics (Demerol, Dilaudid, and Percodan) were examined, no overall differences were found between the humorous, nonhumorous, and no-film conditions. Furthermore, those participants in the humorous film condition who were not given any choice over which films they viewed actually showed significantly higher levels of major analgesic usage than did all other participants. The authors suggested that watching humorous films that are not consistent with one’s humor preferences may be aversive rather than beneficial. In addition, when participants were asked to rate their pain and distress, those who watched either type of movie reported less pain and distress than did those who did not watch any films. Overall, this well-conducted field experiment provides some evidence for beneficial effects of comedy on minor postsurgical pain, although the effects do not seem to extend to more severe pain that requires major analgesics for control, and lack of choice over the comedy may actually have countertherapeutic effects.

Correlational Studies

Svebak et al. (2000) examined the relation between two scales on the SHQ and ratings of pain associated with gallbladder stones in 27 male and female outpatients. A significant negative correlation was found between pain ratings and the Liking of Humor scale \( r = -.34 \), but the correlation between pain and the Metamessage Sensitivity scale was nonsignificant \( r = -.04 \). Several of the experimental studies described above also included self-report measures of sense of humor, allowing for examination of the relation between humor as a personality trait and pain tolerance or threshold. In addition, interactions between these sense of humor scores and the experimental manipulations could be examined to determine whether individuals with high versus low sense of humor scores show differential effects of exposure to comedy. Zillmann et al. (1993) included an ad hoc 18-item scale of humor based on the CHS. No significant correlations were found with pain threshold, and no interactions were found between the humor measure and experimental condition. Similarly, in the study by Weisenberg et al. (1998), no significant correlations were found between pain tolerance and either humor production or appreciation scores on Ziv’s (1981) humor questionnaire; nor were interactions found between either humor measure and experimental condition. Using the same humor scales, Nevo et al. (1993) found a significant correlation between humor production (but not humor appreciation) and pain tolerance \( r = .26, p < .05 \) but no interaction with experimental condition. Finally, Hudak et al. (1991) found no correlation between scores on the SHRQ and discomfort threshold. However, they did find a significant interaction with condition. Participants with low humor scores in the nonhumorous videotape group showed a significant pre- to postvideotape decrease in pain threshold, whereas all other participants showed a slight increase in threshold. In sum, there is very little consistent evidence that sense of humor, measured using self-report scales, is related to pain threshold or tolerance, or that individuals with higher or lower sense of humor scores differ in the degree to which their pain perception is affected by watching comedy videotapes. As with the immunity research, however, it may be more appropriate to aggregate pain tolerance or threshold scores over several assessments to obtain more reliable measures to correlate with trait measures of humor. No stress-moderator studies have been conducted using pain tolerance or threshold as the outcome variable.

Humor, Laughter, and Blood Pressure

Experimental Studies

White and Camarena (1989) conducted a 6-week intervention study to examine the effects of a laughter intervention on diastolic blood pressure (DBP), systolic blood pressure (SBP), and heart rate (HR). The participants were 65 female and 28 male healthy volunteers who were randomly assigned to a laughter treatment group, a relaxation-training group, or a health-education control group. The laughter intervention consisted of engaging in a variety of laughter induction exercises and watching humorous films. Each group met for 1.5 hr each week, and HR and blood pressure measures were obtained before and after each session. Frequency of laughter was not assessed, although the authors noted that laughter was observed to have occurred in each laughter-group session. The results showed no significant pre–postsession changes in DBP, SBP, or HR among participants in the laughter group and no differences between the laughter and health-education control groups. In contrast, the relaxation training group showed significantly lower postsession HR and SBP in comparison with both of the other groups. Thus, this study did not support the hypothesis that a laughter intervention would result in lower levels of HR and blood pressure.

Stress-Moderator Studies

Lefcourt and colleagues (Lefcourt, Davidson, Prkachin, & Mills, 1997) used a laboratory stressor paradigm to examine possible stress-moderating effects of self-reported humor on blood pressure. Sixty male and 49 female participants engaged in five mildly stressful laboratory tasks, and their blood pressure was measured before, immediately after, and 3 min after each task. Self-report measures of sense of humor were unrelated to DBP, but several findings emerged with SBP. Interestingly, significant sex differences were found in the relation between the CHS and overall SBP (averaged over all tasks and measurement times). Among female participants, the findings supported predictions, with those with higher CHS humor scores showing lower SBP overall. In contrast, the results for male participants were opposite to predictions: Higher CHS scores related to higher SBP. Moreover, male participants with higher CHS scores showed a greater increase from baseline in SBP with one of the stressor tasks (mental arithmetic). The pattern of findings with the SHRQ as a
measure of humor was similar, although somewhat weaker. The authors suggested that these sex differences may be due to differences in the way in which men and women express humor. Men may be more likely to use humor in a competitive, tendentious, and maladaptive manner, whereas humor in women may be more tolerant, self-accepting, and adaptive. These results parallel correlational findings by Martin and Kuiper (1999) that men who laughed more frequently over a 3-day self-monitoring period were higher in Type A behavior characteristics such as competitiveness, impatience, and time urgency (but not hostility), whereas women who laughed more frequently were lower in these Type A traits.

Humor and Longevity

There have been two investigations designed to examine the hypothesis that individuals with a greater sense of humor will have greater longevity. In a series of four studies, Rotten (1992) compared the age at death of famous comedians, comedy writers, and humorous authors with that of famous serious entertainers and authors. He found no significant differences in longevity between the two groups, although, interestingly, he found that both professional humorists and serious entertainers died at a significantly younger age than did people who were famous for other reasons. Although this investigation indicates that individuals who make a career from producing humor do not live longer than others, it may be questioned whether professional humorists necessarily have a more humorous outlook in their daily lives or use humor in coping with life stress.

Friedman et al. (1993) reported analyses of data taken from 1,178 male and female participants from the Terman Life-Cycle Study who have been followed since 1921. Parent and teacher ratings of sense of humor and optimism had been obtained on these individuals at the age of 12. These two ratings were combined into a composite measure of cheerfulness. Surprisingly, survival analyses using this measure as a predictor revealed that those individuals rated as having higher cheerfulness at age 12 had higher mortality rates throughout their lifetimes. The relative hazard index was 1.23 (indicating that participants high in cheerfulness had a 1.23 times greater likelihood of dying relative to participants low in cheerfulness at any age), and the effects were similar for both men and women. The authors suggested that these results may have been due to individuals who were high in cheerfulness being less concerned about health risks and taking less care of themselves throughout their lives compared with participants who were low in cheerfulness. These results cast doubt on the hypothesis that a sense of humor increases longevity through beneficial effects on health, although the meaning of the sense of humor ratings provided by parents and teachers in the 1920s is open to debate.

Sense of Humor and Self-Reported Illness Symptoms

Correlational Studies

A number of researchers have examined correlations between trait measures of sense of humor and overall health, as measured by self-report physical symptom checklists. As noted earlier, self-report measures of illness symptomatology contain a significant negative affectivity or neuroticism component, making them less desirable as outcome measures in health research than more objective indicators of health status (Watson & Pennebaker, 1989). Because sense of humor measures are often negatively related with neuroticism (Kohler & Ruch, 1996), any observed negative correlations with symptom reports may be due to this shared neuroticism component rather than any actual health benefits of humor. Nonetheless, for the sake of completeness I describe the studies using this approach.

Some studies have yielded support for the hypothesis that individuals with higher sense of humor scores should report lower levels of illness symptoms over a period of time. In a study described earlier, Dillon and Totten (1989), using a sample of 17 new mothers and their infants, found that mothers' CHS scores were negatively correlated with the reported frequency of upper respiratory infections both in the mothers ($r = -0.51$) and in their infants ($r = -0.58$). Simon (1990), in a sample of 73 male and female participants over 55 years of age, found a significant correlation between a health perception measure and the SHRQ ($r = 0.24$), but not the CHS. Carroll and Shmidt (1992) found a negative correlation of $-0.34$ between the SHRQ and a 13-item inventory of physical health problems in a sample of 51 male and female undergraduate students. In a sample of 36 female business executives, P. S. Fry (1995) found a significant correlation of $-0.38$ between scores on both the CHS and SHRQ and scores on a self-report measure of physical symptomatology. Finally, using the Cheerful Composure facet score from the Trait Cheerfulness Scale (Ruch, Kohler, & Van Thriel, 1996), Ruch and Kohler (1999) found significant negative correlations with a 48-item self-report inventory of bodily complaints ($r = -0.39$ and $-0.31$ for male and female participants, respectively) in a sample of 97 men and 149 women.

However, a number of other studies have failed to show such relations between sense of humor and reported illness symptoms. In a sample of 220 male and female undergraduates, Porterfield (1987) found no significant correlation between scores on either the SHRQ or the CHS and a 33-item physical symptoms scale. Similarly, Anderson and Arnoult (1989) found no correlation between the CHS and either a measure of physical illness symptoms, an overall wellness rating, or the reported frequency of insomnia in a sample of 159 college students. Labott and Martin (1990) also found no correlations between the CHS and a measure of physical health problems in a sample of 510 adult men and women. Finally, McClelland and Cherriff (1997, Study 3) found no relations between either the CHS or measures of humor appreciation and production and the frequency or severity of colds reported retrospectively by participants for the past year, or at a 3-month follow-up, with 71 male and female undergraduates.

Only one study examined the potential role of neuroticism in correlations between sense of humor and self-reported illness symptoms. Korotkov and Hannah (1994), with a sample of 712 male and female undergraduates, found weak but significant negative correlations between the CHS and a 10-item physical symptomatology scale administered on two occasions 4 weeks apart ($r = -0.12$ and $-0.21$ for Times 1 and 2, respectively). However, these correlations disappeared after controlling for scores on a measure of negative emotionality (neuroticism). In sum, although some studies have shown significant simple correlations between measures of sense of humor and overall physical health as assessed by illness symptom checklists, the relationships are not always
replicated, and those correlations that have been obtained may be
due to biases in symptom reporting related to negative affectivity
or neuroticism rather than to actual effects of humor on health
status.

**Stress-Moderator Studies**

Several studies have also examined stress-moderating effects of
sense of humor using physical symptom checklists as the outcome
variable. In a sample of 34 female executives, P. S. Fry (1995,
Study 2) found a significant interaction between negative events
on the Daily Hassles Scale (past month) and the CHS and SHRQ
(both entered concurrently) in predicting scores on a health symp-
toms scale; however, the direction of the interaction was not
reported. A significant interaction between CHS and negative life
events was also found by Anderson and Arnoult (1989) in predict-
ing both scores on a wellness rating scale and frequency of
insomnia, with a sample of 159 undergraduates. However, although
the finding with insomnia was in the predicted direction, the
finding with wellness was opposite to prediction: Participants
with higher humor scores showed a stronger negative relation
between stressors and wellness than did those with lower humor
scores.

Other studies, with larger sample sizes, have not shown signifi-
cant stress-moderating effects. Thus, in a sample of 220 male and
female college students, Porterfield (1987) found no significant
interaction between either the SHRQ or the CHS and negative life
events (in the preceding year) in predicting scores on a physical
symptoms scale. Similarly, Korotkov and Hannah (1994), with a
sample of 712 male and female undergraduates, found no signif-
ificant stress-moderating effect of the CHS on a measure of daily
stress in predicting scores on a measure of perceived physical
symptomatology, either concurrently or prospectively after 4
weeks. In sum, research has provided very little evidence of a
stress-moderating effect of sense of humor on physical health,
using self-report measures of symptomatology. These studies also
cast some doubt on the clinical significance of Martin and Dob-
bin’s (1988) finding of stress-moderating effects of humor on
S-IgA, described earlier, in that the observed effects on S-IgA do
not appear to extend to more long-term health outcomes, at least as
assessed by self-reported illness symptoms.

**Conclusion**

Taken together, the empirical studies reviewed above provide
little evidence for unique positive effects of humor and laughter on
health-related variables. Although some predicted effects have
been obtained, the findings are often inconsistent, and method-
ological problems with many of the studies make it difficult to
draw firm conclusions. With regard to research taking an exper-
imental approach, the most well-controlled studies have been those
examining the effects of humor on pain tolerance. There is some
evidence from these studies that exposure to comedy results in
subsequent increased pain threshold or tolerance and that these
effects are not simply due to distraction. There is also some
suggestion that the effects may be physiologically based rather
than simply due to cognitive-perceptual changes (Weisenberg et
al., 1998). In addition, there is some evidence from field studies
that the analgesic effects of humor observed in the laboratory may
extend to clinical interventions, at least with less severe levels of
pain. However, similar effects are found with stimuli that elicit
negative emotions such as sadness, disgust, and horror, suggesting
that the observed analgesic effects may be due to general emo-
tional arousal regardless of affective valence (although the com-
parable effects with positive and negative emotions may, of
course, be due to different mechanisms). Moreover, none of these
studies examined the relation between overt laughter and changes
in pain tolerance, so it is unclear whether the effects are due to
laughter per se or to positive emotions associated with amusement.

Further research is needed to examine potential physiological
mechanisms that may mediate these effects, particularly the hy-
pothesis that laughter stimulates production of endogenous opi-
oids. It should be noted in this regard that, contrary to frequent
claims in the popular media, none of the studies that included
assays of beta-endorphin have found significant changes in this
variable with exposure to comedy. Another method for examining
the endorphin mediation hypothesis would be to determine
whether humor-associated increases in pain tolerance disappear
when participants are injected with the opiate antagonist naloxone
(e.g., Bandura, Cioffi, Taylor, & Brouillard, 1988).

With regard to immunity, although some experimental studies
have shown changes in various components of immunity with
exposure to comedy, the findings have been rather inconsistent
across studies and across immune system variables, with some
studies showing immun enhances effects and others showing
immunosuppressive effects with particular aspects of immunity.
In fact, given the small sample sizes, the large number of immunity-
related variables assayed, and the large number of statistical tests,
it could be questioned whether the significant results reported are
more than would be expected by chance alone. Moreover, there are
methodological problems with most of these studies, particularly a
lack of adequate control groups, which makes it difficult to deter-
mine whether the observed changes in immunity are due to humor
and laughter or to some other factor such as emotional arousal.
In this regard, some studies examining effects of emo-
tional states (apart from humor) on immunity have found similar
effects for both positive and negative emotions (Futterman, Ke-
meny, Shapiro, & Fahey, 1994; Knapp et al., 1992). More well-
controlled studies are clearly needed before any firm conclusions
may be drawn concerning the effects of humor on the immune
system, and particularly the degree to which such effects might
have any impact on long-term resistance to disease.

In addition, the physiological mechanisms mediating possible
effects of humor on immunity must be examined. Past research
suggests that exposure to humorous stimuli is associated with
activation of the SAM system and, particularly when amusement
is intense and of fairly long duration, with activation of the HPA
axis. Evidence for SAM activation comes from studies showing
increased urinary secretion of adrenaline and noradrenaline (Levi,
1965) and increased skin conductance and HR (Averill, 1969) with
exposure to comedy. Langevin and Day (1972) also found that
cartoons that were rated as funnier were associated with greater
increases in skin conductance and HR. With regard to HPA ac-
vation, some studies using short (10-min) and arguably only mildly
amusing videotapes (scenes from a children’s cartoon television
program) have not shown increased cortisol secretion to be asso-
ciated with humor (Hubert & de Jong-Meyer, 1990, 1991). How-
ever, Hubert et al. (1993), using a longer presentation (90 min) of
an arguably more humorous film (a Monty Python movie), found significantly greater salivary cortisol levels with exposure to comedy as compared with a documentary nature film. Moreover, rated funniness of the comedy film was positively correlated with cortisol levels \( r = .38, p < .01 \). These authors suggested that high emotional arousal, regardless of affective valence, may be associated with increased cortisol secretion and thus HPA activation. Because these types of hormonal changes associated with humor are similar to those associated with stressful events, which are generally found to have immunosuppressive effects (O’Leary, 1990), the findings raise particularly perplexing questions about why laughter might be expected to have immuno-enhancing effects. Perhaps there are other, more subtle differences in hormone or cytokine changes differentiating humor and laughter from responses to stress. Further work is needed to clarify these issues.

With regard to research taking a correlational approach, trait measures of various aspects of sense of humor have generally not been found to be consistently correlated with measures of various components of immunity or pain threshold or tolerance. Some studies have shown significant negative correlations between sense of humor measures and self-reported illness symptoms, but others have shown no correlations between the two. One study showed that the weak negative simple correlations between sense of humor measures and illness symptoms disappeared after controlling for neuroticism. Studies examining the stress-moderator hypothesis have also yielded mixed results, with a few studies showing stress-moderating effects of sense of humor on illness symptoms but others, with generally larger sample sizes, failing to show such effects. With regard to humor and blood pressure, there is evidence from one study for gender differences, with higher sense of humor relating to lower blood pressure in women and a relation in the opposite direction for men. Finally, the few studies that have examined longevity as a function of sense of humor have shown either no effect or an effect opposite to prediction, with individuals high in humor showing increased mortality rates.

Despite the rather unpromising findings in the research to date, there is reason to pursue further investigations of the potential health benefits of humor and laughter, using more systematic, careful, and rigorous research methods and more sophisticated theoretical formulations. The methodological weaknesses noted in much of the experimental research, including inadequate controls and generally small sample sizes, often make it difficult to draw firm conclusions one way or the other. In addition, several of the hypothesized mechanisms discussed earlier have not been adequately investigated, and little attention has been given to distinguishing particular styles or expressions of humor that may be more healthy than others. In view of accumulating research evidence of health-related effects of other constructs related to “positive psychology,” such as optimism, personal control, and a sense of meaning (Taylor, Kemeny, Reed, Bower, & Gruenewald, 2000), and positive emotions generally (Salovey, Rothman, Detweiler, & Steward, 2000), the potential role of humor in health may best be viewed in terms of its relation to a constellation of such positive personality characteristics. Given the longevity and popularity of the idea of health benefits of humor, and the important implications of such an effect if indeed it exists, more careful investigation is warranted.

If progress is to be made, future research into this question clearly must be more rigorously conducted. Studies should be adequately powered for detecting small effects, the designs should be strong, and investigators should test a small number of sharply focused predictions, with a tight rein on the number of tests conducted. In addition, researchers need to attend more carefully to theoretical issues regarding the hypothesized mechanisms, which will impact measurement approaches and study design. Indeed, each of the four hypothesized mechanisms discussed earlier bears further investigation.

Much of the research to date, using experimental laboratory procedures with exposure to comedy videotapes, has either implicitly or explicitly focused on the hypothesis that health benefits result from physiological changes accompanying laughter. However, most of these studies have failed to monitor the actual occurrence of laughter; to distinguish various types of laughter; or to examine the relation between duration, frequency, or intensity of laughter and physiological outcomes. Thus, it may be that genuine physiological effects of particular types or degrees of laughter have gone largely undetected in the research because of sloppy methodological procedures, resulting in the weak and inconsistent pattern of results with which researchers are now faced. In future studies along this line, laughter should be monitored using facial EMG (Ruch & Ekman, 2001) or the Facial Action Coding System (Ruch, 1997), which allow for distinguishing between genuine felt (Duchenne) laughter and felt or feigned laughter (Ekman, Davidson, & Friesen, 1990; Keltner & Bonanno, 1997). Frequencies of each type of laughter can then be correlated with the dependent variables to determine whether possible health effects are limited to genuine spontaneous laughter or occur also with feigned or forced laughter. Besides distinguishing genuine and faked laughter, researchers should also address questions of how much laughter, of what intensity and for how long it is needed to produce various physiological effects. This could be done by varying the funniness and duration of stimuli and by manipulating participants’ laughter by means of instructions to laugh as much as possible versus suppressing laughter.

The hypothesis that health effects of humor may be mediated by positive emotion has not received adequate research attention. As noted earlier, laboratory studies with laughter conditions should also include control conditions eliciting non-humor-related positive emotions and negative emotions, as well as emotionally neutral conditions, so that researchers can examine the degree to which any observed effects are specific to humor and laughter, are common to positive emotions generally, or occur with any emotional arousal regardless of affective valence. Relevant emotion ratings should be used as manipulation checks and also for examining correlations between particular emotions and outcome measures.

It is also possible that any mood-mediated effects of humor are more long-term and cannot be detected in the short time frames examined in laboratory experiments. For example, several studies have shown relations between positive moods and various aspects of immunity over periods of several days (Stone et al., 1987; Valdimarsdottir & Bovbjerg, 1997). Researchers might assess the natural occurrence of laughter or other humor experiences over such time periods, perhaps using diary or time-sampling procedures (e.g., Martin & Kuiper, 1999), and examine the degree to which potential relations between these daily laughter or humor measures and health variables are mediated by self-rated daily moods. Alternatively, humor intervention studies could be con-
ducted in which participants are exposed to humorous stimuli and/or trained in methods for deriving greater humor in their daily lives during a series of sessions over a period of time. Control groups would, of course, be required to control for any non-humor-related effects of the intervention. Health-related outcome measures, such as assays of immunity or occurrence of infectious illnesses, could be examined over time, and self-report mood measures could be used to examine the degree to which any treatment effects are mediated by moods.

The hypothesis that health benefits of humor are mediated by social support has received almost no research attention. It seems likely that individuals who are more humorous and cheerful find it easier to attract friends and develop a rich social support network, resulting in the well-established health benefits of social support (Salovey et al., 2000). However, there is currently only limited research examining the effects of humor on social support (e.g., Gelkopf, Sigal, & Kramer, 1994) or other aspects of interpersonal relationships such as attraction (Cann, Calhoun, & Banks, 1997; Murstein & Brust, 1985), intimacy (Hampes, 1992), or marital satisfaction (Ziv & Gadish, 1989). Thus, further research is needed to examine these proposed mechanisms. Longitudinal research might be beneficial to examine the ways in which various styles of humor lead to the development of social relationships over time. In addition to correlational approaches, experimental studies might be useful for exploring ways in which various styles of humor influence interpersonal attraction and communication. Intervention studies might also be useful in attempting to train individuals to develop more effective styles of humor and observe effects on social relationships.

Future research in this area also should distinguish more carefully between styles or types of humor that are conducive to greater relationship satisfaction, reduction of interpersonal conflicts, empathy, and intimacy and forms of humor that may interfere with effective social relationships. For example, the tendency to engage in humor that is hostile, sarcastic, or disparaging of others may lead to less intimate social relationships and hence less social support, which might in turn result in poorer health outcomes. In contrast, humor that is self-deprecating or that communicates empathy and acceptance of others may be more socially facilitative. Current measures of sense of humor may not adequately distinguish between these potentially maladaptive forms of humor and more adaptive humor, and this may account for the limited correlational findings between sense of humor and health outcomes to date (Martin, 1998). Thus, correlational research examining sense of humor and health, and the potential mediating role of social support, may require the development of new humor measures that differentially assess potentially adaptive and maladaptive forms of humor.

The stress-moderating hypothesis also should be investigated more carefully. As seen in the preceding research review, there is very little evidence of stress-moderating effects of humor on health-related outcomes, using existing self-report measures of sense of humor and life events measures of stress (see also Lefcourt & Thomas, 1998). However, this research approach may be too simplistic, blurring distinctions between various styles of humor and various types of stressors. Certain types of humor may be effective in coping with certain types of stress. For example, self-deprecating humor may be effective in dealing with stress arising from interpersonal conflicts or tensions. Thus, once again, it is important to distinguish between potentially adaptive and maladaptive styles of humor. For example, humor that is excessively self-disparaging or that is used as a form of defensive denial or avoidance may be associated with less effective strategies for coping with stress. In contrast, humor that allows for perspective-taking and distancing oneself from the situation may be conducive to coping.

As with research on coping more generally (Somerfield & McCrae, 2000), there is a need to explore new paradigms and methods in the study of humor as a coping mechanism. For example, rather than assessing coping humor as a personality trait or using retrospective assessments of humor in cross-sectional designs, it may be beneficial to use within-person, process-oriented methods that examine individuals intensively over time (e.g., Tennen, Affleck, Armeli, & Carney, 2000). For example, using time-sampling procedures with handheld computers, researchers could track daily fluctuations of use of humor in coping, stressors, moods, and other adaptational outcomes closer to their actual occurrence. Once again, distinctions could be made between various types of humor as well as stressors. Health outcomes, such as immunity variables and occurrence of infectious illnesses, could be monitored over time.

Finally, further examination of gender differences in humor may be beneficial. As noted earlier, there is some evidence of differential relations between humor and both blood pressure and Type A characteristics for men and women. On the basis of prior research on sex differences in humor styles (e.g., Crawford & Gressley, 1991), Lefcourt and Thomas (1998) argued that women may engage in forms of humor that are more conducive to effective coping with stress and enhanced social support.

In conclusion, despite the popularity of the idea that humor and laughter have significant health benefits, the current empirical evidence is generally weak and inconclusive. More carefully conducted and theoretically informed research is needed before one can have any confidence that humor or laughter impact physical health in a positive way. The present review did not examine the question of whether humor may have a beneficial role in psychotherapy, or whether the introduction of humor and clowning into the health care setting may improve the mood and quality of life of patients. However, this review does indicate that attempts to promote the therapeutic use of humor for purposes of improving physical health are premature and unwarranted by the current research evidence.

References


West: Laughter therapy. Workshop presented at the meeting of the International Society for Humor Studies, Oakland, CA.


Ruch, W., & Kohler, G. (1999). The measurement of state and trait cheerfulness. In I. Mervielde, I. J. Deary, F. De Fruyt, & F. Ostendorf (Eds.), Personality psychology in Europe (pp. 67–83). Tilburg, the Netherlands: Tilburg University Press.


Received April 14, 2000
Revision received December 18, 2000
Accepted January 8, 2001