

Stress and Health Behaviors



Stress

- Stress is “the state arising when the individual perceives that the demands placed on them exceed (or threaten to exceed) their capacity to cope, and therefore threaten their wellbeing...Conscious thought need not be involved.”
 - Martin, 1997, page 118

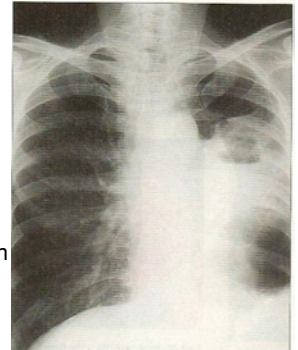
Stress and Disease

- Biomedicine and much of Psychology treat symptoms, not underlying problems
- Stress contributes to almost every medical and psychological illness that we see



Impact of Stress

- Top 6 Killers of Americans:
 - Heart Disease
 - Cancer
 - Stroke
 - COPD
 - Pneumonia/Influenza
 - Traumatic Injury
- Stress is linked to all of them
 - APA, 2004



Stress Stats from the APA

- 54% of Americans concerned about stress levels in their daily lives
- 73% report money as the number one stressor in their lives
- 66% say they're likely to seek help for stress
 - 70 to 90% of physician office visits are for stress-related problems

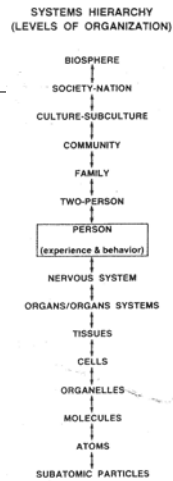
Links with Freudian psychology

- Repression, especially of strong emotions and other psychological phenomena lead to somatic illness
- Specific issues can manifest as specific physical phenomena
- Defense mechanisms often take the form of coping behaviors



Biopsychosocial Model

- George Engel, 1980
- Systems theory
- Allows for the study of organized wholes and component parts
- Nature is ordered as a hierarchically arranged continuum
- Each level of the hierarchy represents an organized dynamic whole
- Individuals exist as part of a hierarchical continuum



Engels' Critique of Biomedicine Borrell-Carrio, Suchman, & Epstein, 2004

- A **biochemical alteration** does **not** translate directly into an illness. The appearance of illness results from the **interaction** of diverse causal factors, including those at the molecular, individual and social levels. And the converse, **psychological alterations** may, under certain circumstances, **manifest as illnesses** or forms of suffering that constitute health problems, including, at times, biological correlates
- The presence of a biological derangement does not shed light on **the meaning of the symptoms** to the patient...
- **Psychosocial variables** are more important determinants of susceptibility, severity, and course of illness than had been previously appreciated by those who maintain a biomedical view of illness

Engels' Critique of Biomedicine Borrell-Carrio, Suchman, & Epstein, 2004

- Adopting a **sick role** is not necessarily associated with the presence of a biological derangement
- The success of most biological treatments is influenced by psychosocial factors, for example, the so-called **placebo effect**
- The patient-clinician **relationship** influences medical outcomes, even if only because of its influence on adherence to a chosen treatment
- Unlike inanimate objects of scientific scrutiny, patients are profoundly **influenced by the way in which they are studied**, and the scientists engaged in the study are influenced by their subjects

Biomedical Predictors of Pain and Depression in People with Rheumatoid Arthritis

- Extent of joint deterioration
- Extent of muscle atrophy
- Extent of generalized inflammation



Biopsychosocial Predictors of Pain and Depression in people with Rheumatoid Arthritis (Covic et al., 2003)

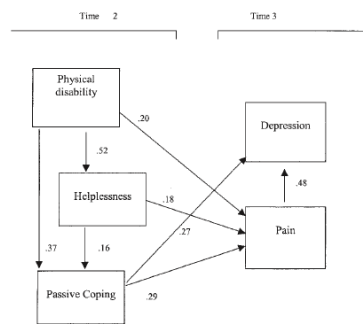
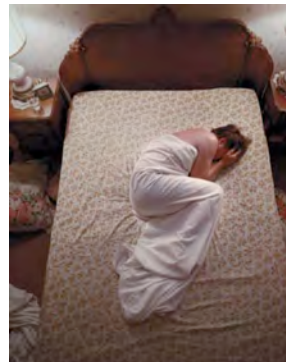


FIG. 3. Time 2 path model in prediction of pain and depression at Time 3.

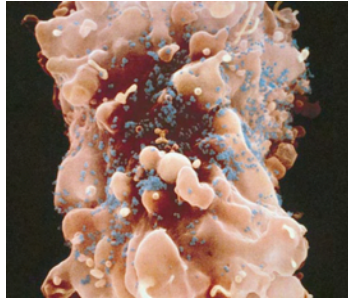
Stress & Depression



- Chronic Stress can lead to depression
- Both involve feelings of loss of control & predictability
- Major stressful events often precede depressive episodes
- Medical treatments involving steroids frequently lead to depression

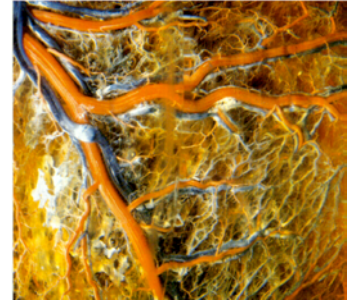
Stress and HIV/AIDS

- AIDS increases 2-3x when stress is above median levels
- Risk doubles with each severe life stressor &/or for every 5 mg/dl increase in Cortisol



Stress and Heart Disease

- Increased SNS activity is associated with death and disability from heart disease
 - Curtis & O'Keefe, 2002
- Increased mortality from heart attacks on Mondays and first week of the month
 - Maynard, 2000



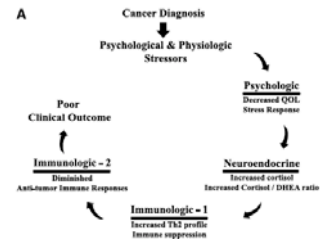
Effects of maternal cortisol on pregnancy and the fetus in later life (Michael & Papageorgiou, 2008)

- Intra-uterine growth restriction
- Increased risk of pre-term labor
- Programming of post-natal hypertension
- Programming of post-natal HPA axis activity
- Alterations in post-natal behavior



Stress and Cancer

- Stress is inversely correlated with various aspects of immune activity
- Life events prior to cancer diagnosis appear to be linked with onset and progression of disease
- Cancer diagnosis itself is a major life stressor, which may compromise disease progression and survival
- Stress' effects primarily mediated through immune system



Stress and Insomnia

- Insomnia affects about 9 - 12% of adults in the U.S.
- Associated with more frequent health problems, and more hospitalizations for all causes
- Total sleep deprivation is associated with activation of many immune parameters, including proinflammatory cytokines
- Chronic insomnia is associated with depressed immune function (Savard et al., 2003)

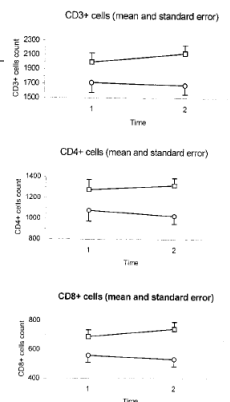
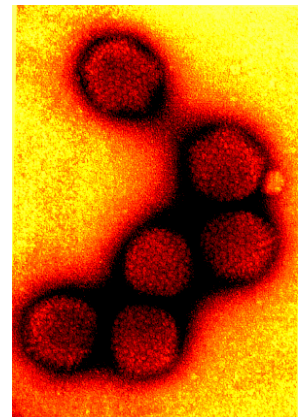


Fig. 2. Lymphocyte and monocyte counts in insomnia patients (INS, —□—) and good sleepers (GS, —○—) across time.

Stress & URI

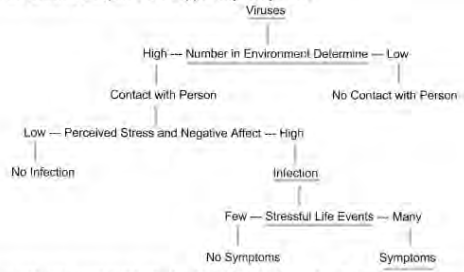
- Inoculate healthy volunteers with cold virus
- Measure infection and symptom rates
- Assess perceived stress, life events, and negative affect
 - Cohen et al., 1991



Algorithm of Stress & Colds

Figure 3

Algorithm for the Possible Development of an Upper Respiratory Illness



Note. Algorithm graphed from data presented in Cohen, Tyrrell, and Smith (1993). High-low is median split of pencil-and-paper test scores.

Psychological stress interferes with DNA repair in white blood (immune) cells

- Faulty DNA repair is associated with increased incidence of cancer
- Blood samples were taken from 56 people - 1/2 were psychologically distressed, the other 1/2 normal
- Cells were exposed to X-Rays to induce DNA damage
- Cells from distressed patients showed impaired DNA repair due to down-regulation of gene coding for O6-methyl guanine methyltransferase
- Glaser, 2005

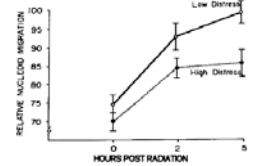
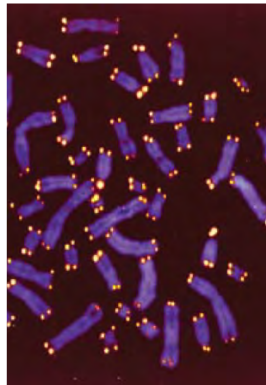


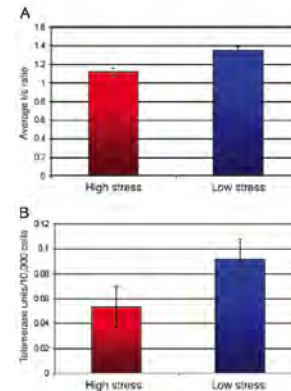
Fig. 4. Mean values for DNA repair (±SE) in lymphocytes from high- and low-distressed psychiatric inpatients at 0, 2, and 5h after X-irradiation.

Telomeres and Aging

- Caps on the ends of strands of DNA in cells that serve to stabilize the structure of chromosomes and regulate cell lifespan
- Telomeres get shorter every time a cell divides, and when telomeres get very short, the cell dies
- An enzyme, telomerase, helps maintain the length of telomeres



Stress and Telomere Length



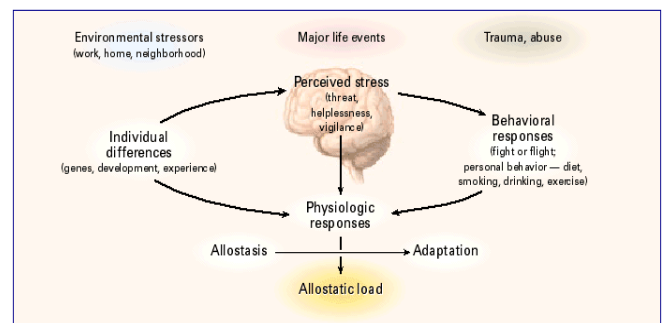
Epel, 2004

Stress and response to vaccination (a marker of adaptive immunity)



Fig. 1. Percentage of caregivers and controls showing a clinically significant fourfold increase in antibody 1 month after vaccination using antibody data from two different assays.

Stress and Adaptation

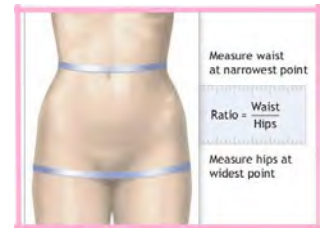


Allostatic Load

- Allostasis maintains a steady state in the face of stressors
- Brain: perceptions
- Endocrine System: stress hormones
- Immune System: defense of the body
 - McEwen, 2002

Allostatic Load

- Measured with several parameters
 - Stress hormones
 - Lipid profile
 - Markers of glucose metabolism
 - Blood Pressure
 - Waist-Hip Ratio
 - Kinnunen et al., 2005



Stressors Can Be External OR Internal

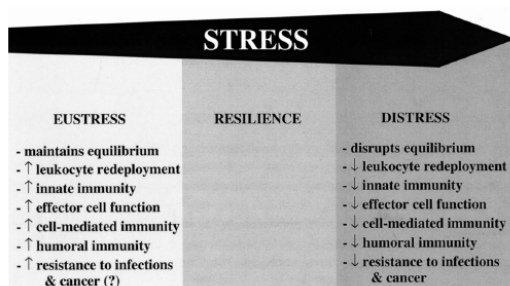


Our thoughts and feelings can act as major stressors if they tax or exceed our ability to respond effectively. This is true even if the thought or feeling has no correspondence with reality.

Jon Kabat-Zinn

“Stress-related disease emerges, predominantly, out of the fact that we so often **activate a physiological system** that has evolved for responding to **acute physical emergencies**, but we turn it on for **months on end, worrying** about mortgages, relationships, and promotions.”
 - Sapolsky (1998) page 7

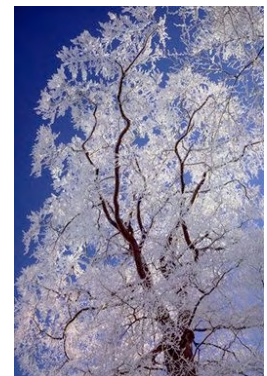
Eustress to Distress



Dhabar, 2000

Types of Stressors

- Environmental
 - Sunlight & SAD
 - Noise
 - Interferes with childrens' ability to learn to read
 - Rabinowitz, 2005
 - Gravity
 - EMF



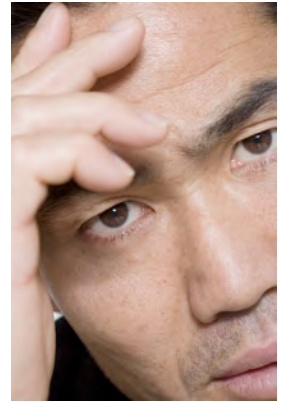
Stressful Occupations

- Uncontrollability
- Fast pace
- Excess responsibility
- Role conflicts
- Monotonous, repetitive jobs
- Lack of meaningful activities
- Lundberg, 2003



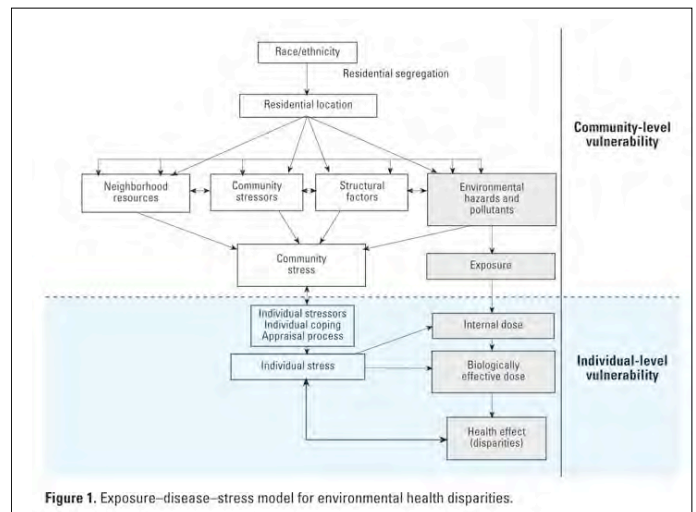
Psychological Stressors

- Thoughts
- Worries
 - Taxes
 - Family Issues
- Attitudes
- Perceptions



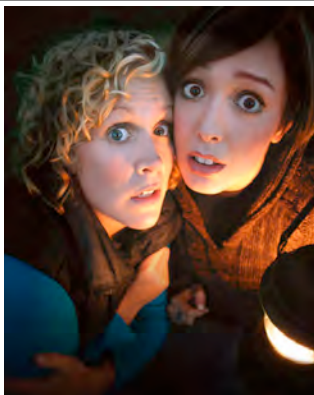
Social Stressors

- Daily hassles
 - "hell is other people"
- Peer Pressure
- Personal Relationships
- Competition
- Racism/Bigotry



Stress Response

- Stressors of all types evoke the same response in the body-mind
- This includes the anticipation of something bad happening



The Human Stress Response is about surviving a life-threatening event

- Attack on one's person
- Attack on a loved one (or anyone, for that matter)
- Need to escape immediate danger
- Need to seek mating partner
- Need to seek food in times of famine



Primary function of the stress response

- Respond to threats frequently faced by hunter-gatherer humans - the 4 Fs

- Famine - need to seek food every day and cope with seasonal famines
- Flight - need to flee from attackers & animals
- Fight - need to defend self from attackers & animals
- F*** - need to seek mates and frequently fight for them

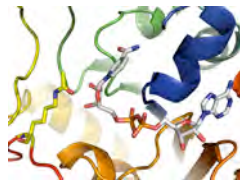


Human beings frequently respond to stress with a primitive "famine" response



Primary function of the stress response

- Mobilize resources for escape and surviving injury
 - Make ample fuel available for large muscle function
- Shut down long-term projects
 - Inhibit digestion of food
 - Inhibit reproductive functions
 - Inhibit tissue building
 - Inhibit immune function



Stress can be Acute or Chronic or Both

- Acute: immediate, intense, short-acting
- Chronic: gradual, less intense, long-lasting
 - constant grinding stress
 - unemployment, caregiving, high-conflict marriages, divorce
 - frequent, repetitive jolts of acute stress
 - fallout from major life events
 - death of family member, serious injury to self or family member, victimization



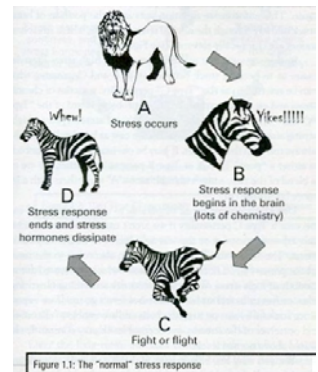
In general, acute stress is healthy stress

- Something happens, you deal with it and move on
- Does NOT exceed ability to cope
- Healthy when the stress is successfully managed and NOT superimposed on other chronic stressors



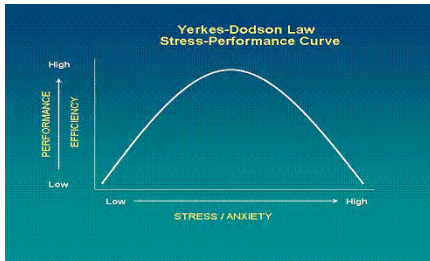
Healthy stress responses end when the stressor is resolved

- This is the typical responses seen in animals
- The stress response is marked by drastic, high-intensity physical exercise (fight or flight)
- All the sugar and fat released into the blood is used by the skeletal muscles - so there's no buildup
- The system returns to normal after the physical release



Stress and challenge are good as long as they don't provoke excessive anxiety

- Human motivation and performance is dependent upon challenges from the environment or within oneself
- As the level of challenge increases, to does performance - to a certain point



What is eustress?

- Challenging events that one feels capable of handling, even if they're very difficult
- Opportunities to gain a sense of mastery over one's life and one's self
- In the context of low chronic stress, acute stress is adaptive and easy to recover from - *it's what we're made to do*
- In the context of high chronic stress, acute stress can be harmful the immune, cardiovascular, and other systems

Chronic stress is unhealthy stress

- Little or no time for recovery between daily challenges
- Little outlet for social connection and comfort
- No "hope" of things ever getting better
- Feeling out of control and helpless
- Unhealthy coping mechanisms don't provide adequate release of tension and metabolic build-up



Chronic stress

- Chronic stress is the physiological result of prolonged elevation of the chemicals and nervous system activation that normally are only active for a short time during acute stress responses
- They can get stuck "on"
- The body isn't designed to live this way for long periods of time



Chronic stress is a strong risk factor (or covariate) with poor health behaviors

Table 1
Regression Coefficients for Stress and Health Behaviors

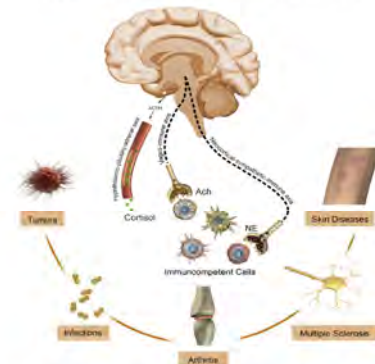
Variable	Women (n = 6,620)			Men (n = 5,490)		
	B	SE _B	p	B	SE _B	p
High-fat diet		.03	< .01	0.22	.04	< .01
Exercise frequency (times per week)						
Mild	0.02	.08	> .05	0.03	.08	
Moderate	0.02	.03	> .06	0.02	.01	
Strenuous	0.01	.01	> .06	0.01	< .01	
Alcohol use	0.007	0.008	.40	0.010	0.010	.38
Current smoker	0.009	0.002	< .01	0.006	0.002	< .01
Number of cigarettes smoked per day	-0.06	0.08	.43	0.23	0.12	.05
Change in smoking during past year (current smokers)	-0.02	0.01	< .01	-0.02	0.01	< .01
Plan to quit smoking (current smokers)						
In next 6 months	-0.004	0.004	.43	-0.007	0.005	.19
In next 30 days	-0.004	0.004	.23	0.001	0.005	.86
Number of times quit smoking (≥24 hours) during past year	0.09	0.16	.57	-0.18	0.22	.42
Quit smoking confidence	-0.09	0.03	< .01	-0.13	0.03	< .01
Confidence in not smoking when stressed	-0.05	0.01	< .01	-0.05	0.01	< .01

Note. Regression coefficients are controlled for age, education, ethnicity, and marital status; p values are based on all measures analyzed as continuous variables.

Physiology of the Stress Response

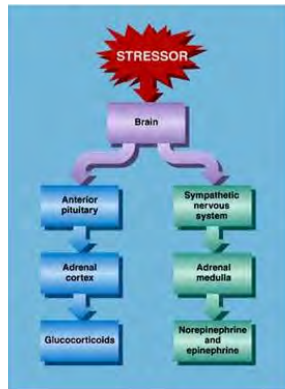
M.E. Kenney, M. Schellowski / Brain, Behavior, and Immunity 21 (2007) 1000-1018

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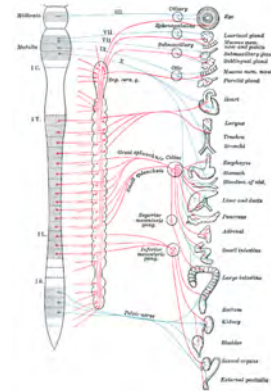
The stress response has 2 major components

- Activation of the sympathetic nervous system
- Activation of the HPA axis



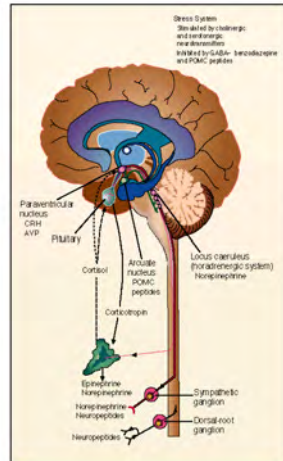
The Nervous System Component of the Stress Response

- With stress you go into "Fight or Flight," which is created by activation of the Sympathetic Nervous System



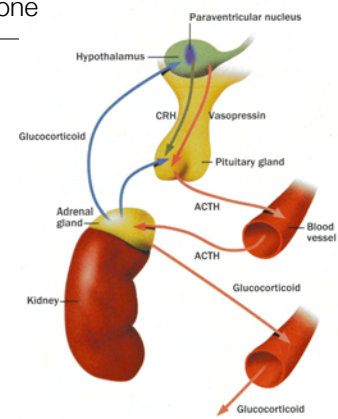
Endocrine Response to Stress

- Cortisol
 - From Adrenal Glands
- Catecholamines
 - From Adrenal Glands
 - From SNS Fibers



Cortisol: a steroid hormone

- From Adrenal Cortex
- Steroid
- Slower-Acting
- Changes the expression of genes in target cells
- Stays in body for prolonged periods of time

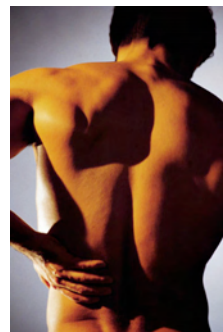


What does cortisol do? Get you ready for a fight by fueling imminent intense physical activity

- ↑ Free Fatty Acids
- ↑ Blood Glucose
- ↑ Blood Pressure
- ↓ Effective Immune Function
- ↓ Vitamin Availability



Symptoms of Chronic Stress



- Headaches
- Muscle Tension
- Digestive Problems
- Irregular or Rapid Heartbeats
- Sleep Problems
- Frequent Colds and Infections

Assessing Perceived Stress

- Stressful Life Events: Holmes & Rahe 1967
- Social Readjustment Rating Scale
- Perceived Stress Questionnaire
- Higher Scores : More Illness

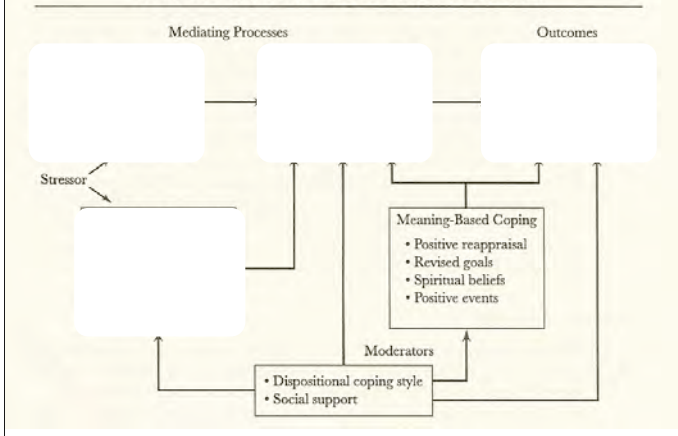


Transactional Models: It's not about you, or what happens to you, but the interplay between...

- Stress is a function of perception
 - Lazarus, 1966
- "Person-Environment Fit"
 - French & Kahn, 1962
- Buffering effects of Social Support
 - Cohen & Willis, 1985



FIGURE 10.1. DIAGRAM OF THE TRANSACTIONAL MODEL OF STRESS AND COPING.



Transactional Model of Stress & Coping

- Stress is a person-environment transaction

Primary Appraisal

- Potential threat of the stimulus

Secondary Appraisal

- Ability to alter the situation and manage emotional responses

What is an appraisal?



- An appraisal is a cognitive interpretation you make regarding a potential stressor or challenge
- An appraisal is what you tell yourself about what's going on...

Step 1: Primary Appraisal

- Evaluation of the potential threat of an event (or thought)
- Is this a threat to my well-being?
- Is this a challenge?
- Is this irrelevant?



Negative Primary Appraisals

- Associated with negative psychological and physical adjustment
 - Passive pain coping
 - Venting
 - Helplessness
 - Increased levels of pain



Positive Primary Appraisals

- Increased sense of control
- Increased use of problem-focused coping
- Increased use of social support
- Less psychological distress



Step 2: Secondary Appraisal

- If primary appraisal detects a threat:
 - Can I deal with this?
 - Do I have any control over this situation?



Step 2: Secondary Appraisal

- If perceived coping ability is:
 - Effective, then stress symptoms usually not experienced (hassles)
 - Marginally effective, coping efforts are increased (at a cost) and distress may result if efforts aren't effective
 - Ineffective, the tendency is to choose strategies such as withdrawal, emotion-focused coping, helplessness



Can I deal with this? How's my self-efficacy?

- Focus on the individual's sense of control over how he or she will deal with the situation
- Not a focus on the causes of the situation
- Stress happens when a person thinks their ability to cope is being overwhelmed by the demands of the situation

Coping



- We are born only for suffering and for joy, and one can almost say that the loftiest seize joy across suffering.
 - Beethoven, 1816

What are the desired outcomes of coping?

- Solutions to the problems
- Emotional well-being & freedom from distress
- Good health and healthy behaviors
- Avoidance of future stressors (proactive coping)



What is Coping?

- “The **behavioral and cognitive efforts** one uses to manage the internal and external demands of a stressful situation” (Chang, 1998)
- Behavioral: What you **do** when faced with a stressor
- Cognitive: What you **think** (tell yourself) when faced with a stressor
- Internal demands: The anxiety, anger, worry and other emotions and thoughts you have when faced with a stressor
- External demands: What you need to do to meet the challenge of a stressor

Two Types of Coping

- Coping is the actual use of two types of strategies directed at changing and dealing with a stressful situation:

• Problem management

- Strategies directed at changing a stressful situation

• Emotional regulation

- Strategies directed at changing the way one thinks or feels about a stressful situation

Problem Management



- List making
- Mobilizing resources
- Problem solving
- Information seeking
- Eliciting instrumental social support

Emotional Regulation

- The methods people use to influence their subjective emotional experiences
- Primitive: always seek the most pleasant experience possible
- Sophisticated: always seek to obtain positive outcomes in a given situation (instrumental benefits)
- So you're not always seeking pleasure...



Emotional Regulation Strategies

- Emotional Social Support
- Venting
- Disclosure
- Avoidance & Denial
- Artistic & Social Expression
- Meditation
- Exercise



Maladaptive coping is usually some type of avoidant behavior

- Workaholism
- Busyness
- Chemicals
- Television/Internet
- Compulsive Eating
- Compulsive Shopping
- Emotional Excesses



Maladaptive Coping



- This may be effective in the short term but leads to other problems in the long run
- Important to recognize “bad habits” as coping mechanisms (smoking, overeating, TV, alcohol, etc.)
- Withdrawal of one coping mechanism requires provision of another

Where does maladaptive coping come from?

- Adopting “bad habits” like substance abuse in response to demands while growing up
- Unwillingness to let go of coping strategies that don’t work any more (immaturity)
- Learned patterns from parents/peers/culture (aggression, control freakiness, overcompensation)
- Limited opportunity to learn better responses (dysfunctional social environment)

When coping doesn’t work...

- Cognitive problems (concentration, memory)
- Emotional problems (fear/anxiety, depression)
- Behavioral problems (irritability, withdrawal, self-abuse)
- Physiological problems (immunological, cardiovascular, hormonal, GI, etc., etc.)
- Spiritual problems (disconnection, meaninglessness)

Meaning-Based Coping

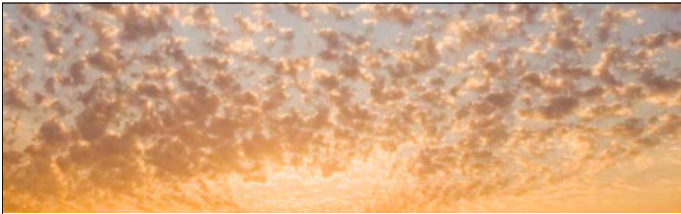
- Coping processes that induce *positive emotion*
- Positive emotion sustains the coping process by allowing reenactment of problem- or emotion-focused coping



Viktor Frankl: “Man’s Search for Meaning”

- Evoked the sustaining image of his wife to survive the misery of Auschwitz and forced marches in winter
- Her image, rendered fully and multi-sensorally, helped him transcend his situation





Signifiers of Meaning-Based Coping

- Life has a purpose and coherence
- Meaning occurs through personal accomplishments, interpersonal encounters, or encounters with art or nature (Frankl)
- Attaching one's existence to something larger such as a spiritual reality

What are the desired outcomes of coping?

- Emotional well-being
- Functional status
- Health Behaviors
- Avoidance of future stressors (proactive coping)



Meaning-based coping strategies

- Positive reinterpretation
- Forgiveness
- Acceptance
- Religion and Spirituality



Stress Management

- Reduces cardiac risk factors
 - McCrone, 2001
- Decreases doctor visits
 - Roth & Stanley, 2002
- Enhances psychological well-being
 - Williams et al., 2001



Stress management improves blood sugar control in people with Diabetes Type II

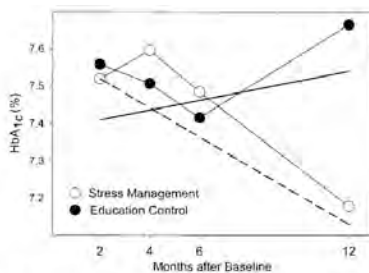


Figure 1—Treatment-related changes in HbA_{1c} with statistical adjustment for baseline levels. The linear component of change is shown by the straight line.

Surwit et al., 2002

Effects of a relaxation and guided imagery intervention with children with asthma

TABLE 1
Number of Asthmatic Episodes and Consumption of β_2 Inhalers in the 6 Months prior to the Study and during the 6-Month Study Period

	Prior to study	p^a	During study
Asthmatic episodes			
Control	1.9 \pm 0.5 ^b	>.05	2.1 \pm 0.5
PSI	3.8 \pm 1.1	<.01	2.1 \pm 0.7
β_2 inhalers			
Control	3.3 \pm 0.8	>.05	3.4 \pm 0.6
PSI	4.6 \pm 0.8	<.0003	2.1 \pm 0.4

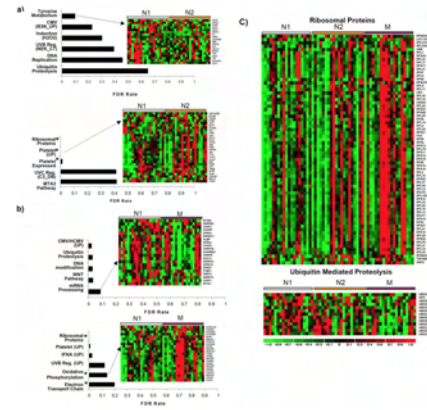
^a p value determined by repeated measures one-way analysis of variance.

^b Mean \pm SE.

Castes et al., 1999

Dusek et al., 2008: Genomic counter-stress changes induced by the Relaxation Response

- Gene mapping in three groups of people: long term meditators (M), non-meditators (N1) and non-meditators who underwent training in the relaxation response (N2)
- 2209 genes were differentially expressed in group M compared to group N1, and 1561 genes differentially expressed in group N2 compared to N1
- These genes regulate processes of cellular metabolism, oxidative phosphorylation, generation of reactive oxygen species (free radicals) and response to oxidative stress
- **These processes, when enhanced, serve to protect the body from the cellular damage and aging effects of stress**



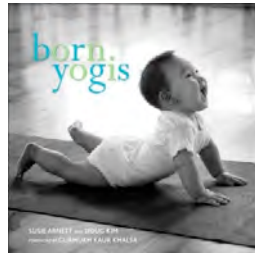
Dusek et al., 2008: Genomic counter-stress changes induced by the Relaxation Response

Benefits of Yoga

- Decreased cortisol levels during yoga practice and overall
- Decreased perceived stress and fatigue



Figure 1. The possible effects of yoga on behavioral, psychological and physiological measures are illustrated. This article focuses on current evidences for physiological changes.



Guided imagery and surgical outcomes: Schwab et al., 2007

- Patients who had hysterectomies. The comparison group listened to a GI tape 3 times before surgery. Control group, no tape, just standard pre-operative care
- Comparison group had significantly less anxiety and fear about the procedure
- In addition, their costs were lower!

	Comparison Group (N=73)	Intervention Group (N=53)	Difference	t-test
Mean total billed	\$13962	\$11959	(\$2003) -14%	$P=0.055$
Mean pharmacy billed	\$1964	\$1695	(\$268) -14%	$P=0.181$
Mean length of stay (days)	2.85	2.62	-0.23 -8%	$P=0.074$

Effects of a cognitive-behavioral stress management intervention in men with HIV

Table 3
Pre- and Posttreatment Means and Standard Errors of Measurement for Mood and Perceived Stress in HIV+ Gay Men in Cognitive-Behavioral Stress Management (CBSM) Versus Control

Measure	CBSM				Control				ANCOVA F	df
	Pretreatment		Posttreatment		Pretreatment		Posttreatment			
	M	SEM	M	SEM	M	SEM	M	SEM		
POMS										
Anxiety	12.79	1.04	8.61	0.77	11.83	1.50	12.37	1.72	10.32**	1, 63
Anger	12.21	1.30	7.96	0.99	11.39	2.20	14.20	2.78	11.78**	1, 63
TMD	39.65	5.09	22.18	4.26	33.09	8.16	37.40	9.58	8.47**	1, 63
PSS	42.12	1.14	37.07	0.99	37.47	1.81	38.16	2.14	4.29*	1, 59

Note. ANCOVA = analysis of covariance; POMS = Profile of Mood States; TMD = Total Mood Disturbance; PSS = Perceived Stress Scale.

* $p < .05$, two-tailed. ** $p < .01$, two-tailed.

Antoni et al., 2000

Effects of a cognitive-behavioral stress management intervention in men with HIV

Table 4
Pre- and Posttreatment Means and Standard Errors of Measurement for 24-Hr Urinary Output of Catecholamines in HIV+ Gay Men in Cognitive-Behavioral Stress Management (CBSM) Versus Control

Catecholamine*	CBSM				Control			
	Pretreatment		Posttreatment		Pretreatment		Posttreatment	
	M	SEM	M	SEM	M	SEM	M	SEM
Epinephrine (E)	11.88	2.14	6.30	1.33	8.34	1.90	7.15	0.84
Norepinephrine (NE)	60.79	6.66	55.40	7.88	41.43	8.14	63.30	19.20
Total (E + NE)	72.67	7.78	61.70	8.66	52.17	9.75	73.06	21.55

* $\mu\text{g}/24 \text{ hr}$.

Antoni et al., 2000

Effects of a cognitive-behavioral stress management intervention in men with HIV

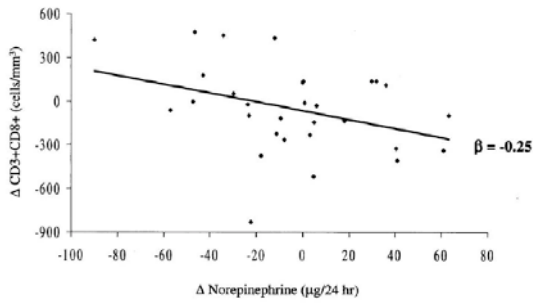


Figure 4. Scatter plot showing the relationship between changes in norepinephrine over the 10-week intervention period and changes in T-suppressor/cytotoxic (CD3+CD8+) cells from study entry to the 6- to 12-month follow-up in HIV+ gay men participating in the study.

Effects of a cognitive-behavioral stress management intervention in men with HIV

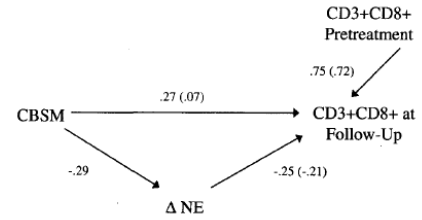


Figure 5. Path analysis testing mediation of cognitive-behavioral stress management (CBSM) intervention effects on CD8+CD3+ cells at follow-up by changes in 24-hr urinary norepinephrine (NE) output over the 10-week intervention period. Coefficients outside of parentheses are standardized regression weights; values within parentheses are regression weights when CD8+CD3+ pretreatment values and pre-post treatment NE change are entered before CBSM.

Stress management effectively blunts the deleterious effects of a positive HIV test (Antoni et al., 1991)

- 47 asymptomatic gay men randomly assigned to control or treatment group while waiting for results of HIV test
- Intervention group met twice weekly for 10 weeks in groups for cognitive restructuring and relaxation training
- Immune parameters were measured at baseline and in the days after results of the tests were given
- Control group had greater negative affect and poorer immune functioning after diagnosis

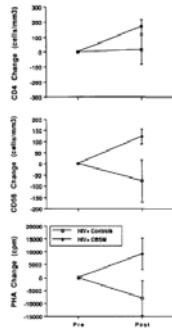


Figure 7. Helper-inducer (CD4) and natural killer (CD8) cell counts and lymphocyte proliferative responses to phytohemagglutinin (PMA) expressed as counts per minute (cpm) at pre- and postdiagnosis time points for responsive cognitive-behavioral stress management (HIV+ CBSM) and HIV+ control groups. (HIV+ = human immunodeficiency virus)

Exercise, Fitness and Reactivity to Stress Forcier et al., 2006

- Meta-analysis of several studies of cardiovascular reactivity to stress in fit and unfit people
- Cardiovascular reactivity = elevations in heart rate and blood pressure in the face of a stressful situation
- High levels of CR are associated with elevations in morbidity and mortality due to cardiovascular disease
- Fitness provides protection against heart rate elevation and systolic BP elevation in the face of stress, and confers faster recovery of HR after a stressor

