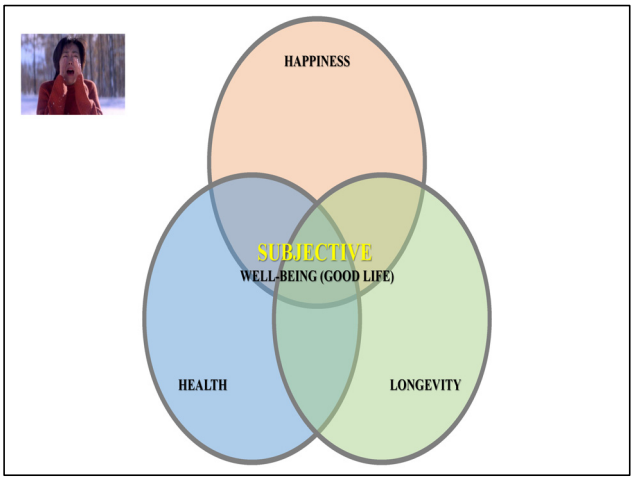
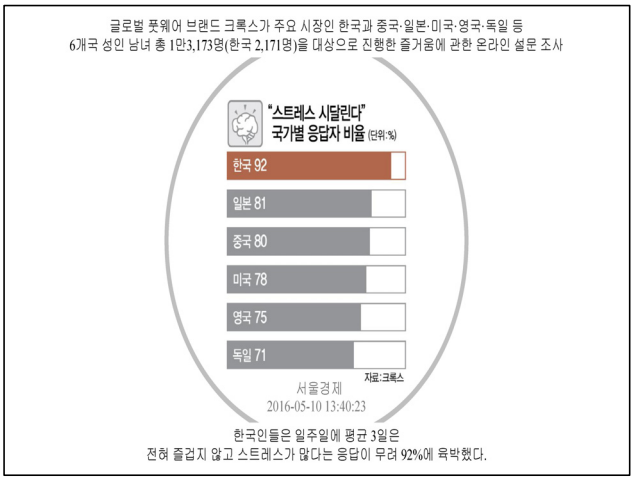
스트레스, 몸과 마음

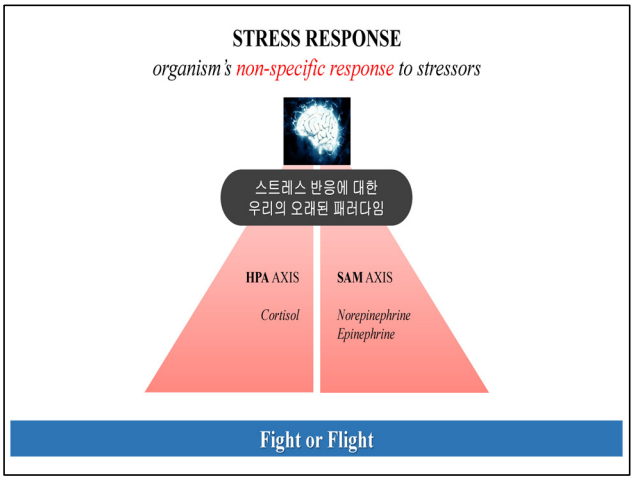
안 성 기
더필잎요양병원

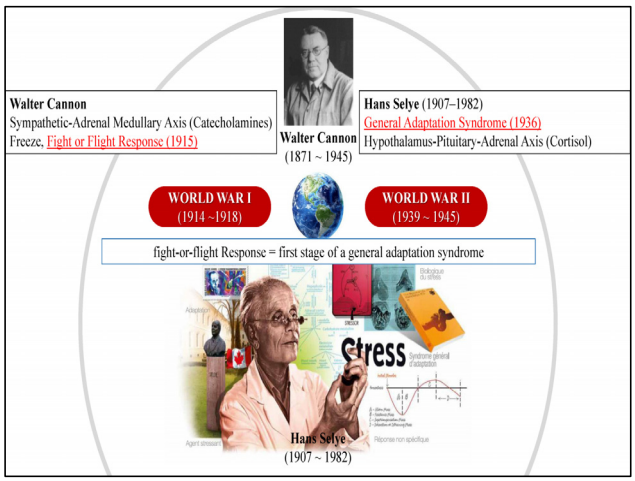
Stress, mind, and body

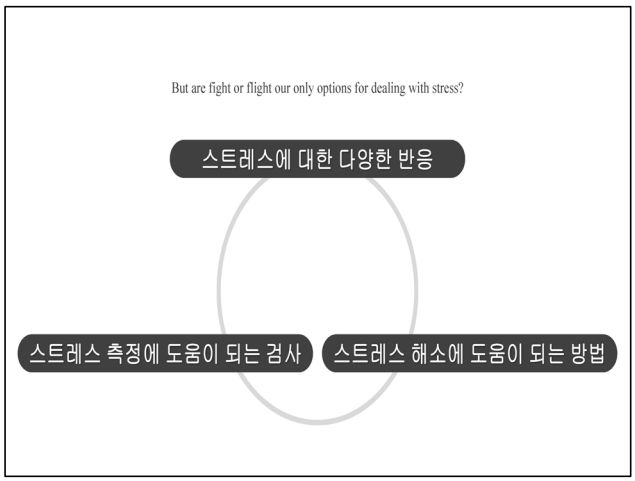
Seong Gi An, MD
Department of Neurology, ThePilip Hospital, Korea



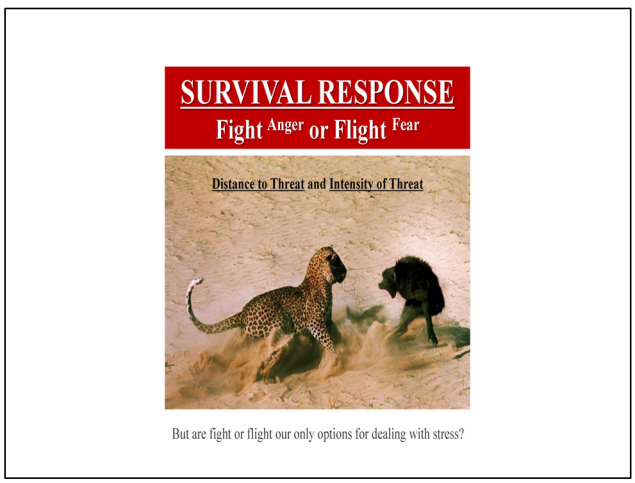


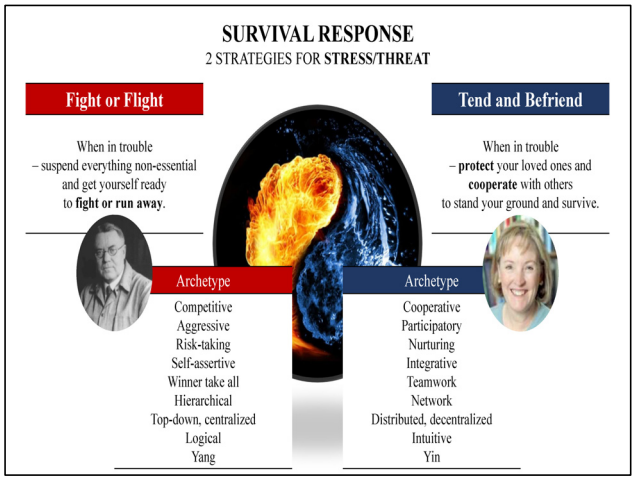






스트레스 대한 반응의 다양성



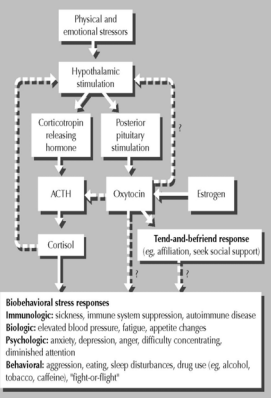


TEND AND BEFRIEND THEORY

people often respond to stress by tending to offspring and affiliating with others.

THREAT/STRESS → OXYTOCIN RELEASE → SEEK SOCIAL CONTACT

Biobehavioral Effects of Stress, including Proposed Stress Effects of Oxytocin.

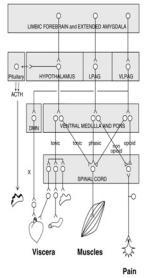


Curr Psychiatry Rep. 2002 Dec;4(6):441-8.

DEFENSE CASCADE

Defense Repertoire & Signature Neural Pathway

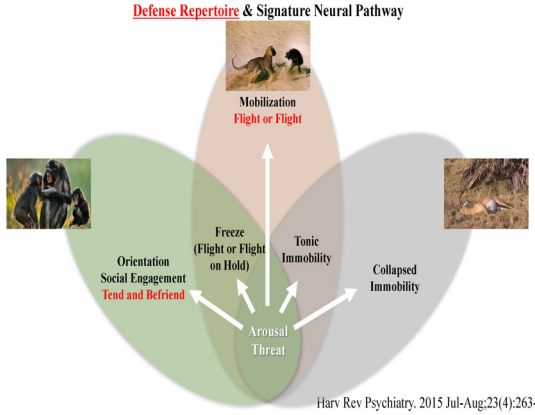
a continuum of **innate, hard-wired, automatically activated defense behaviors**



Harv Rev Psychiatry. 2015 Jul-Aug;23(4):263-87.

DEFENSE CASCADE

Defense Repertoire & Signature Neural Pathway



Harv Rev Psychiatry. 2015 Jul-Aug;23(4):263-87.

FREEZE

(Flight or Flight on Hold)

All Animals Can Freeze

Freezing in a rat.
The rat is **stopped in midmovement**. Despite being immobilized, the rat remains **alert**;
it continues to **scan** the environment; and its body is **tense** and **poised for action**. Its ears are flattened.
If the predator attacks, freezing will give way to flight, and the rat will attempt to dart away to safety.

TONIC IMMOBILITY

The trunk and limbs are **rigid** and may be held in **unusual** or **awkward postures**.

The body can often be manipulated (waxy flexibility). The eyes may be closed or open.

If the latter, the rat will have a glassy, unfocused gaze. Because the animal has the **appearance of being dead**, tonic immobility is also known, following Darwin's terminology, as ***feigning death***.

COLLAPSED IMMOBILITY

The trunk and limbs are limp and immobile. The animal has the appearance of **being dead**.
The term ***death feint*** has been used to describe collapsed immobility in animals

Impala in and slowly out of collapsed immobility

5 STEPS OF DEFENSIVE CASCADE

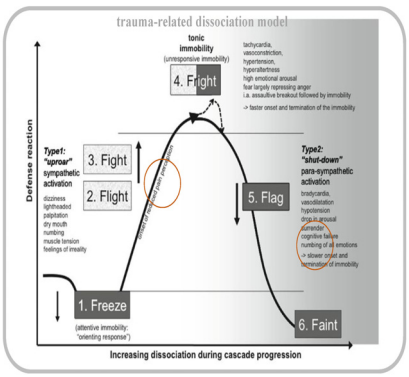
Arousal: muscles tense, breathing and **heart rate increase** as the body prepares for action

Fight or flight: active defense response for **dealing** with threat

Freezing: a fight-or-flight response put on hold

Tonic immobility: inability to move or call out; **shut down** in the face of fear.
A variation is **collapsed immobility**, with loss of muscle tone and changes in **consciousness**.
Tonic and collapsed immobility are "responses to **inescapable threat** or **strategies of last resort**."

Quiescent immobility: after the threat or danger has passed, a state of quiescence
that promotes **rest and healing**



Defense cascade as it evolves along 6 stages (Schauer & Elbert, 2010)
The sympathetic arousal reaches a maximum at the fright stage, and is eventually replaced by the onset of dissociative "shut-down"
Procedia - Social and Behavioral Sciences 33 (2012) 95 – 99

Table 1. Short description of the 6 responses within the defense cascade according to Schauer & Elbert (2010).

Stages	Short description	ANS activation pattern
Freeze	"stop, look, and listen"/orienting response: focused attention, information processing, preparedness	moderate sympathetic
Flight & Fight	"alarm response": increased arousal & heart rate, cardiac & muscular vasodilatation, faster & deeper breath	marked sympathetic
Fright	"tonic immobility"; high alertness, unresponsiveness, and preparedness for a possible escape in cases of direct physical contact (e.g. sharp objects, injury)	sympathetic & parasympathetic
Flag & Faint	"flaccid immobility" with unresponsiveness, derealization, depersonalization, emotional numbness, memory and central information processing decline	marked parasympathetic

Procedia - Social and Behavioral Sciences 33 (2012) 95 – 99

CATATONIA

Catatonia is a state of **psychogenic motor immobility** and behavioral abnormality manifested by stupor

TONIC IMMOBILITY

Of **nearly 300 women** who visited the rape clinic,
70 percent experienced at least "**significant**" **tonic immobility**
and **48 percent** met the criteria for "**extreme**" **tonic immobility** during the rape.
(The condition's severity was assessed using a scale that measured
feelings of being frozen, **mute**, **numb** and so on.)

Tonic immobility during sexual assault
- a common reaction predicting post-traumatic stress disorder and severe depression.
Möller A, Söndergaard HP, Helström L. Acta Obstet Gynecol Scand. 2017 Aug;96(8):932-938.

COLLAPSED IMMOBILITY

Vasovagal syncope is loss of consciousness mediated by the vagus nerve.
Vasovagal syncope is the most common type of fainting.

TRIUME BRAIN THEORY
Paul D. MacLean
1960s

POLYVAGAL THEORY
Stephen Porges
1994

Lizard Brain	Mammal Brain	Human Brain
Brain stem & cerebelum	Limbic System	Neocortex
Fight or flight	Emotions, memories, habits	Language, abstract thought, imagination, consciousness
Autopilot	Decisions	Reasons, rationalizes

PARASYMPATHETIC NERVOUS SYSTEM
DORSAL VAGAL - EMERGENCY STATE

Increases
Fuel storage & insulin activity
Endorphins that help numb and raise the pain threshold.

Decreases
Heart Rate • Blood Pressure
Temperature • Muscle Tone
Facial Expressions • Eye Contact
Intonations • Awareness of the Human Voice • Social Behavior • Sexual Responses • Immune Response

SYMPATHETIC NERVOUS SYSTEM

Increases
Blood Pressure • Heart Rate
Fuel Availability • Adrenaline
Oxygen circluation to vital organs
Blood Clotting • Pupil Size

Decreases
Fuel Storage • Insulin Activity
Digestion • Salvation
Relational Ability
Immune Response

PARASYMPATHETIC NERVOUS SYSTEM
VENTRAL VAGAL

Increases
Digestion • Intestinal Motility
Resistance to Infection
Immune Response
Rest and Recuperation
Circulation to non-vital organs (skin, extremities)
Oxytocin (neuromodulator involved in social bonds that allows immobility without fear)
Ability to Relate and Connect

Decreases
Defensive Responses

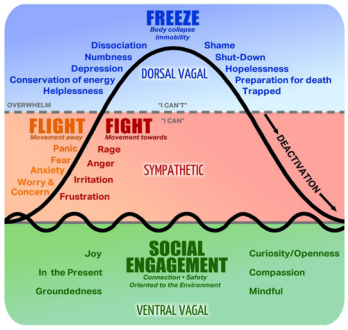
THE POLYVAGAL THEORY:

PHYLOGENETIC SUBSTRATES OF A SOCIAL NERVOUS SYSTEM

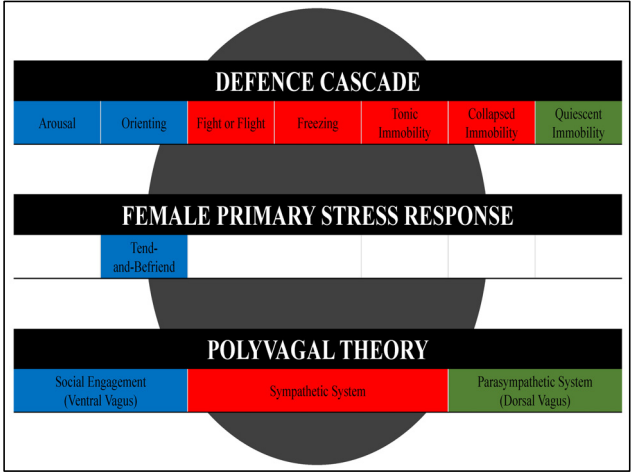
Porges SW. Int J Psychophysiol. 2001 Oct;42(2):123-46.

The third stage, **unique to mammals**, is characterized by **a myelinated vagus** that can **rapidly regulate cardiac output** to foster **engagement and disengagement with the environment**. The **mammalian vagus** is neuroanatomically **linked to the cranial nerves that regulate social engagement** via facial expression and vocalization. As the autonomic nervous system changed through the process of evolution, so did the interplay between the autonomic nervous system and the other physiological systems that respond to stress, including the cortex, the hypothalamic-pituitary-adrenal axis, the neuropeptides of oxytocin and vasopressin, and the immune system…..

POLYVAGAL THEORY



Neuroception: A Subconscious System for Detecting Threats and Safety
Faulty neuroception might lie at the root of several psychiatric disorders, including autism, schizophrenia, anxiety disorders, depression and reactive attachment disorder.

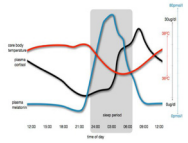


스트레스 측정에 도움이 되는 검사
CORTISOL
NLR
HRV

SERUM CORTISOL

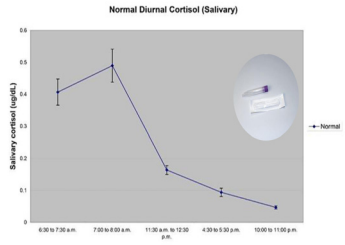
HPA-axis rhythms promote adaptation to **predictable (i.e. the earth's rotation)** and **unpredictable (i.e. stressors) changes** in **environmental factors**.
Best Pract Res Clin Endocrinol Metab. 2017 Oct;31(5):445-457

A circadian rhythm characterized
by **a morning peak or cortisol awakening response (CAR),**
a slow decline throughout the day, and **a low or undetectable amount at midnight**.
Martin PA, Crump MH. The adrenal gland: Ames (IA): Iowa State Press, 2003



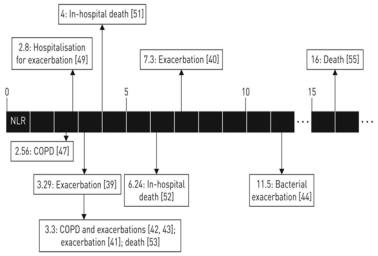
Serum corticosterone concentration is an appropriate assay
for the measurement of **acute stress** but is not an appropriate measure of chronic stress.
Lab Anim (NY). 2014 Aug;43(8):276-82.

SALIVARY CORTISOL



Salivary cortisol offer **a novel approach in research of stress biomarkers**
with its ease of collection and potentially wide scope for application.
Salivary Cortisol Levels As A Biological Marker of Stress Reaction.
Bozovic D[1], Racic M[2], Ivkovic N[3]. Med Arch. 2013;67(5):374-7.

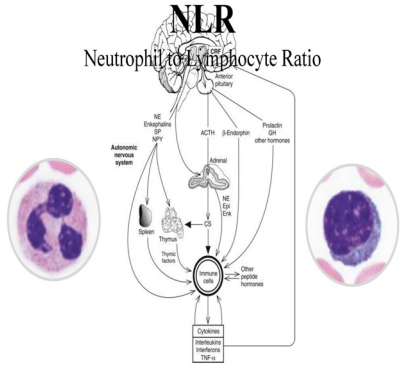
Neutrophil to lymphocyte ratio (NLR) cut-off values
in chronic obstructive pulmonary disease (COPD) identified in the studies reviewed.
European Respiratory Review 2018 27: 170113



NLR in peripheral blood is being increasingly studied
as **a systemic inflammatory marker**, particularly considering its rapid, widely available, and relatively inexpensive assessment through routine blood count analysis.

NLR

Neutrophil to Lymphocyte Ratio



Neutrophilia with or without lymphopenia occurs in response to **chronic exposure to corticosterone**.
Therefore, the neutrophil-lymphocyte ratio provides a more accurate measure of the shift in circulating white blood cell types

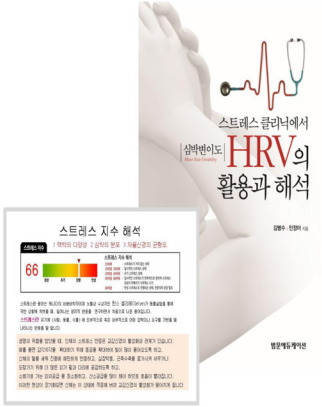
Lab Anim (NY). 2014 Aug;43(8):276-82.

Elevated serum corticosterone concentrations,
but not neutrophil-lymphocyte ratios, were associated with **acute stress exposure**,
whereas **elevated neutrophil-lymphocyte ratios**, but not serum corticosterone concentrations,
were associated with **chronic stress exposure**.

As a result of these observations,
the neutrophil-lymphocyte ratio has been characterized as **a potential indicator of chronic stress in multiple species, including humans**, dolphins, cows, pigs, horses and guinea pigs.

Evaluation of the neutrophil-lymphocyte ratio as a measure of distress in rats.
Swan MP[1], Hickman DL[1]. Lab Anim (NY). 2014 Aug;43(8):276-82

HRV



심박변이도검사

- 자율신경계균형검사 -

High-frequency heart rate variability (HF-HRV)
denotes heart rate variations associated with respiration.
Respiratory sinus arrhythmia occurs when the heart rate accelerates and decelerates
on inspiration and expiration, respectively. HF-HRV is determined by **vagally mediated parasympathetic activity**.
The cardiovascular center inhibits vagal outflow during inhalation and restores vagal outflow during exhalation.
Although the heart is dually innervated, the influence of the SNS on the heart occurs too slowly
to affect beat-to-beat changes quickly. Therefore, **HF-HRV** directly measures
parasympathetic control of the heart.

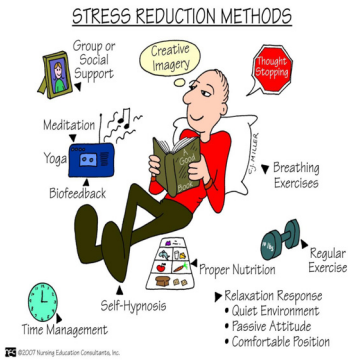
Antioxid Redox Signal. 2018 Mar 20; 28(9):837-851.

TABLE 1 | Summary of the main heart rate variability parameters and their physiological origin.

	Variable	Description	Physiological origin
Time-domain	SDNN	Standard deviation of all R–R intervals	Cyclic components responsible for heart rate variability
	RMSSD	Root mean square of successive differences	Vagal tone
	pNN50	Percentage of successive normal sinus RR intervals more than 50 ms	Vagal tone
	Peak-valley	Time-domain filter dynamically centered at the exact ongoing respiratory frequency	Vagal tone
Frequency-domain	ULF	Ultra-low frequencies	Circadian oscillations, core body temperature, metabolism and the renin-angiotensin system
	VLF	Very-low frequencies	Long-term regulation mechanisms, thermoregulation and hormonal mechanisms
	LF	Low frequencies	Mix of sympathetic and vagal activity, baroreflex activity
	HF	High frequencies	Vagal tone
	LF/HF	Low frequencies/high-frequencies ratio	Mix of sympathetic and vagal activity
Non-linear indices	SD1	Standard deviation – Poincaré plot Crosswise	Unclear, depicts quick and high frequent changes in heart rate variability
	SD2	Standard deviation – Poincaré plot Lengthwise	Unclear, depicts long-term changes in heart rate variability

Front. Psychol., 20 February 2017

스트레스를 줄이는 다양한 방법



BREATHING

Diaphragmatic Breathing (Slow Abdominal Breathing), Deep Breathing, 2:1 Breathing

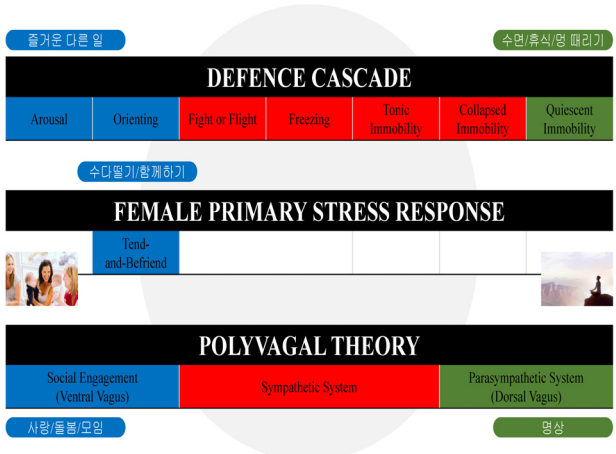
part of a feedback loop that **improves vagal tone**
by stimulating the relaxation response of the parasympathetic nervous system

BREATHING

Sympathetic
"Fight or Flight"

Parasympathetic
"Rest and Digest"

TEND-AND-BEFRIEND RESPONSE
SOCIAL ENGAGEMENT



Perceived loneliness is **a significant risk factor**

for mortality, equal to or exceeding **smoking**, **obesity**, **not exercising**

(for those with chronic cardiac disease or for healthy individuals),

environmental pollution, or **excessive drinking**.

Bruce E Wampold. World Psychiatry. 2015 Oct; 14(3): 270–277

LOCATION, VOCATION, **PROCREATION**

: HOW CHOICE INFLENCES **LIFE EXPECTANCY** IN **DOCTORS**.

Holleyman R, Vann Jones S. Occup Med (Lond). 2016 Jun;66(4):276-278.

We analysed a decade of obituaries from the British Medical Journal published between January **2003** and December **2012**. Data included age at death (AAD), specialty, region (deanery), marriage status and children.

A total of **3068 obituaries** were eligible for inclusion.

Significant Predictors of AAD (Age At Death)

Factor	Relative Model Effect (Years), 95% CI	Significant (*P*)
Male sex	+3.8 (2.4 to 5.2)	<0.001
Each additional child	**+1.1 (0.7 to 1.4)**	**<0.001**
Specialty		
Anaesthetics	−5.2 (−7.1 to −2.9)	<0.001
Public health	+5.1 (2.7 to 7.9)	<0.001
Psychiatry	−3.8 (−5.8 to −1.8)	<0.001
Radiology	−3.5 (−6.5 to −0.5)	<0.05
Paediatrics	−2.6 (−5.1 to −0.1)	<0.05
Obstetrics and gynaecology	+3.1 (0.4 to 5.8)	<0.05
Laboratory	+2.3 (0.2 to 4.3)	<0.05
Deanery		
London	+2.4 (1.2 to 3.6)	<0.001
Northern Ireland	+3.4 (0.7 to 6.0)	<0.01

Multiple regression model summary: R^2 value = 0.052 (SPSS Inc.).

Occup Med (Lond). 2016 Jun;66(4):276-278

Having children conferred **a survival benefit** of **one year** per **additional child**, **up to 5 children**. Doctors who died young may not yet have started a family; however, a sensitivity analysis excluding those who died before the age of 40 showed no confounding effect ($P < 0.05$). Interestingly, this survival benefit was significant for **all groups except paediatricians**.

Occup Med (Lond). 2016 Jun;66(4):276-278

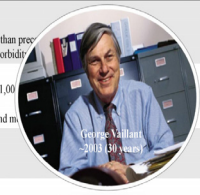
A HAPPIER AND HEALTHIER LIFE

The Grant Study is part of the Study of **Adult Development** at Harvard Medical School.
It is a **75**-year longitudinal study of **268** physically- and mentally-healthy Harvard college sophomores from the classes of **1939–1944**.

MAIN RESULTS

George Vaillant, who directed the study for more than three decades, has published a summation of the key insights the study has yielded:

Alcoholism is a disorder of great destructive power.
- Alcoholism was the main cause of divorce between the Grant Study men and their wives.
- Strongly correlates with neurosis and depression, which tended to follow alcohol abuse, rather than prec
- Together with associated cigarette smoking, was the single greatest contributor to their early morbidit



Financial success depends on warmth of relationships and, above a certain level, not on intelligence.
- Those who scored highest on measurements of "warm relationships" earned an average of $141,00 between ages 55 and 60).
- No significant difference in maximum income earned by men with IQs in the 110–115 range and m

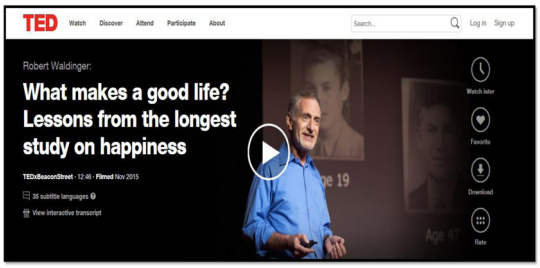
Political mindedness correlates with intimacy: Aging liberals have way more sex.
- The most-conservative men ceased sexual relations at an average age of 68.
- The most-liberal men had active sex lives into their 80s.

The **warmth of childhood relationship with mothers** matters long into adulthood:
- Men who had "warm" childhood relationships with their mothers earned **an average of $87,000 more a year** than men whose mothers were uncaring.
- Men who had poor childhood relationships with their mothers were much more likely to develop **dementia** when old.
- Late in their professional lives, the men's boyhood relationships with their mothers—but not with their fathers—were associated with **effectiveness at work**.
- The warmth of childhood relationships with mothers had **no significant bearing on "life satisfaction" at 75**.

The **warmth of childhood relationship with fathers** correlated with:
- Lower rates of **adult anxiety.**
- **Greater enjoyment of vacations.**
- Increased **"life satisfaction" at age 75.**

Vaillant's main conclusion is that "**warmth of relationships throughout life** have the greatest positive impact on **'life satisfaction'**. Put differently, Vaillant says the study shows: "**Happiness is love**. Full stop."

A psychiatrist from Harvard who became only the **fourth person** to run the **Grant Study** back in 2003.



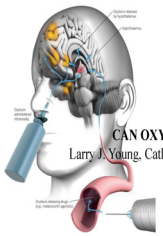
"People who are more isolated than they want to be from others find that they are less happy, their **health** declines earlier in midlife, their **brain functioning** declines sooner and they live shorter **lives** than people who are not lonely. And **good, close relationships** seem to buffer us from some of the slings and arrows of getting old."

"**some lifestyle characteristics**, like **family coherence**, avoidance of smoking, plant-based diet, moderate and daily physical activity, **social engagement**, where people of all ages are socially active and **integrated into the community** are common in all people enrolled in the surveys"
- www.bluezones.com

WARMTH OF RELATIONSHIP

GOOD AND CLOSE RELATIONSHIP

HAPPINESS/HEALTH/LONGEVITY
IS
LOVE



CAN OXYTOCIN TREAT AUTISM?
Larry J. Young, Catherine E. Barrett. *Science* 20 Feb 2015

Recently oxytocin has received increasing attention, both scientifically for its role in social bonding, **stress regulation**, and mental health, as well as in the more popular media. It has been advertised as a universal "**love hormone**", as the remedy against loneliness, fears, partner relationship and sexual problems.

Psychoneuroendocrinology. 2013 Sep;38(9):1883-94

WORK-LIFE BALANCE

the amount of time you spend doing your job
compared with the **amount of time you spend with your family** and **doing things you enjoy**."
Defined by Cambridge Dictionary

아이와 놀기

아침단식/블랙커피 — My Tips for Stress Reduction — 아내와 술 한잔

일찍 자기