

XXXIV Congresso Nazionale SIPPS

# Dagli albori della vita... un cammino insieme



## Felicità e sistema immunitario

Lucia Leonardi

**Torino**

Star Hotel Majestic - Corso Vittorio Emanuele

**22-25 Settembre 2022**

Presidenti del Congresso:  
GIUSEPPE DI MAURO | GIANNI BONA

In memoria del:  
PROF. GIANCARLO MUSSA



*Felicità: stato d'animo di chi è sereno, non turbato da dolori  
o preoccupazioni e gode di questo suo stato*

*Felicitas: condizione di produttività, di beatitudine o felicità ispirata dalla divinità Felicitas  
portatrice di fortuna*

“HEALTH IS A STATE OF COMPLETE PHYSICAL,  
MENTAL AND SOCIAL WELL-BEING, AND NOT MERELY  
THE ABSENCE OF DISEASE OR INFIRMITY.”

—World Health Organization, 1948

# Happiness and Longevity in the United States

Hazard Ratios of Happiness and the Risk of Death for U.S. Adults, 1978–2008 (N=31,481)

	Model 1	Model 2	Model 3	Model 4	Model 5
<b>General Happiness (very)</b>					
Pretty happy	1.07 **	1.07 **	1.06 *	1.07 **	1.06 *
Not happy	1.21 ***	1.20 ***	1.15 ***	1.15 ***	1.14 **
<b>Covariates</b>					
Male	1.39 ***	1.39 ***	1.44 ***	1.44 ***	1.43 ***
<b>Race (white)</b>					
Black	1.39 ***	1.38 ***	1.31 ***	1.30 ***	1.31 ***
Other race	1.06 ***	1.06	1.04	1.03	1.04
<b>Marital Status (married)</b>					
Widowed		1.03	1.00	1.00	1.00
Divorced		0.99	0.97	0.97	0.96
Never married		1.13 **	1.12 **	1.13 **	1.12 **
<b>Income to needs (less than 100%)</b>					
100–199%			0.91 **	0.91 **	0.92 *
200–299%			0.88 **	0.88 **	0.88 **
300% or more			0.92 *	0.92 *	0.92 *
<b>Education (less than HS)</b>					
High School			0.97	0.97	0.98
Some college			0.94 *	0.93 *	0.94 +
College degree			0.84 ***	0.85 ***	0.85 ***
<b>Employment (full time)</b>					
Part time			1.02	1.02	1.03
Temp not working			1.15 +	1.15 +	1.15 +
Unemployed, laid off			1.11	1.11	1.11
Retired			1.07 *	1.07 *	1.07 *
School			1.06	1.07	1.07

- Model 1 sesso e razza
- Model 2 stato civile
- Model 3 stato socioeconomico
- Model 4 area geografica
- Model 5 religione

## Rischio mortalità

6% più alto tra individui abbastanza felici

14% più alto tra individui **non felici**

vs individui molto felici

al netto dei parametri analizzati

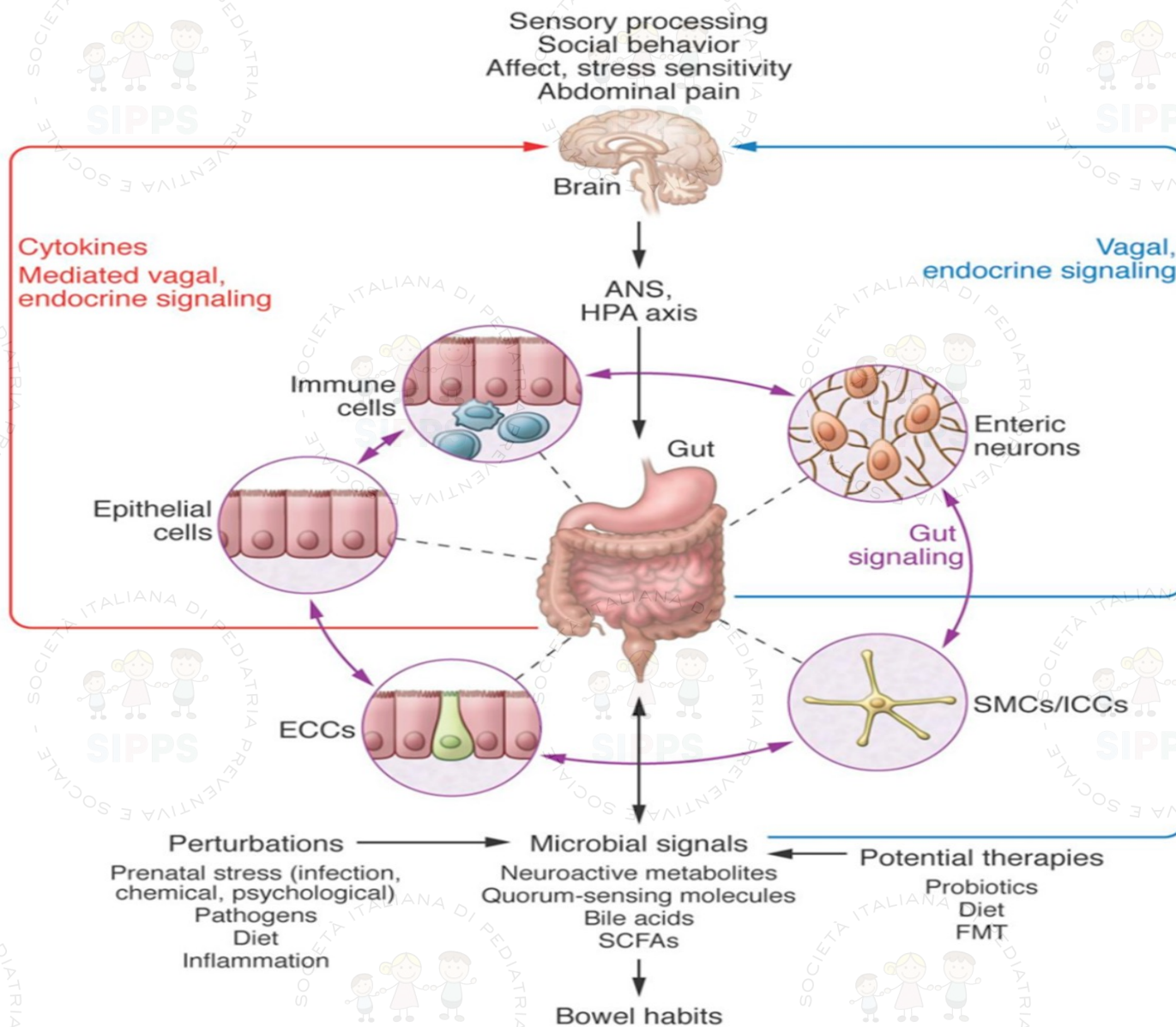
**FELICITA'** indicatore autonomo di benessere

## Nesso anatomico-funzionale SNC e sistema immunitario

- SN autonomo/organismi linfoidi
- Citochine → sviluppo e normale funzione cerebrale (az. Neurotrasmettitori)
- Catecolamine → sistema immunitario

**I tre cervelli  
maturano quasi  
completamente a  
tre anni:**

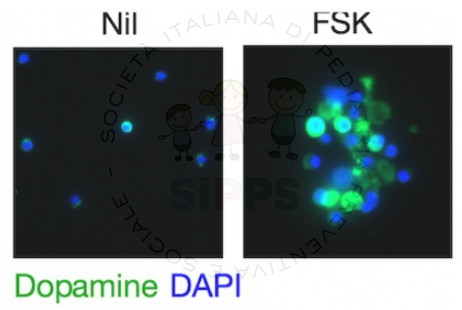
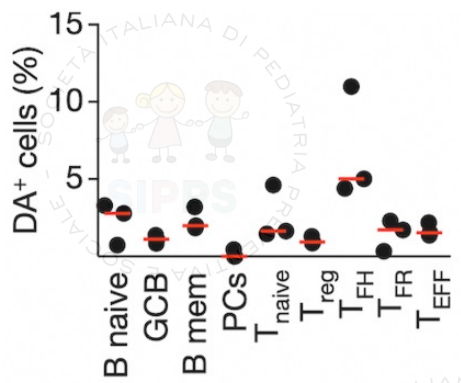
- **Cervello**
- **Intestino**
- **Sist. Immunitario**



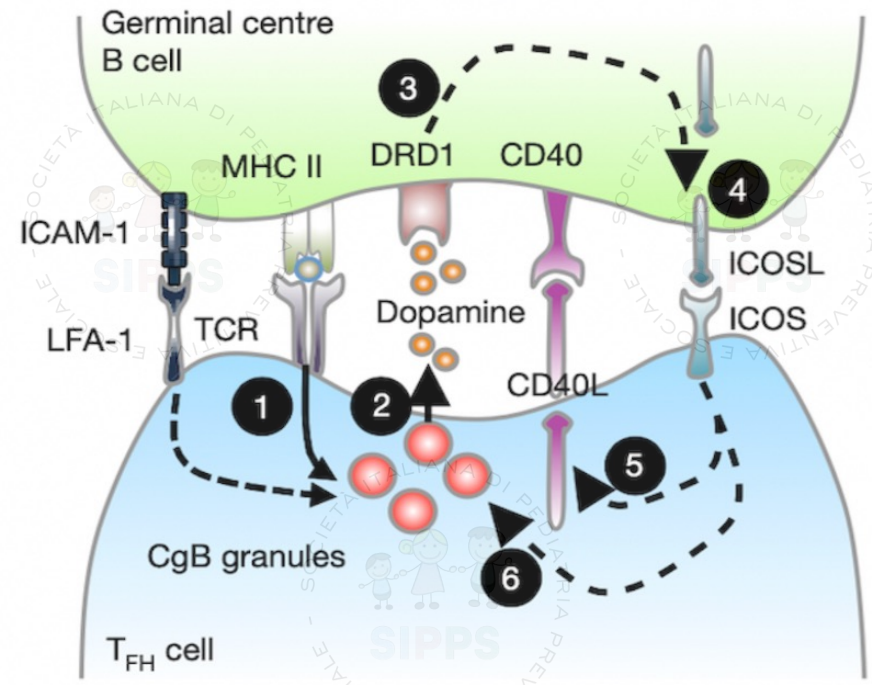
ANS = autonomic nervous system; HPA = hypothalamic-pituitary-adrenal; SMC = smooth muscle cells; ICC = interstitial cells of Cajal; ECC = enterochromaffin cells; SCFAs = short-chain fatty acids;

Chernikova, M.A.  
*Nutrients* 2021

# T<sub>FH</sub>-derived dopamine accelerates productive synapses in germinal centres



News Difese immunitarie  
**L'ormone della felicità migliora le difese immunitarie**



1. interazione ThFe cellule B del centro germinale
2. dopamina viene rilasciata dai granuli di CgB
3. DRD1 sui linfociti B riconosce dopamina
4. aumento dell'espressione di ICOSL --> ICOS
- 5 ICOSL --> ICOS --> attivazione CD40L + formazione CgB

**Inflammatory Cytokines in Depression: Neurobiological Mechanisms and Therapeutic Implications**

Jennifer C. Felger<sup>1</sup> and Francis E. Lotrich<sup>2</sup>

**The Bidirectional Relationship of Depression and Inflammation: Double Trouble**

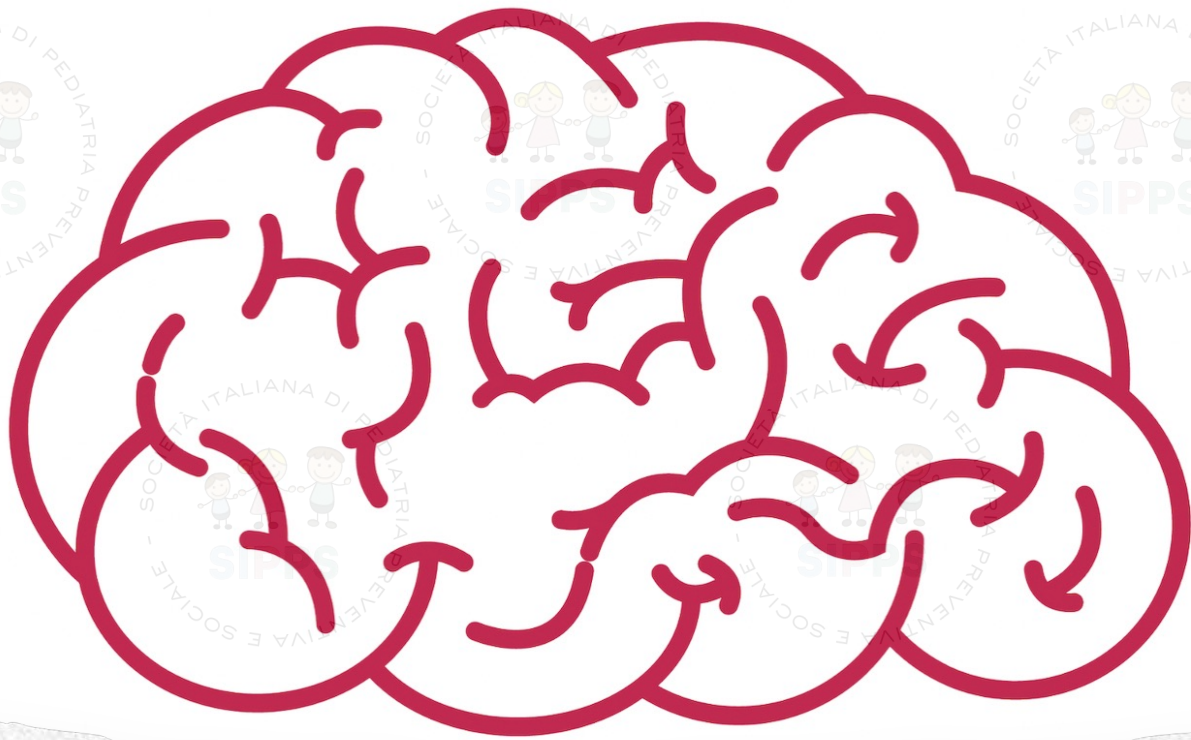
Éléonore Beurel<sup>1,2</sup>, Marisa Toups<sup>3</sup>, Charles B. Nemeroff<sup>3,\*</sup>

**Elevati markers infiammatori sierici = rischio di depressione e psicosi nelle persone sane**

**Antinfiammatori trattamenti efficaci per i pazienti NP**

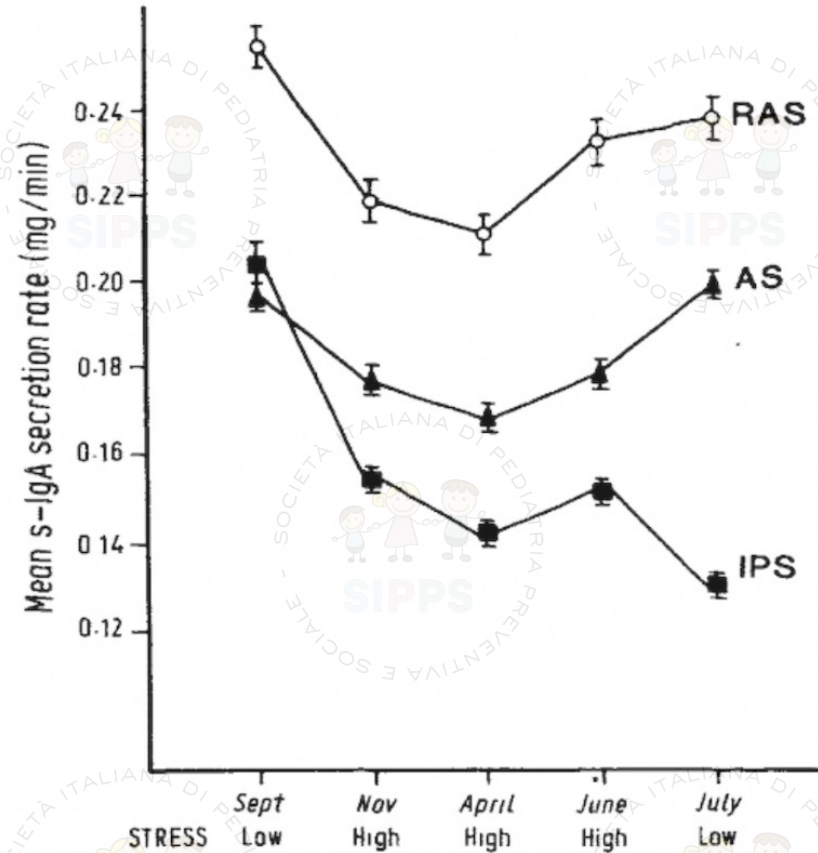
JAMA Psychiatry | [Original Investigation](#)

**A Nationwide Study in Denmark of the Association Between Treated Infections and the Subsequent Risk of Treated Mental Disorders in Children and Adolescents**



Stato d'animo negativo → Sistema immunitario ?

## ACADEMIC STRESS, POWER MOTIVATION, AND DECREASE IN SECRETION RATE OF SALIVARY SECRETORY IMMUNOGLOBULIN A



Mean salivary immunoglobulin A secretion rate in high and low stress periods for all subjects (AS), those with the relaxed affiliative motive syndrome (RAS), and those with the inhibited power motive syndrome (IPS).

Vertical bars = standard error of the mean.



**Stress percepito e dosaggio s-IgA**

64 studenti 1 anno odontoiatria  
periodi di basso/alto stress

2 assetti motivazionali:

- IPS potere leadership
- RAS affiliazione/socialità

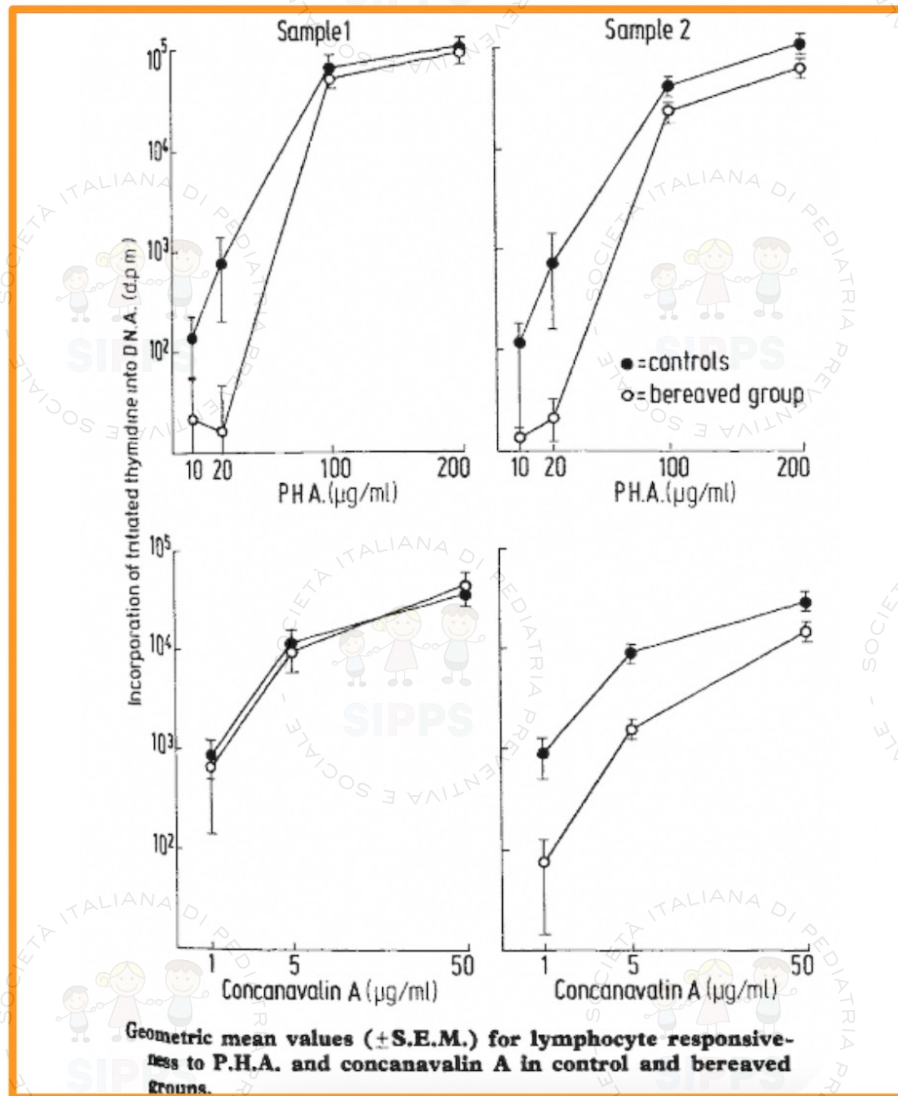
s-IgA basse nei periodi alto stress vs  
basso stress per entrambi i gruppi

ma RAS livelli più alti di sIgA per ogni  
periodo



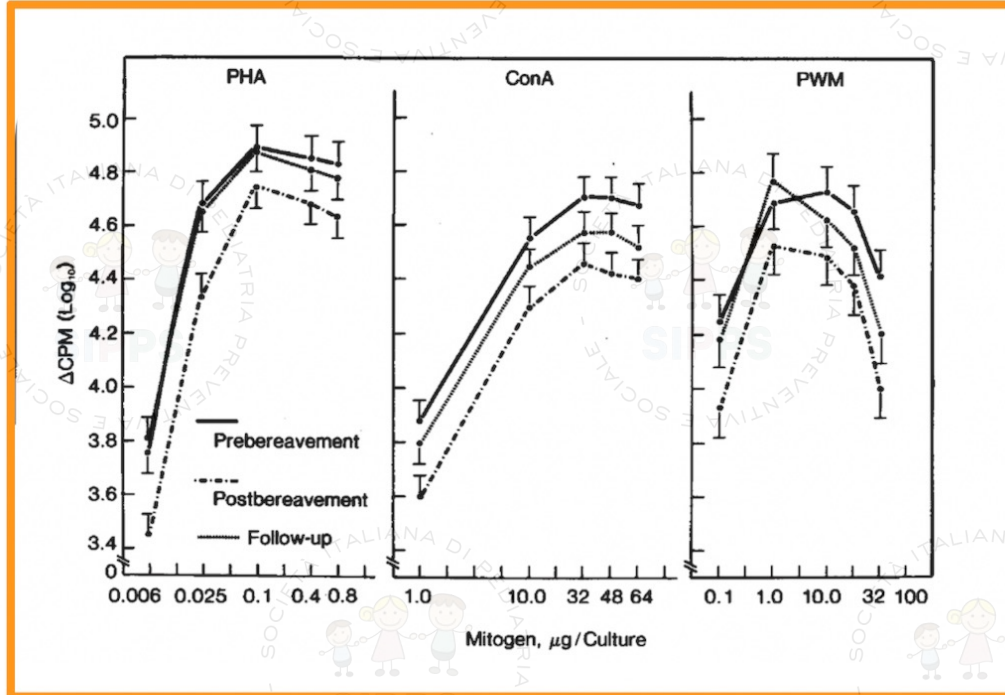


## DEPRESSED LYMPHOCYTE FUNCTION AFTER BEREAVEMENT



26 vedove, 8 settimane dopo lutto  
 linfoproliferazione T (PHA) < controlli  
 Nessuna differenza cortisolo, prolattina, IGF1, TSH

## Suppression of Lymphocyte Stimulation Following Bereavement

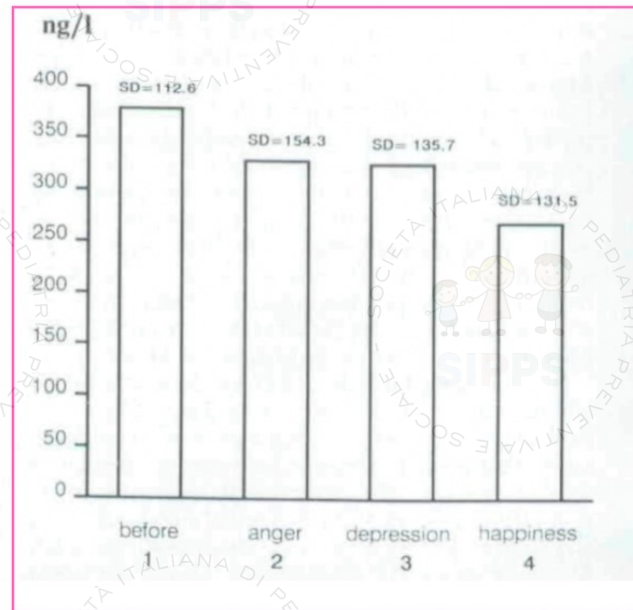
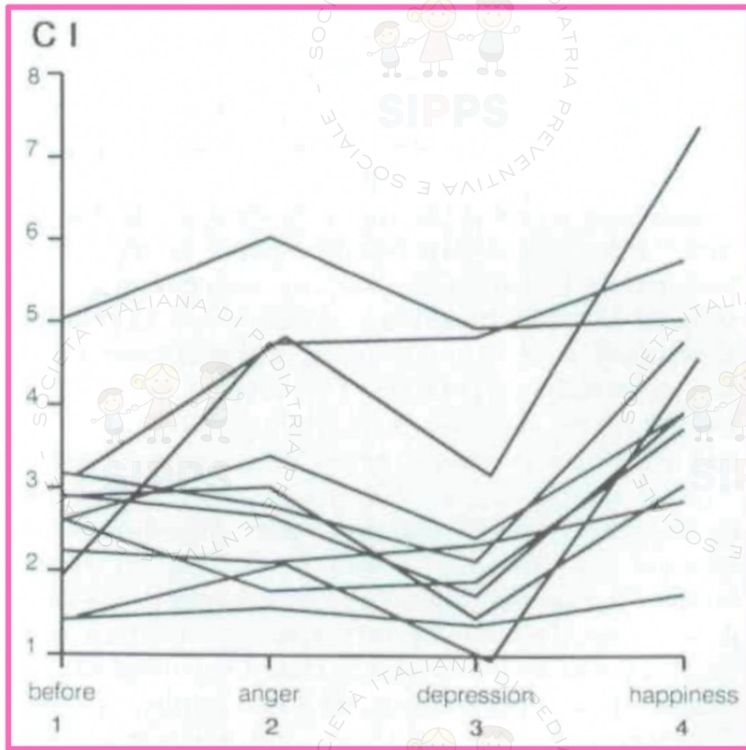


***Ridotta linfoproliferazione T con più stimoli  
nelle prime fasi del lutto >> fasi successive***



Stato d'animo positivo → Sistema immunitario?

# Monocyte Chemotactic Activity in Sera after Hypnotically Induced Emotional States



**11/96 studenti altamente suscettibili all'ipnosi  
eventi infanzia: rabbia depressione --> felicità**

**Attività chemiotattica monociti + cortisolo e catecolamine pre/post ipnosi**

**chemiotassi ridotta in stato depressivo vs rabbia**

**chemiotassi aumentata in stato felice vs pre-ipnosi e post rabbia + depressione**

**Livelli cortisolo e catecolamine non correlati a attività chemiotattica**



**effetti a lungo termine stato d'animo positivo**

**PES positive emotional style**  
**NES negative emotional style**



- ProWle of Mood States (POMS)
- AVect Scale
- Goldberg's Big-5 Factor Scales
- Larsen and Diener Circumplex
- Mackay Circumplex

9 item positivi (lively, full-of-pep, energetic, happy, pleased, cheerful, at-ease, calm, and relaxed)  
9 item negativi (sad, depressed, unhappy, on-edge, nervous, tense, hostile, resentful, and angry)

# Positive Emotional Style Predicts Resistance to Illness After Experimental Exposure to Rhinovirus or Influenza A Virus



**TABLE 1. Percent Persons Developing a Cold by Positive Emotional Style (tertiles) and by Virus<sup>a</sup>**

Virus	Positive Emotional Style		
	Low	Middle	High
Flu	26.1 (n = 8)	17.2 (n = 15)	15.5 (n = 15)
RV39	40.8 (n = 56)	37.7 (n = 49)	27.4 (n = 50)
Total	39.0 (n = 64)	32.9 (n = 64)	24.6 (n = 65)

<sup>a</sup> Presented data are adjusted for virus, viral-specific antibody level and Negative Emotional Style.

**TABLE 2. Mean Symptom Bias Score (residualized) by Emotional Style Tertiles and Virus<sup>a</sup>**

Virus	Positive Emotional Style		
	Low	Middle	High
Flu	0.18 (n = 8)	0.05 (n = 15)	-0.05 (n = 15)
RV39	0.17 (n = 56)	0.00 (n = 49)	-0.15 (n = 50)
Total	0.17 (n = 64)	0.01 (n = 64)	-0.13 (n = 65)
Virus	Negative Emotional Style		
	Low	Middle	High
Flu	-0.06 (n = 11)	0.03 (n = 15)	0.15 (n = 12)
RV39	-0.12 (n = 55)	0.00 (n = 47)	0.09 (n = 53)
Total	-0.11 (n = 66)	0.01 (n = 62)	0.10 (n = 65)

A score of 0 indicates symptom reports that are exactly what one would expect from objective signs of illness. Positive scores indicate higher symptom scores than expected and negative scores indicate lower scores than expected. These scores are adjusted for the eight standard control variables.

95 M +98 F - 21 -55 aa  
 PES: felicità, vivacità, calma  
 NES: ansia, ostilità, depressione  
 Inoculazione rinovirus7 influenza virus

PES < R di infezione o sintomi soggettivi  
 Al netto di parametri sociodemografici e NES  
 PA conferisce benefici per la salute indipendentemente dai livelli di NES

# Emotional Style and Susceptibility to the Common Cold

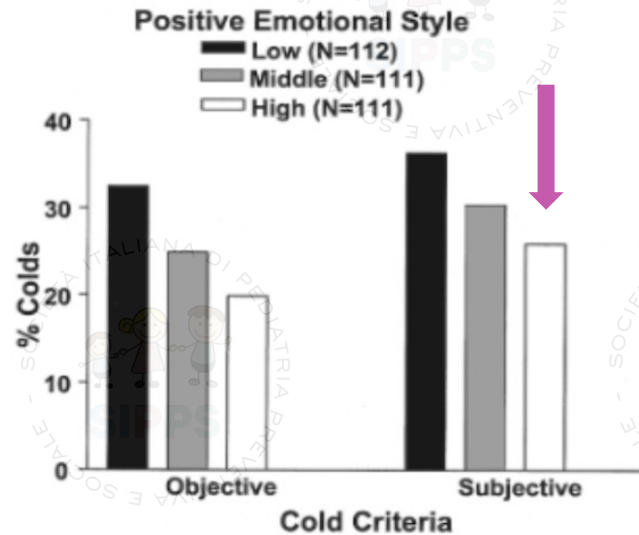


Fig. 1. Positive emotional style (by interviews) and incidence of clinical (infection + illness) colds using objective and subjective criteria for illness.

159 M + 175 F (18 -54 aa)  
 Inoculazione 2 RSV  
 >PES <R infezione + sintomi soggettivi



PES correla con migliore qualità sonno, esercizio fisico. ridotti livelli di catecolamine e cortisolo.

Nessun parametro (sociodemografico, NES, pratiche salutari, ormoni) correla con ridotto R di raffreddore

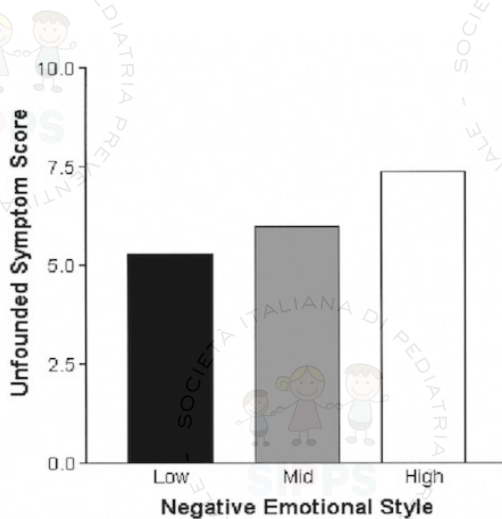


Fig. 3. Negative emotional style (by interviews) and unfounded symptoms (symptom scores adjusted for standard controls, infection status, total mucuciliary clearance, and mucus weights).

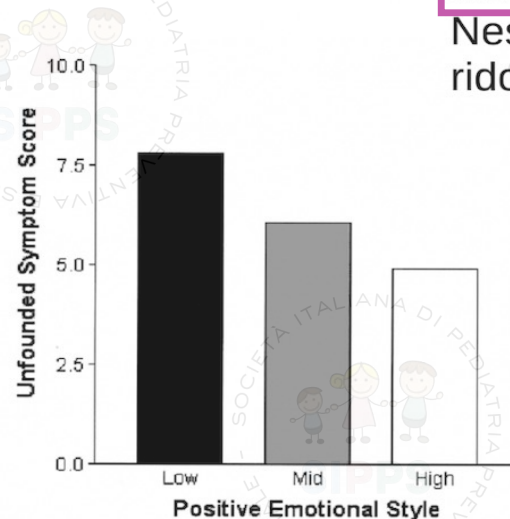
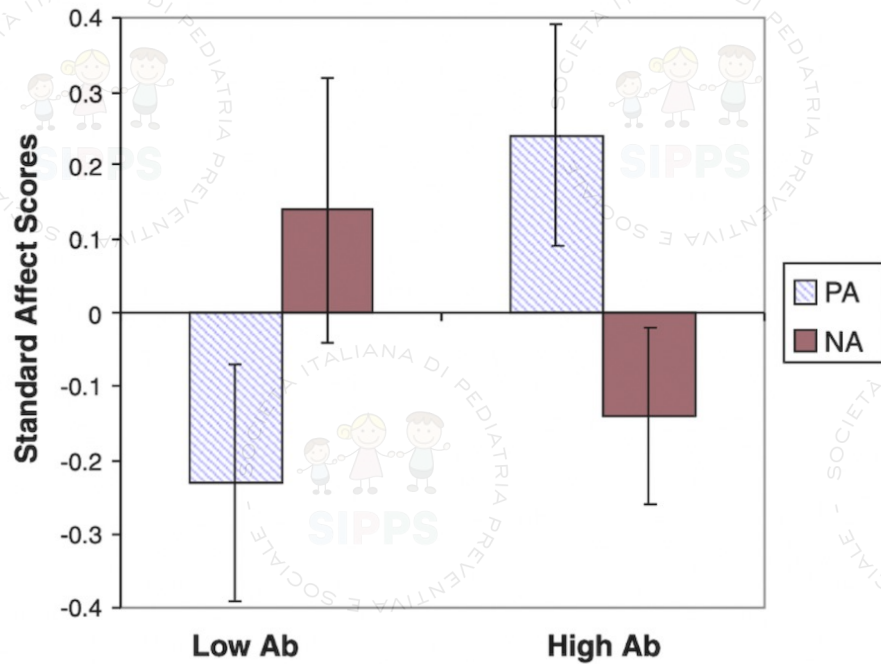


Fig. 4. Positive emotional style (by interviews) and unfounded symptoms (symptom scores adjusted for standard controls, infection status, total mucuciliary clearance, and mucus weights).

## Trait positive affect and antibody response to hepatitis B vaccination



**81 studenti vaccinati per epatite B**  
**Sierologia a 5 m (II dose) + batteria test psicologici**

**PES elevato => maggiore risposta anticorpale specifica**  
**indipendentemente da fattori sociodemografici, pratiche**  
**salutari, NES, ottimismo**

**felicita - risposta s immunitario in vi**

Fig. 1. Positive and negative affect standardized scores among individuals high and low in antibody response after controlling for age, BMI, and sex.



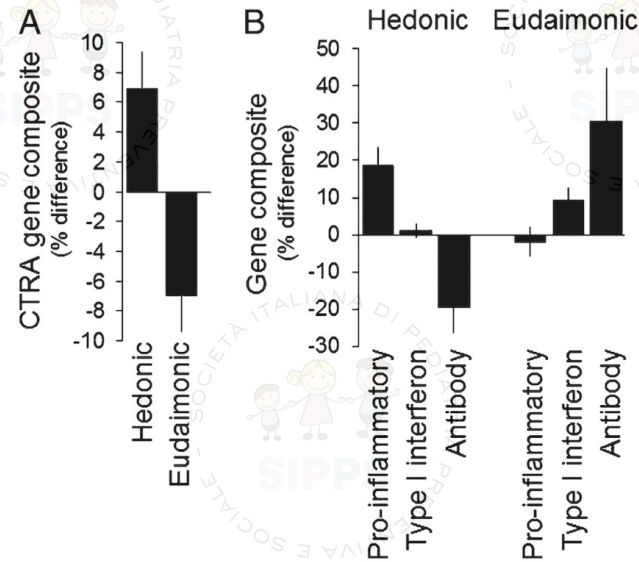
# A functional genomic perspective on human well-being

Barbara L. Fredrickson<sup>a</sup>, Karen M. Grewen<sup>b</sup>, Kimberly A. Coffey<sup>a</sup>, Sara B. Algoe<sup>a</sup>, Ann M. Firestone<sup>a</sup>, Jesusa M. G. Arevalo<sup>c</sup>, Jeffrey Ma<sup>c</sup>, and Steven W. Cole<sup>c,d,1</sup>

80 adulti sani

-distinti per profilo di benessere edonico ed eudaimonico

- Analisi profilo di espressione genica **CTRA (Conserved Transcriptional Response to Adversity)**
- CTRA upregolato in corso di eventi stressogeni: attivazione pathway NF- $\kappa$ B e ridotta espressione pathway IFN I- STAT



**Fig. 2.** Expression of the CTRA gene set. (A) Linear model-based estimates of mean difference ( $\pm$ SEM) in expression in a 53-gene CTRA contrast score in PBMCs from individuals with low levels ( $-2$  SD relative to sample mean) vs. high levels ( $+2$  SD) of hedonic well-being and eudaimonic well-being (each adjusting for the other and for demographic and behavioral covariates). (B) Differential expression of CTRA subcomponents: 19 proinflammatory genes, 31 type I IFN response genes, and three antibody synthesis genes.

**Di fronte al mare, la felicità è un'idea semplice**  
**Jean-Claude Izzo**



**felicità "edonica"**  
**somma di esperienze affettive positive di un individuo**  
**adattamenti fisiologici e psicologici di base**

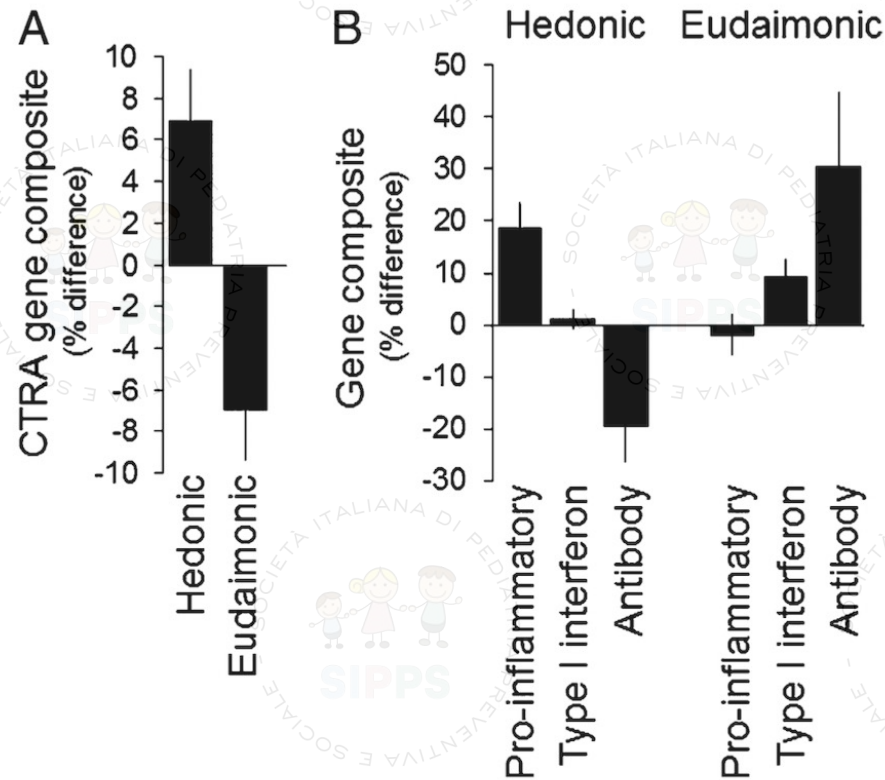
**la "buona vita", anziché la "bella vita".**



**felicità "eudaimonica"**  
**ricerca di un significato e di uno scopo/realizzazione**  
**al di là della autogrificazione**  
**capacità sociali e culturali più complesse**

# A functional genomic perspective on human well-being

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Jesusa M. G. Arevalo<sup>c</sup>, Jeffrey Ma<sup>c</sup>, and Steven W. Cole<sup>c,d,1</sup>



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Elevato profilo edonico= upregolazione CTRA

Elevato profilo eudaimonico = down-regolazione del CTRA

**Ruolo evolutivistico**

## Inflammation: The Dynamic Force of Health and Disease

### Immunodeficit vs Disregolazione Sistema Immunitario (autoimmunità/ infiammazione)

Disregolazione meccanismi controregolatori/fallimento risoluzione insulto causale

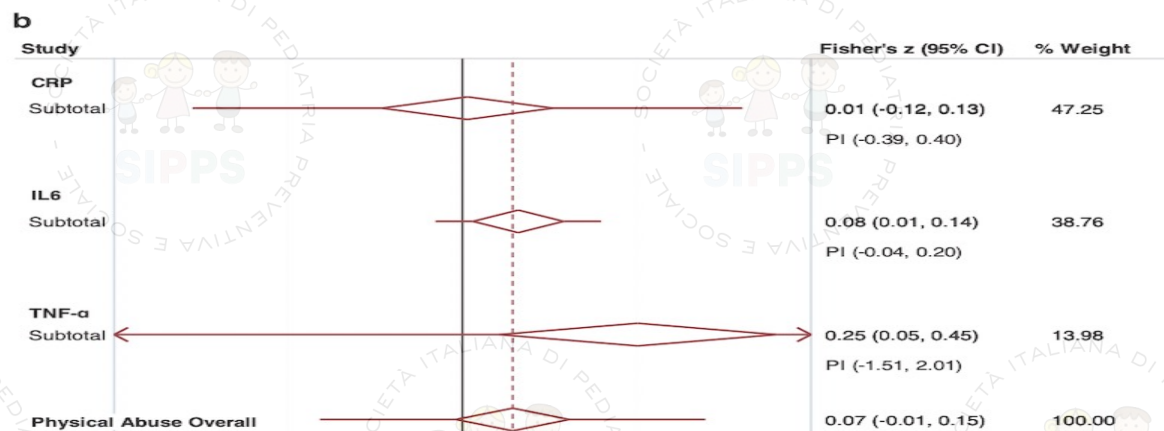
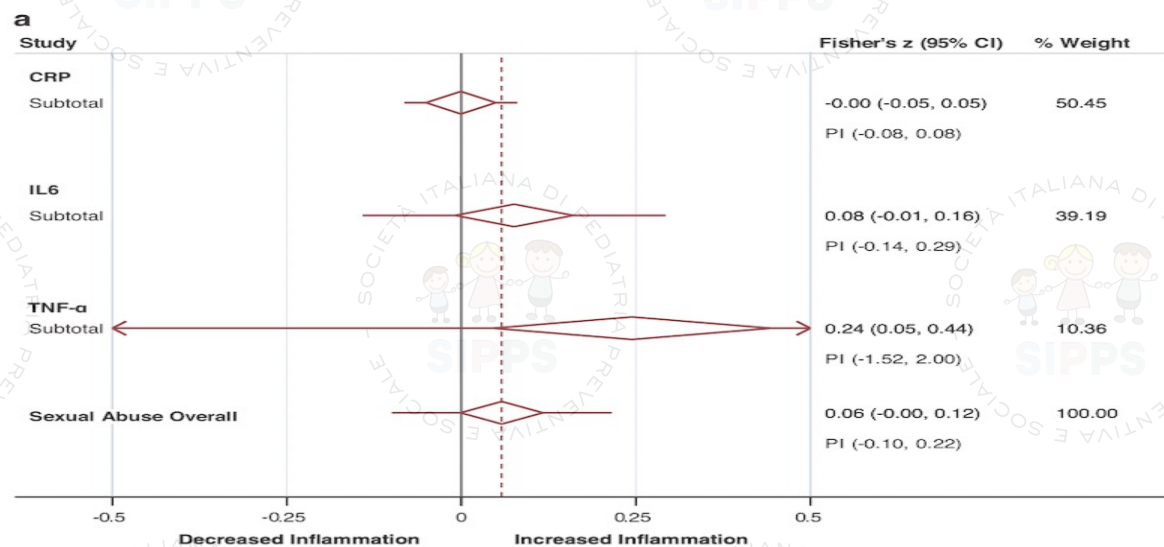


Stato infiammatorio cronico sistemico, di basso grado



Malattie croniche e/o età dipendenti **“inflamm-aging”**

**Stato Emotivo → Disregolazione Immunitaria!**



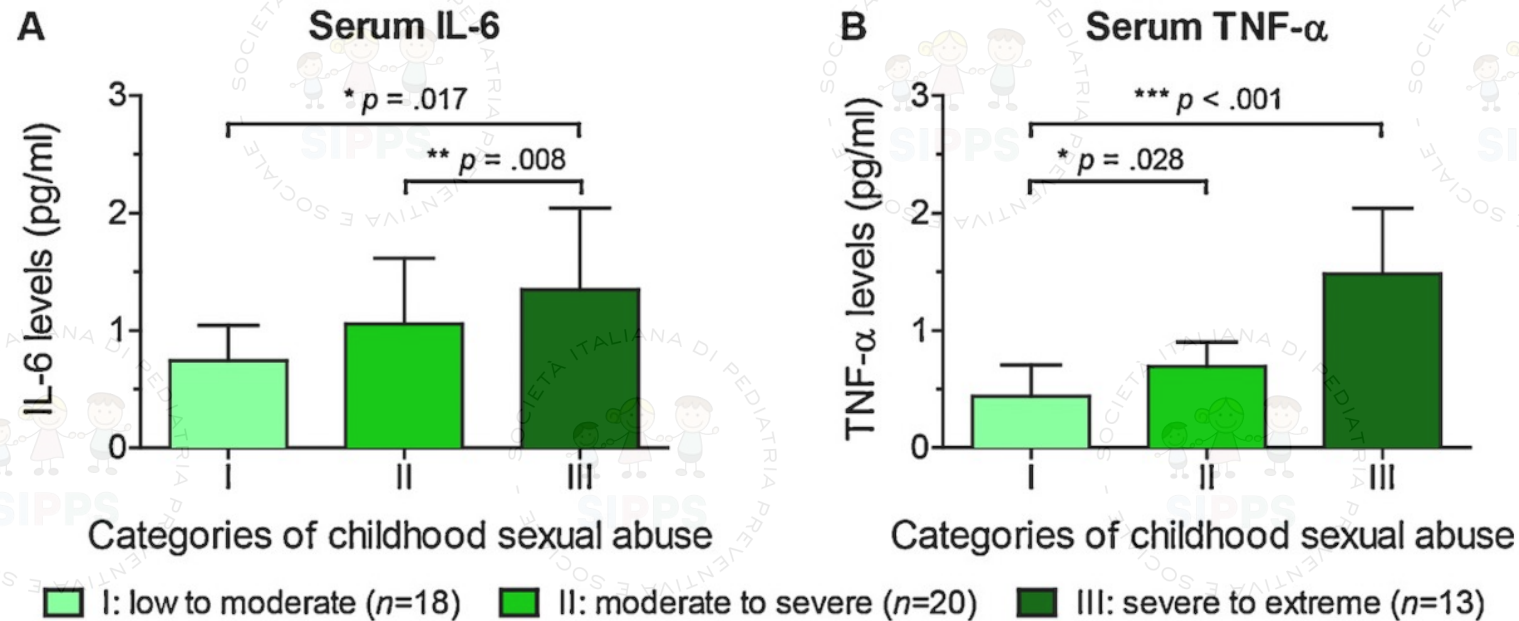
meta-analisi 25 articoli,

Individui esposti a traumi nell'infanzia elevati livelli sierici basali di PRC, IL-6, TNF- $\alpha$  in età adulta

Cytokine levels in major depression are related to childhood trauma but not to recent stressors

Laura Grosse<sup>a,b,\*</sup>, Oliver Ambrée<sup>a</sup>, Silke Jörgens<sup>a</sup>, M. Catharine Jawahar<sup>c</sup>, Gaurav Singhal<sup>c</sup>, David Stacey<sup>c</sup>, Volker Arolt<sup>a</sup>, Bernhard T. Baune<sup>c</sup>

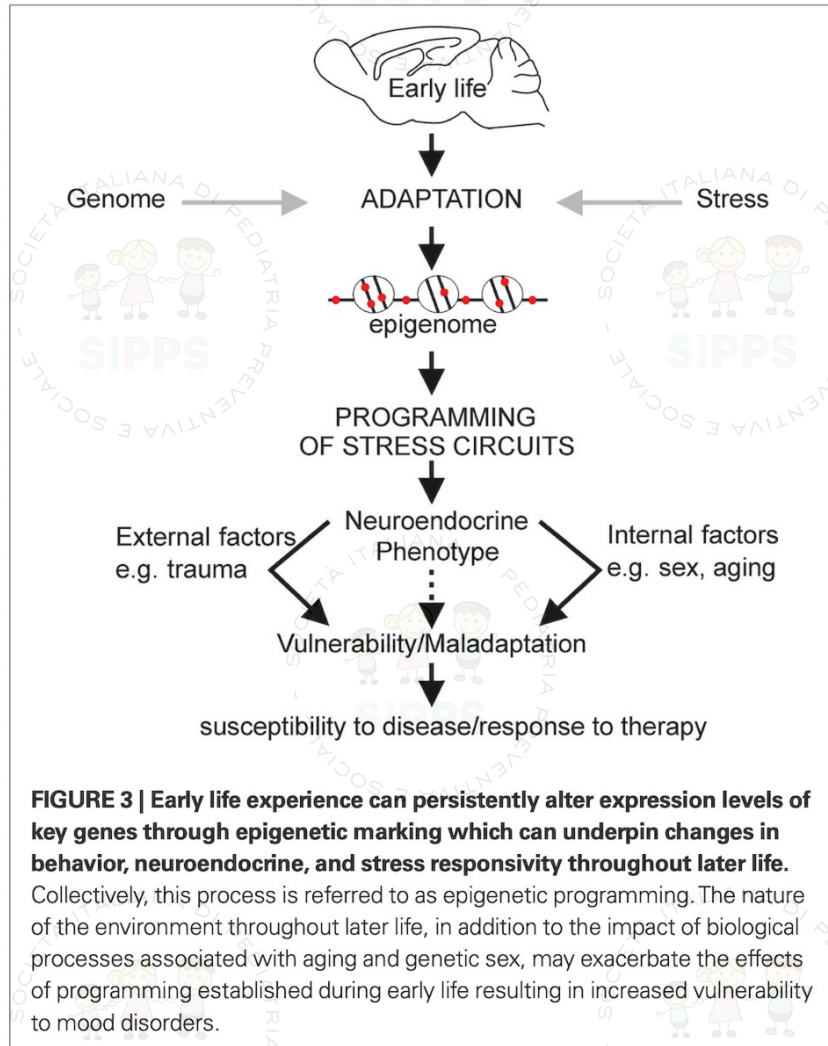
L. Grosse et al. / Psychoneuroendocrinology 73 (2016) 24–31



**Fig. 1.** Serum tumor necrosis factor alpha and interleukin 6 levels in association with childhood sexual abuse in depressed patients.

# Epigenetics of early child development

**Chris Murgatroyd\* and Dietmar Spengler**



**FIGURE 3 | Early life experience can persistently alter expression levels of key genes through epigenetic marking which can underpin changes in behavior, neuroendocrine, and stress responsivity throughout later life.**

Collectively, this process is referred to as epigenetic programming. The nature of the environment throughout later life, in addition to the impact of biological processes associated with aging and genetic sex, may exacerbate the effects of programming established during early life resulting in increased vulnerability to mood disorders.

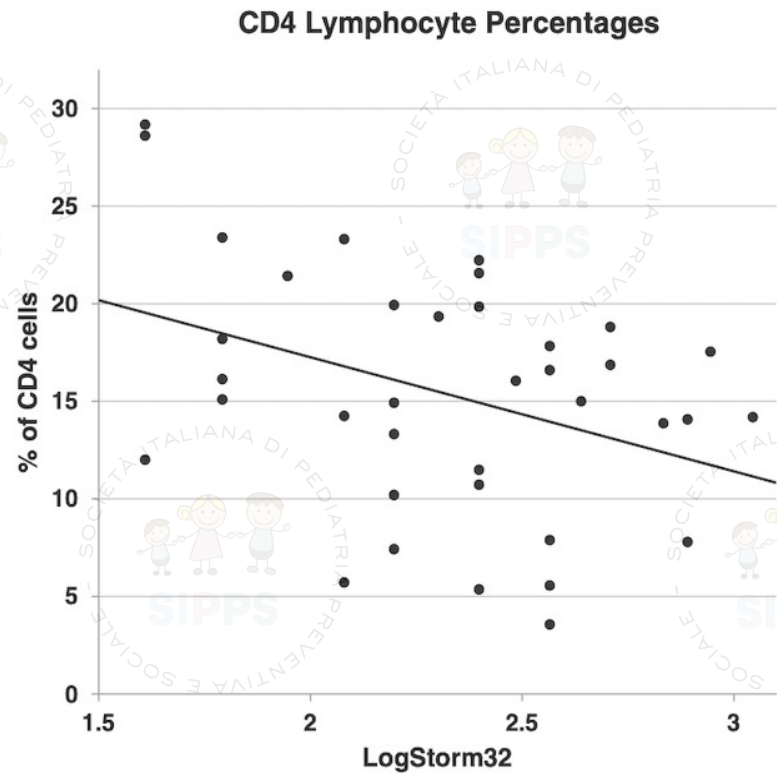


Prenatal maternal stress predicts reductions in CD4+ lymphocytes, increases in innate-derived cytokines, and a Th2 shift in adolescents:  
Project Ice Storm

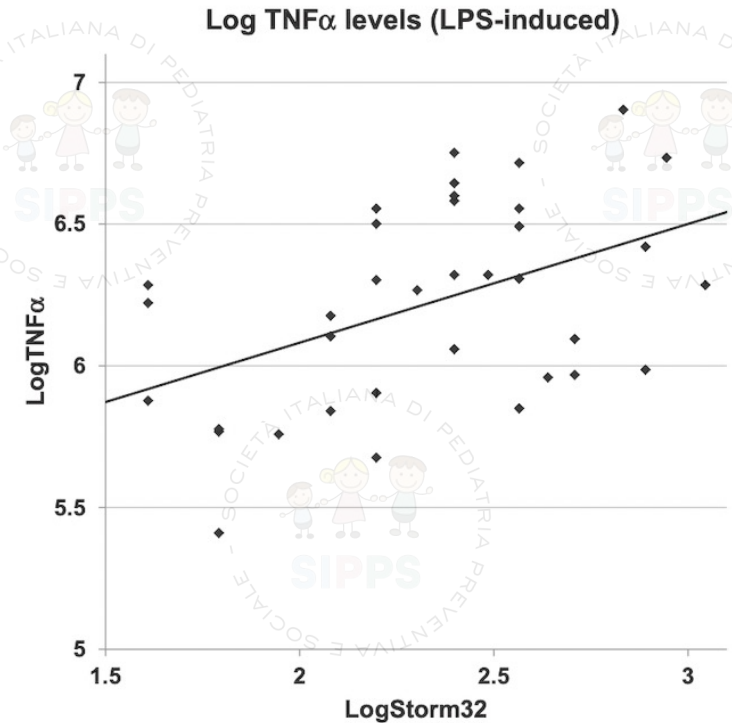
Franz Veru<sup>a,b</sup>, Kelsey Dancause<sup>a,b</sup>, David P. Laplante<sup>b</sup>, Suzanne King<sup>a,b,\*</sup>, Giamal Luheshi<sup>a,b</sup>

<sup>a</sup> Department of Psychiatry, McGill University, Canada

<sup>b</sup> Douglas Mental Health University Institute, Canada



**Fig. 1.** Effect of exposure to objective hardship during prenatal life (LogStorm32) on the percentage of CD4+ cells at age 13½. Scatter plot showing the correlation between objective hardship (LogStorm32) and CD4+ cell percentages;  $r = -0.38$ ,  $p < 0.05$ .



**Fig. 2.** Effect of exposure to objective hardship during prenatal life (LogStorm32) on the production of TNF- $\alpha$  in culture with LPS at age 13½. Scatter plot showing the correlation between objective hardship (LogStorm32) and TNF- $\alpha$  levels (LogTNF- $\alpha$ );  $r = 0.46$ ,  $p < 0.01$ .





**In fondo vogliamo una sola cosa –  
« la vita beata », la vita che è semplicemente  
vita, semplicemente felicità »  
**Sant'Agostino di Ippona****

**È possibile intervenire su effetti  
patogenetici dovuti al NES?**

**E' possibile attivare/ allenare il nostro  
PES?**

**Settembre 2022**

“Interventi SINGOLI E consolidati per migliorare stato salute psicofisica  
medicina alternativa” e “terapie complementari”

Randomized Controlled Trial > J Pediatr Oncol Nurs. 2009 Jan-Feb;26(1):16-28.  
doi: 10.1177/1043454208323295. Epub 2008 Dec 11.

### Massage therapy for children with cancer

Janice Post-White<sup>1</sup>, Maura Fitzgerald, Kay Savik, Mary C Hooke, Anne B Hannahan,  
Susan F Sencer

Clinical Trial > Int J Neurosci. 2001 Jan;106(1-2):35-45. doi: 10.3109/00207450109149736.

### HIV adolescents show improved immune function following massage therapy

M A Diego<sup>1</sup>, T Field, M Hernandez-Reif, K Shaw, L Friedman, G Ironson

Affiliations + expand

PMID: 11264907 DOI: 10.3109/00207450109149736

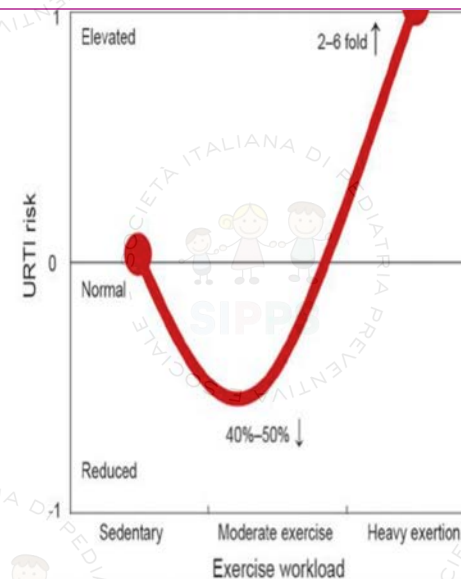
### A randomized placebo-controlled trial of massage therapy on the immune system of preterm infants.

Ang JY<sup>1</sup>, Lua JL, Mathur A, Thomas R, Asmar BI, Savasan S, Buck S, Long M, Shankaran S

Author information

## 2 ore nel verde attiva produzione linfociti

WHO → Disordine da deficit di natura nei bambini  
NèB): dalla parte dei bambini” = Fad -ISS



Es fisico moderato non agonistico  
Migliora parametri immunologici e in contemporanea PES  
riducendo i livelli complessivi di infiammazione cronica.

The effect of mindfulness-based interventions on immunity-related biomarkers: a comprehensive meta-analysis of randomised controlled trials

- Una metanalisi di 48 RCT -->effetti sul SI della MBI
- 6 biomarkers (CD4, PCR, IL6, NF-κB, lunghezza del telomero, attività della telomerasi ) pre e post-intervento
- MBI possa ridurre infiammazione e protegge contro l'invecchiamento cellulare

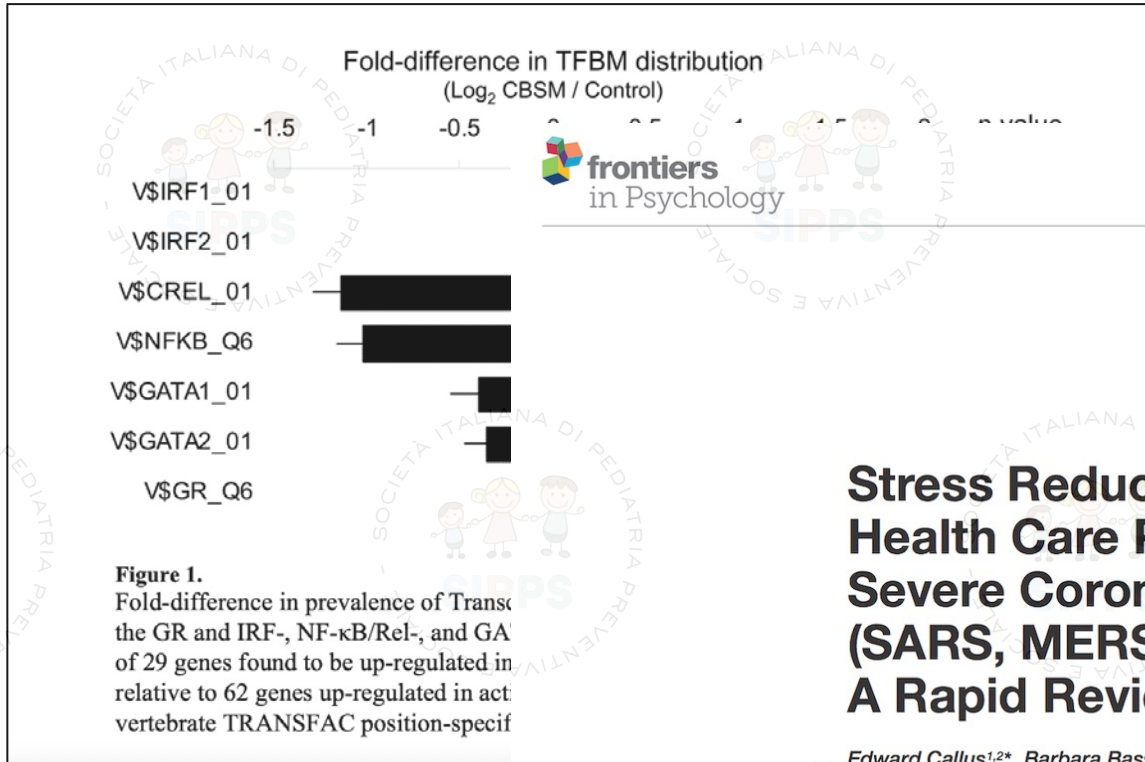
Abstracts retrieved through

Meta-analyses of MBI and immune-related biomarkers at post intervention and follow-up.

	SMDC (SE)	p value	Heterogeneity			Egger's test Z-statistic (p-value)
			Q-statistic (df;p value)	$\tau^2$	$I^2$	
<i>Post intervention</i>						
CD4+	0.09 (0.07)	0.20	19.55 (11; 0.05)	0.02	40.36%	0.91 (0.37)
CRP	-0.14 (0.07)	0.04*	42.23 (21;<0.01)	0.04	50.08%	-1.05 (0.29)
IL-6	-0.35 (0.18)	0.03*	132.63 (16;<0.01)	0.46	94.26%	-1.71 (0.09)
NF-KB	-0.25 (0.22)	0.26	-	-	-	-
Telomerase activity	0.81 (0.33)	0.01*	84.44 (6; <0.01)	0.70	92.24%	2.29 (0.02)
Telomere length	0.12 (0.06)	0.04*	10.12 (8; 0.25)	0.00	13.25%	1.57 (0.12)
<i>Follow-up</i>						
CD4+	0.22 (0.15)	0.16	4.21 (2;0.12)	0.04	52.37%	1.99 (<0.05)
CRP	-0.39 (0.15)	<0.01*	20.92 (6;<0.01)	0.10	72.81%	-3.76 (<0.01)
IL-6	-0.13 (0.08)	0.11	6.40 (4;0.17)	0.01	36.67%	1.88 (0.06)

Notes: CRP = C-reactive protein; IL-6 = interleukin-6; NF-KB = nuclear factor-KB; SE = standard error; df = degrees of freedom; '\*' = p < .05; '†' = p < .10.

# Cognitive-behavioral stress management reverses anxiety-related leukocyte transcriptional dynamics

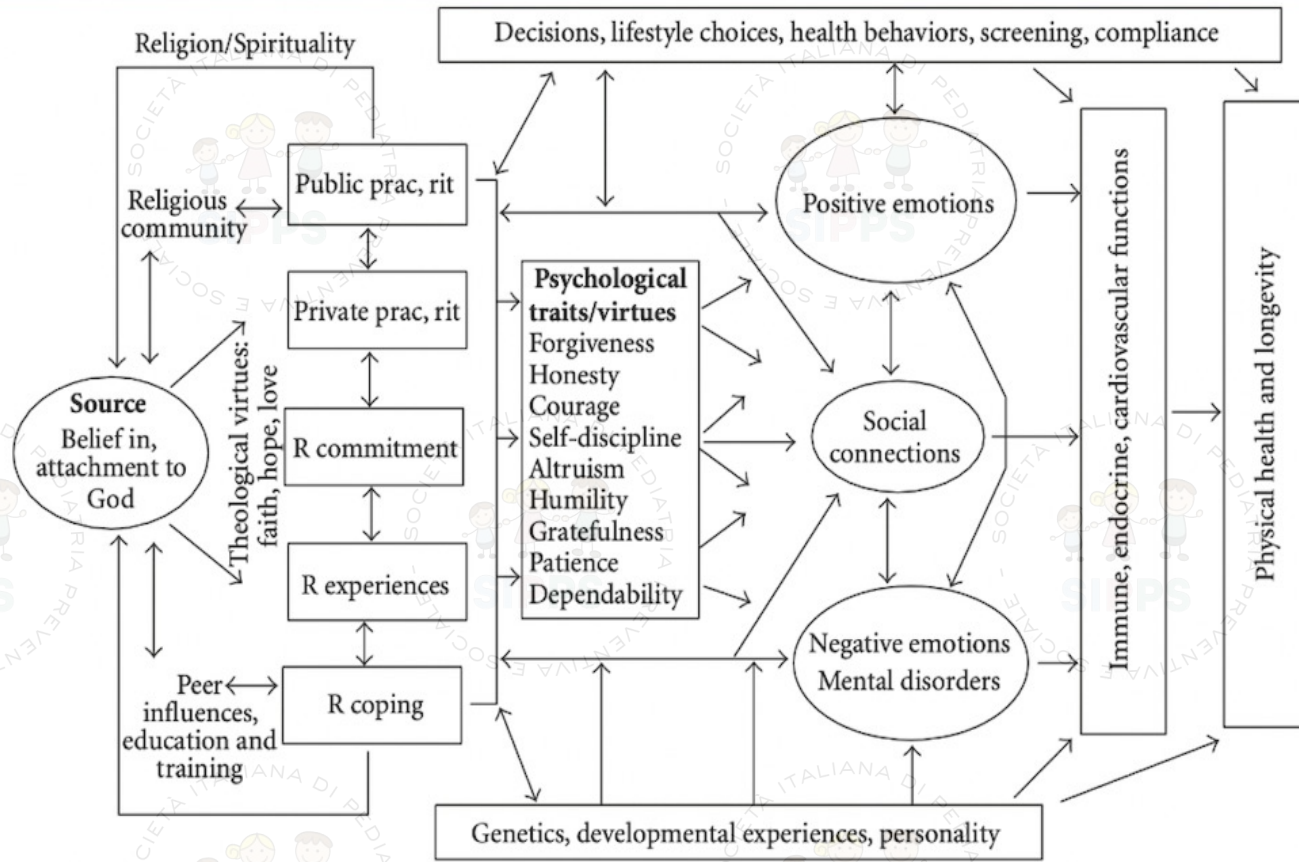


## Stress Reduction Techniques for Health Care Providers Dealing With Severe Coronavirus Infections (SARS, MERS, and COVID-19): A Rapid Review

Edward Callus<sup>1,2\*</sup>, Barbara Bassola<sup>3</sup>, Valentina Fiolo<sup>1</sup>, Enrico G. Bertoldo<sup>1</sup>, Silvana Pagliuca<sup>1</sup> and Maura Lusignani<sup>2,3</sup>

ione geni  
e aumenta risposta INF I vs controllo

ogy, physiological changes



Theoretical model of causal pathways to physical health for Western monotheistic religions (Christianity, Islam, and Judaism)



*Proprietà terapeutiche preghiera/pratiche spirituali non religiose*  
*Longevità + sistema immunitario più efficiente*  
*Suor Andre' 118 anni*

*«Dove c'è musica non può esserci nulla di cattivo»*

*M. de Cervantes*

In media ascoltiamo musica due ore e un quarto al giorno

Effetti più benefici sul SI al mattino

Partecipazione attiva alle attività musicali produce significativi effetti sul sistema immunitario rispetto alla passiva partecipazione

Immunological responses to music: leukocytes.

Study	Activity details	NK	CD4+ T	CD8+ T	CD4/CD8 ratio	CD16	CD3	lymphocytes	Memory T
<i>Active participation</i>									
Bittman et al. (2001)	Group drumming	↑							
Koyama et al. (2009)	Group drumming		↑ <sup>a</sup>					↑ <sup>a</sup>	↑ <sup>a</sup>
Cai et al. (2001)	Music therapy	v	v		v		v		
<i>Live music – experimenter-selected (various styles)</i>									
Staricoff et al. (2002)			-	↑					
<i>Recorded music – participant-selected (various styles)</i>									
Leardi et al. (2007)	(From choice of genres vs new age)	↓ <sup>c</sup>							
<i>Recorded music – experimenter-selected (stimulating)</i>									
Hirokawa and Ohira (2003)	Stimulating vs sedative	-	↑ <sup>-b</sup>	-					

Note: Arrows (↓ or ↑) indicate significantly higher or lower levels relative to both baseline and control conditions, unless otherwise specified. Arrows (v or ^) indicate that without music (i.e. in control groups), levels decreased or increased, but with music levels remained constant. Dashes indicate no significant change. Blank fields indicate that the biomarker was not investigated. Abbreviations: NK, Natural Killer cell count; CD4+ T, T helper cells; CD8+ T, cytotoxic T cells.

- <sup>a</sup> The experimenters found an increase only in older, not younger patients.
- <sup>b</sup> The experimenters found an increase only for stimulating music, not sedative.
- <sup>c</sup> Although cortisol levels decreased in both groups compared to controls, the experimenters found a significantly greater decrease in the group where patients selected their music from one of four styles compared to the group who listened to new age music.

# The neurochemistry of music

Mona Lisa Chanda and Daniel J. Levitin

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## Markers for stress and immunity

Study	Population	OT	CORT	ACTH	E	NE	β-end	GH	NK	IL-6	IgA
<b>Experimenter-selected relaxing music</b>											
[69]	Surgery patients		↓								
[70]	Surgery patients		↓								-
[120]	Surgery patients	↑									
[99]	Surgery patients							↑		↓	
[139]	Surgery patients		↓								
[52]	Healthy		-								↑
[59]	Healthy		↓								
[60]	Healthy										
[61]	Healthy		↓								
[62]	Healthy		-								
[100]	Healthy		-								
[104] <sup>a</sup>	Healthy		-								↑
[105] <sup>b</sup>	Healthy										↑
[140] <sup>c</sup>	Healthy										↑
[141]	Healthy <sup>d</sup>		↓								
[142]	Healthy		↓								
<b>Experimenter-selected stimulating music</b>											
[62]	Healthy		↑	↑	-	↑	↑	↑			↑
[63]	Healthy		↑								
[143] <sup>e</sup>	Healthy		↑								
[144] <sup>f</sup>	Lung infection patients		↓								
[145] <sup>g</sup>	Dancers		↓								
<b>Participant-selected music (various styles)</b>											
[84]	Surgery patients		↓							↓	
[85]	Surgery patients		-								
[86]	Surgery patients		-								
[87]	Surgery patients		↓								
<b>Group drumming</b>											
[94]	Healthy										
[97]	Healthy										
[98]	Healthy		↓								
<b>Singing</b>											
[57]	Singers	↑	↑↓ <sup>h</sup>								
[58]	Singers		↓								↑
[106]	Singers		↑↓ <sup>i</sup>								↑
[108]	Non-musicians										

Note: Arrows (↑ or ↓) indicate significantly higher or lower levels relative to baseline and/or control conditions; arrows pointing in both directions (↑↓) indicate bidirectional



# Immune System May Benefit From the Ability to Laugh



**Daily occurrence of laughter: Relationships with age, gender, and Type A personality**

Bambini ridono fino a 300 volte al giorno

Adulti fino a 18 volte al giorno

Ridere è una caratteristica distintiva degli esseri umani

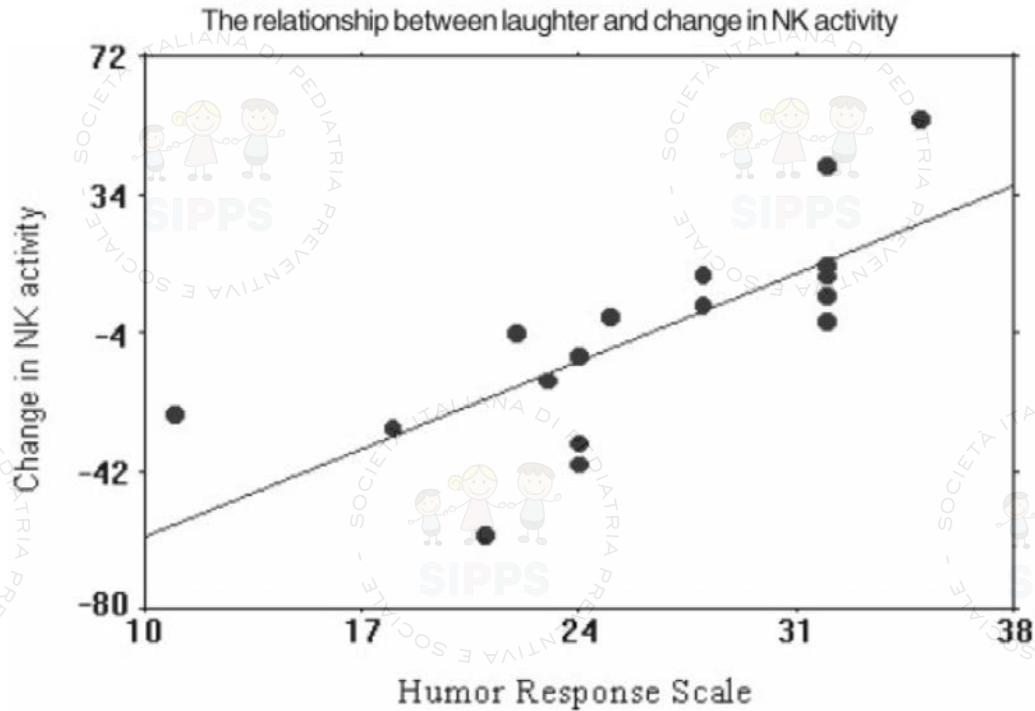
1964 Norman Cousins  
Spondilite anchilosante  
visione di film comici e nella lettura di libri che lo  
facessero ridere +**Vitamina C**  
con soli **10 minuti di risate riesce ad avere 2 ore di**  
**sonno senza dolori**

# Humor and Laughter May Influence Health IV. Humor and Immune Function

**Table 1.** Brief overview of outcomes using a humorous stimulus

Health Outcome	Results
Muscle relaxation	Periods of intense laughter are followed by relaxed muscle tone (26,27).
Urinary epinephrine and norepinephrine levels	Hormonal measures of sympathetic nervous system activation increased during a humorous video (28).
Galvanic skin response and blood pressure	A humorous stimulus lead to increased galvanic skin response, but stable blood pressure indicating that while humor appears to involve activation of the sympathetic nervous system (SNS), it also acts to buffer some of the actions of the SNS on blood pressure (29).
Changes in heart and respiratory rate	Laughter leads to increased heart rate, respiratory rate and oxygen consumption (30).
Measures of anxiety, heart rate and blood pressure	Exposure to a humorous stimulus decreased self-reported anxiety in a group of college students who were waiting to receive an electrical shock, but did not significantly affect physiological measures of anxiety (heart rate and blood pressure), compared to those in the no humor control group (31).
Relaxation as measured by Biofeedback	College students who scored high on internal locus of control had increased relaxation following exposure to a humorous stimulus (32).
Various hormonal measures	Berk (5). Serum cortisol, growth hormone and plasma dopac all decreased during the humorous stimulus. No significant change was found in serum prolactin, beta endorphins, epinephrine or norepinephrine.
SIgA	Exposure to a humorous stimulus increases SIgA (6,11).
NK cell activity	Wise (21) reported that exposure to a humorous stimulus did not significantly increase NK activity. Berk (22) reported that exposure to a humorous stimulus significantly increased NK activity (series of five studies). Finally, Bennett (24) reported that exposure to a humorous video did not significantly increase NK activity. However, laughter in response to the humorous video was significantly correlated with improved NK activity.

# The effect of mirthful laughter on stress and natural killer cell activity



video divertente VS video di viaggi

scala della risposta umoristica >25 avevano maggiore attività NK che era direttamente proporzionale all'entità della risata

$r = 0.774$   $P = 0.001$

**Figure 1.** Plot represents the relationship between change in NK cell functioning and subject humor response (24).

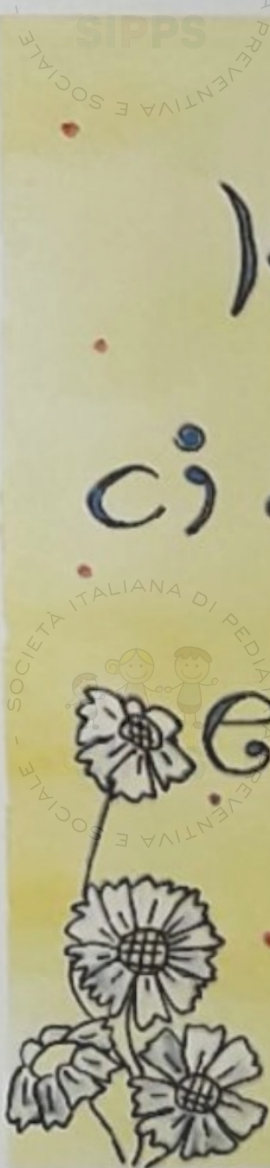


*“Happiness is not a matter of intensity but of balance, order, rhythm and harmony.”*  
—Thomas Merton

- PES → sist immunitario felice → PES
- Nutrito numero di dati clinici a conferma di come allenare la nostra felicità e il nostro sistema immunitario
- Beneficio per noi e le future generazioni

"E' il tempo che tu hai perduto per la tua rosa che ha

fai ciò che ti è possibile per mostrare



In questa classe  
ci si prende cura di sé  
e degli altri!!



fatto la tua rosa con importanza  
da un piccolo principe (A. de Saint-Exupery)

che hai cura degli altri, e renderai questo mondo migliore.