



Blood as Mirror of the Soul

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DISCLOSURES

No conflict of interest to report



Battle against, in and of the mind



Pre-deployment

- Personality
- Coping strategy and sources
- Stress reactivity

Deployment

- Combat Stressor
- Operational Stressor

Post-deployment

- PTSD
- CMHD
- Behaviour
- Suicidality

Assessment tools of work stress

Self reported assessment tools

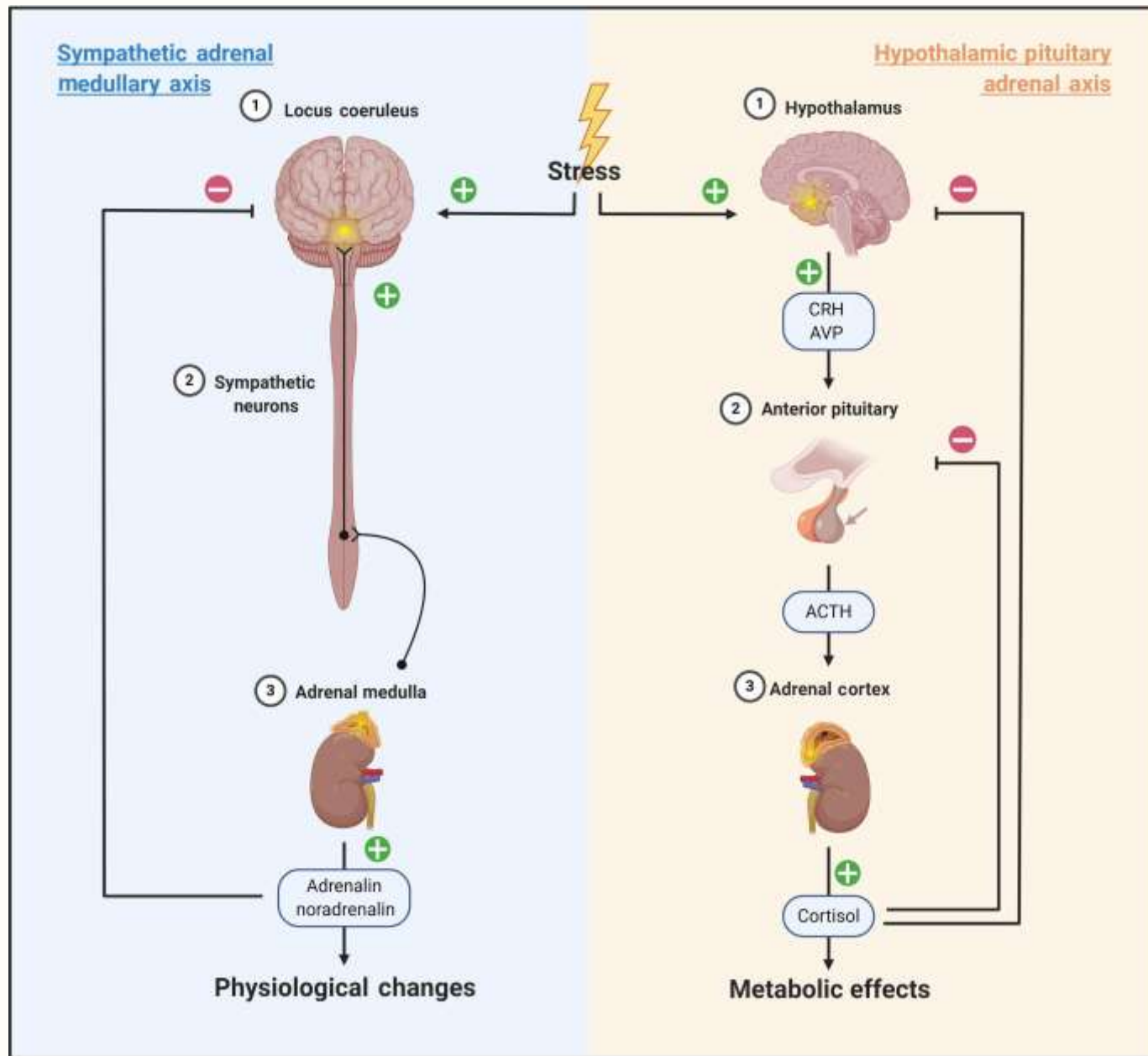
COPSOQ, ERIQ, DSCQ, JCQ,

External observed assessment tools

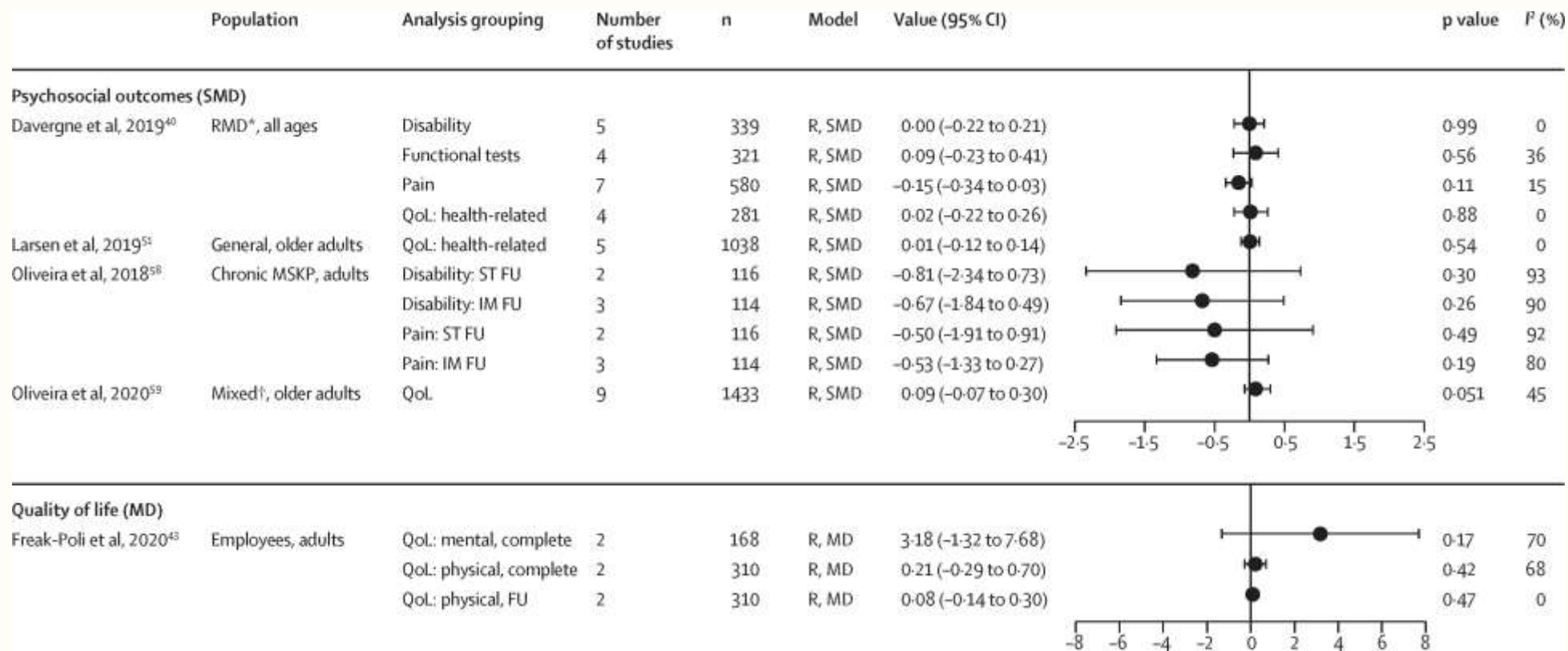
JEM, ethnography, interviews, observation

Biomarkers

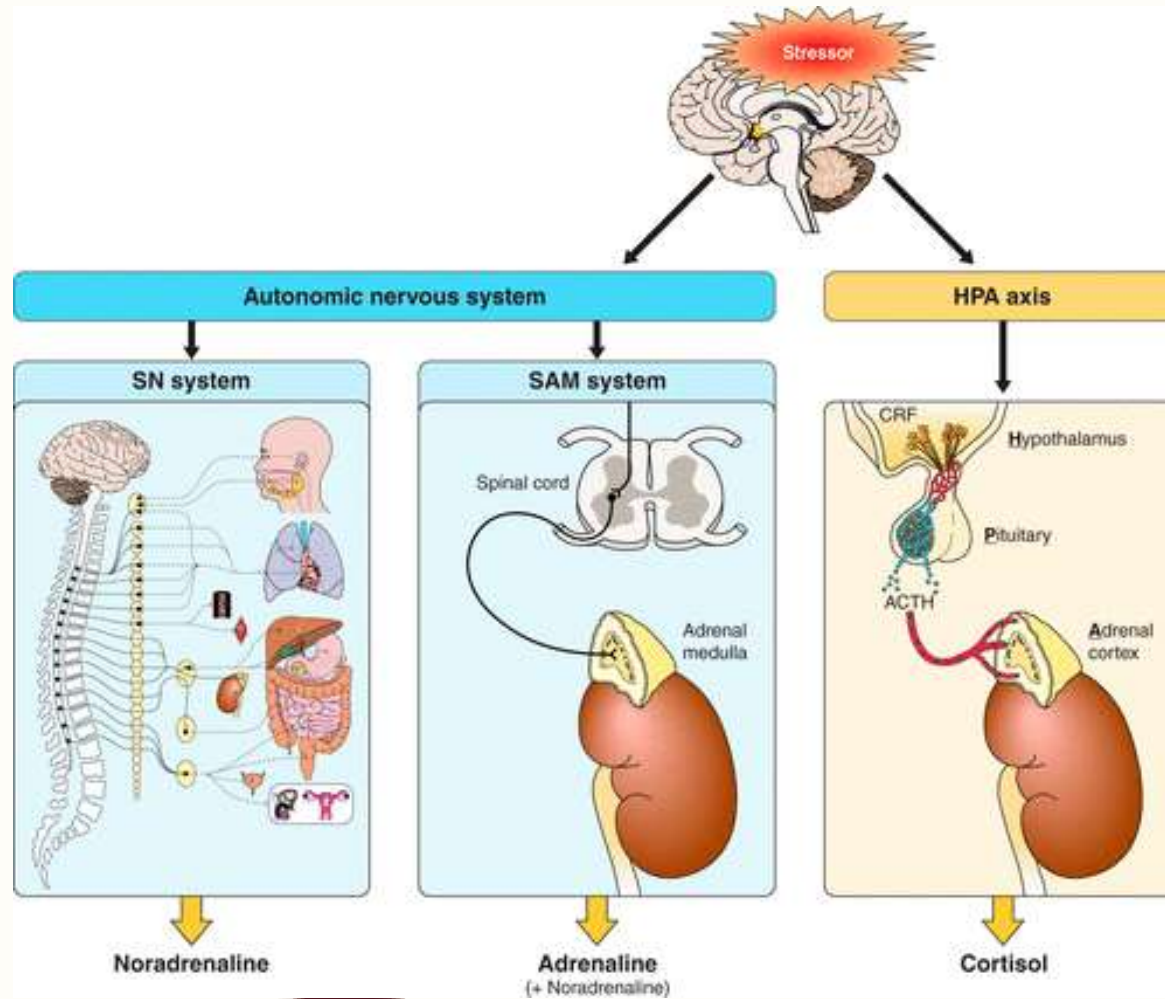
biological and digital



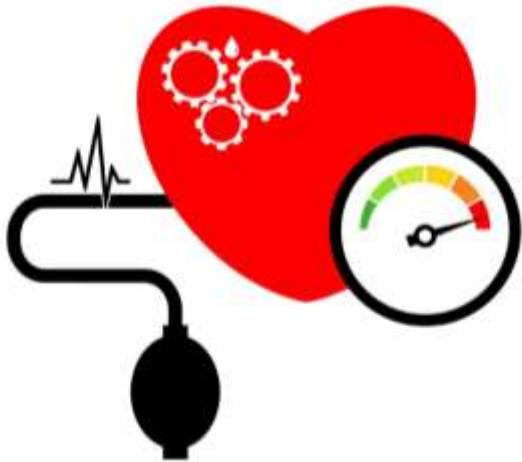
Digital markers



Biological markers



Sympathetic-adrenal medullary axis



▷ **Adrenaline, noradrenaline, dopamine, alpha-amylase**

- No consistent findings

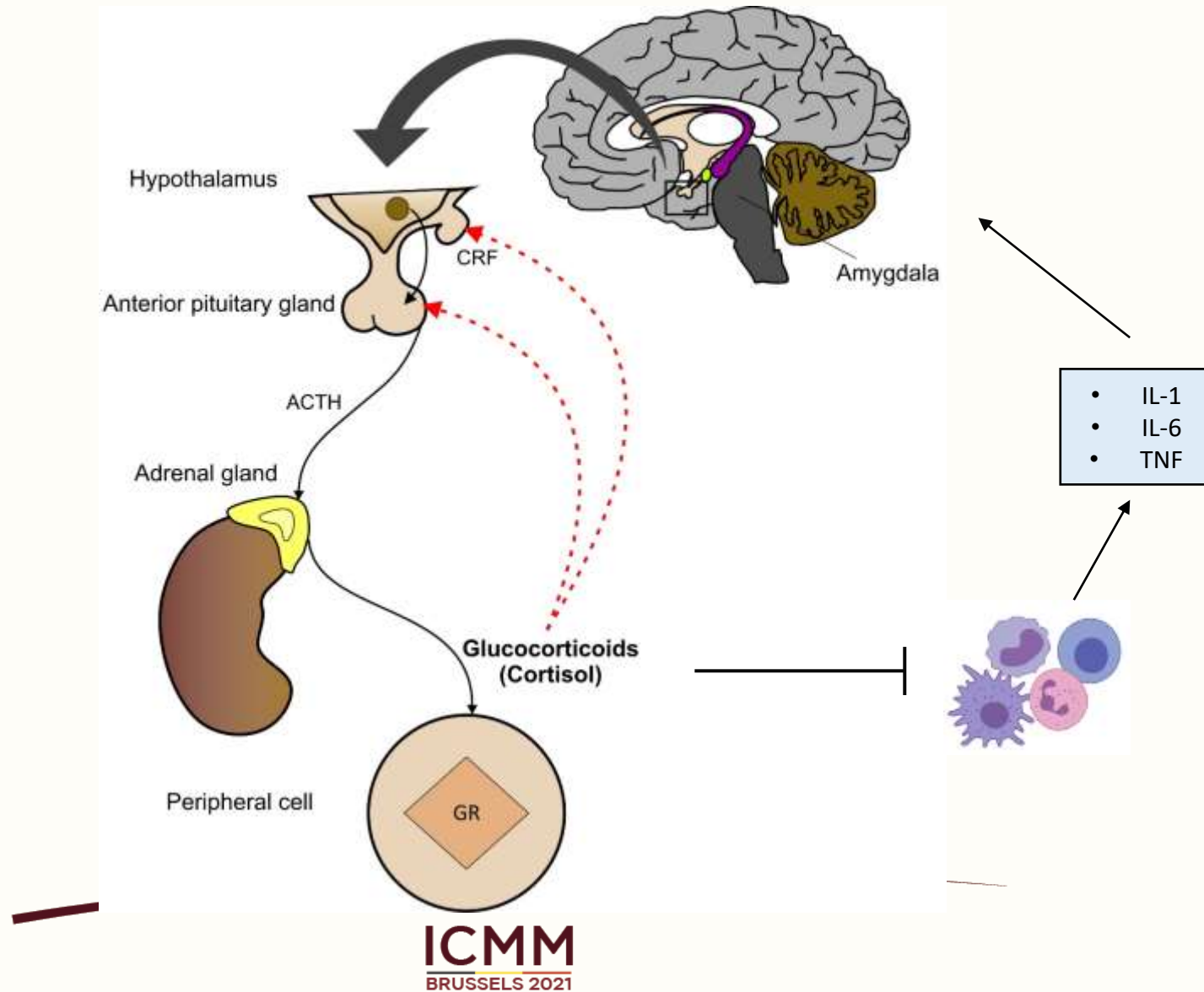
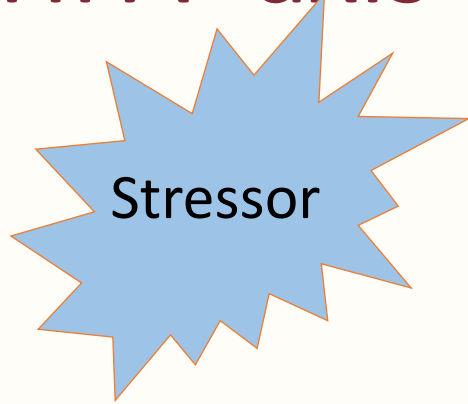
▷ **Blood pressure**

- Lower systolic blood pressure in patients with burnout

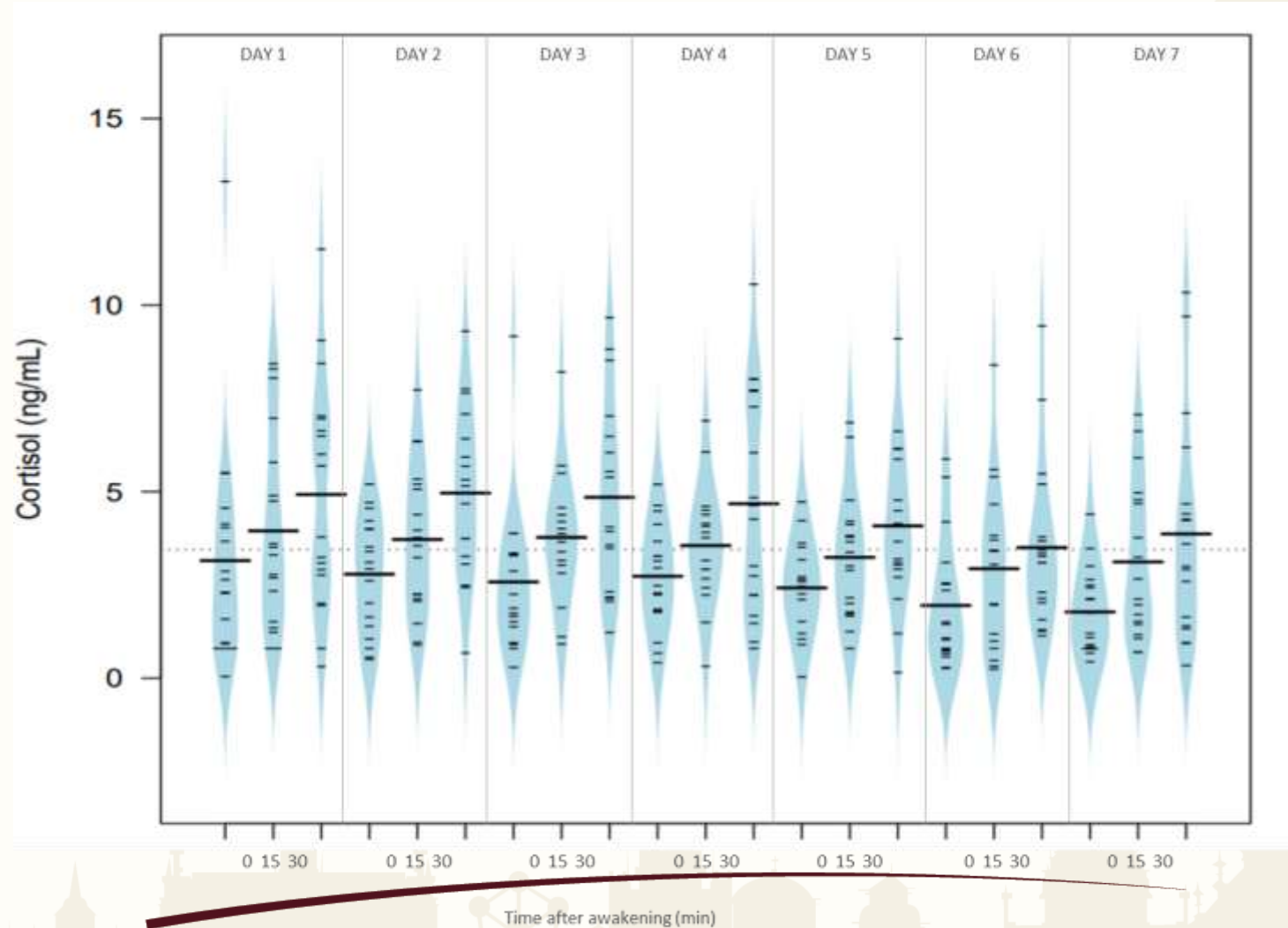
▷ **Heart rate variability**

- Balance between sympathetic and parasympathetic influences on heart rate
- Decreased HRV in people with burnout (increase of sympathetic activity)

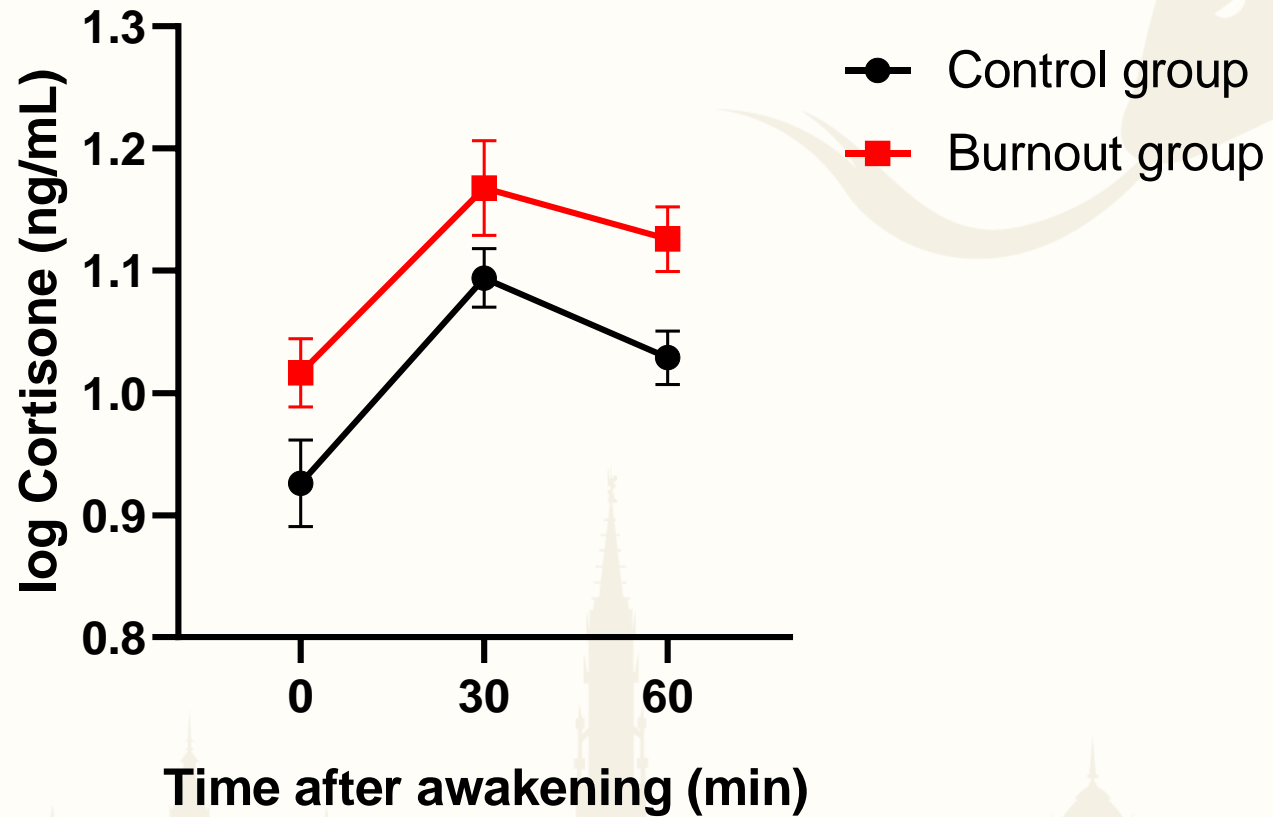
HPA- axis



HPA -axis



HPA-axis



HPA-axis



▷ Cortisol-cortisone-cortisol awakening response

- No consistent findings

▷ Dehydroepiandrosterone (DHEAS)

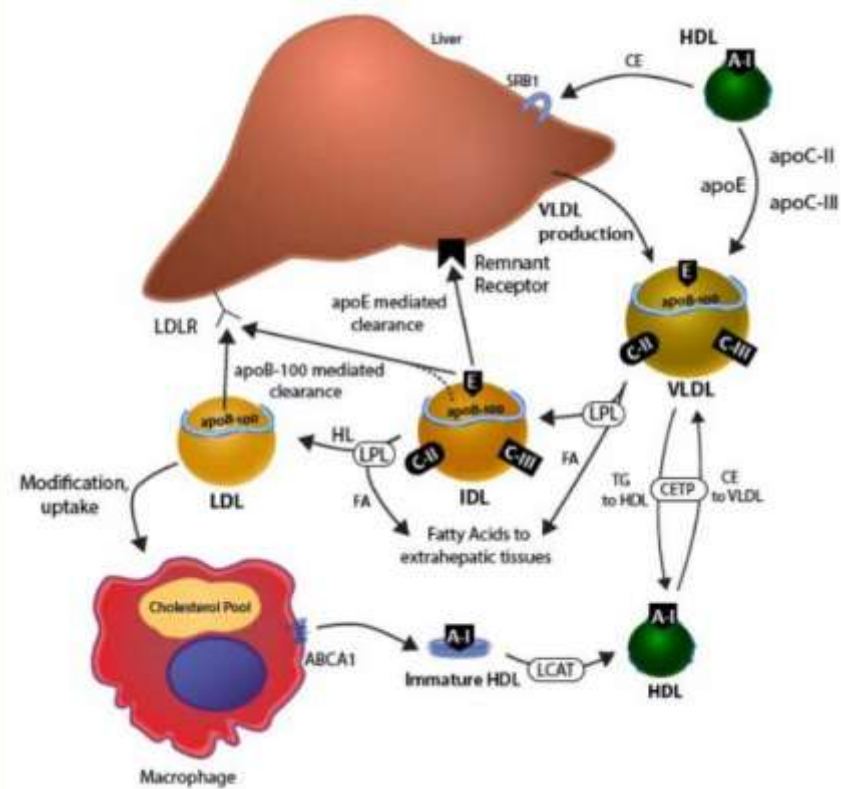
- Steroid hormone with an immunomodulatory function opposite to cortisol
- Higher DHEAS levels in burnout cases compared to controls???

Biomarkers immune response and inflammation



- ▷ **Inflammation: C-Reactive Protein (CRP), IL-6, MCP-1, IP-10, IL-18 and MIP**
 - Mostly no or positive association
- ▷ **Immunoglobulines: IgA (most studied), IgG, IgM, IgE and IgD**
 - Mostly no association, either inconsistent
- ▷ **Blood count**
 - Mostly no or significant association

Metabolic and other biomarkers



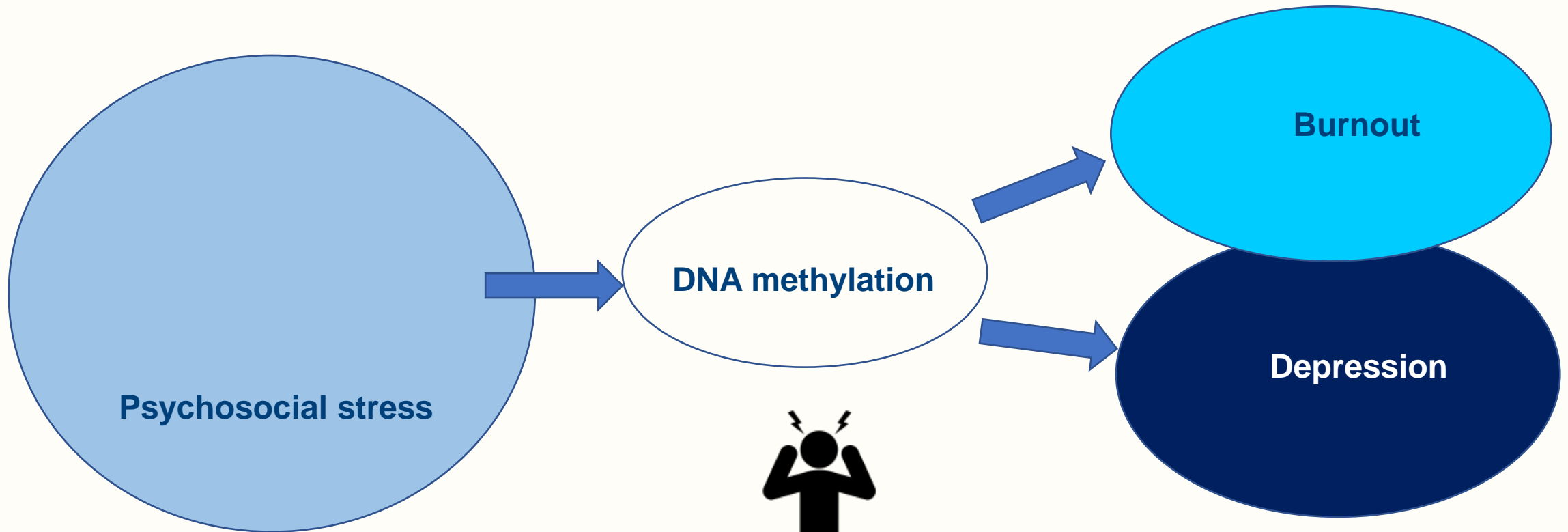
▷ Total cholesterol, HDL, LDL, triglycerides, VLDL, total protein, glucose, lipoprotein and Hba1c

- Mostly no association

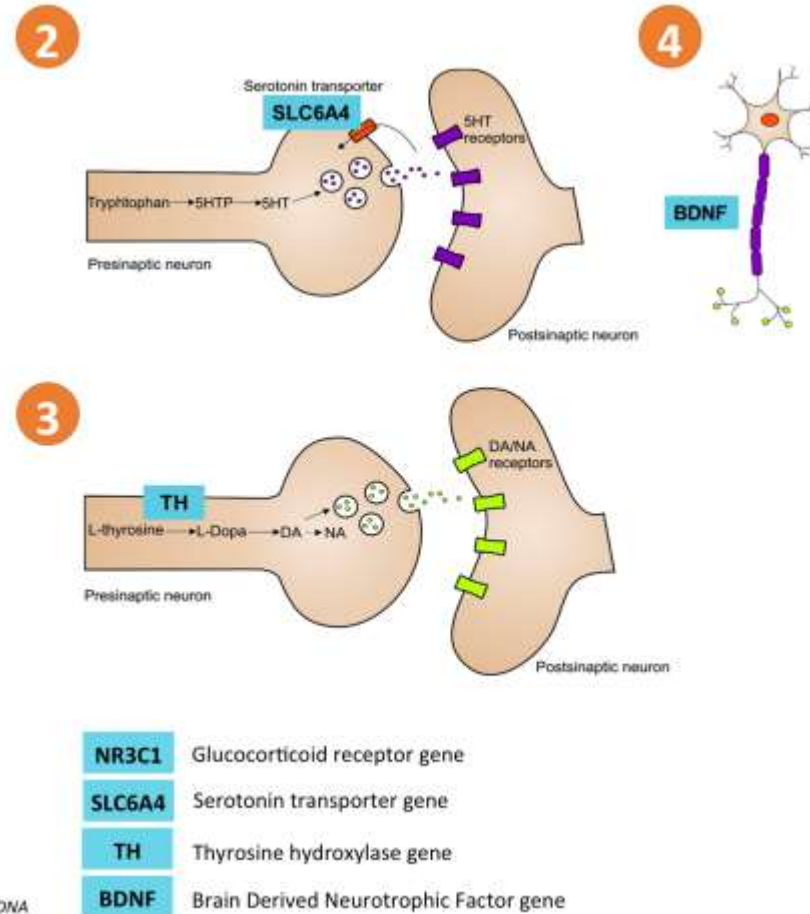
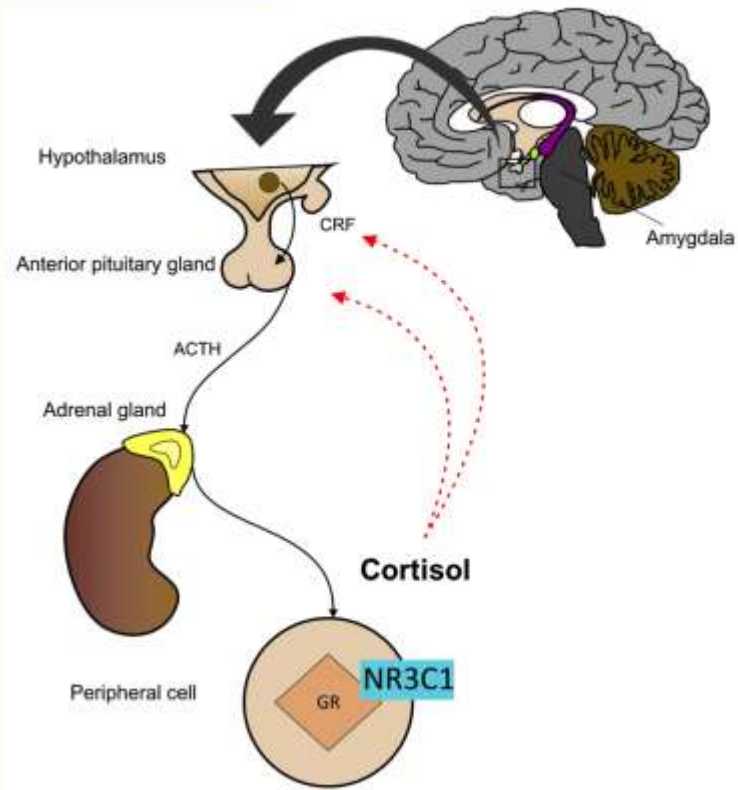
▷ Haemostatic biomarkers

- Mostly no association

Omic biomarkers



Target genes

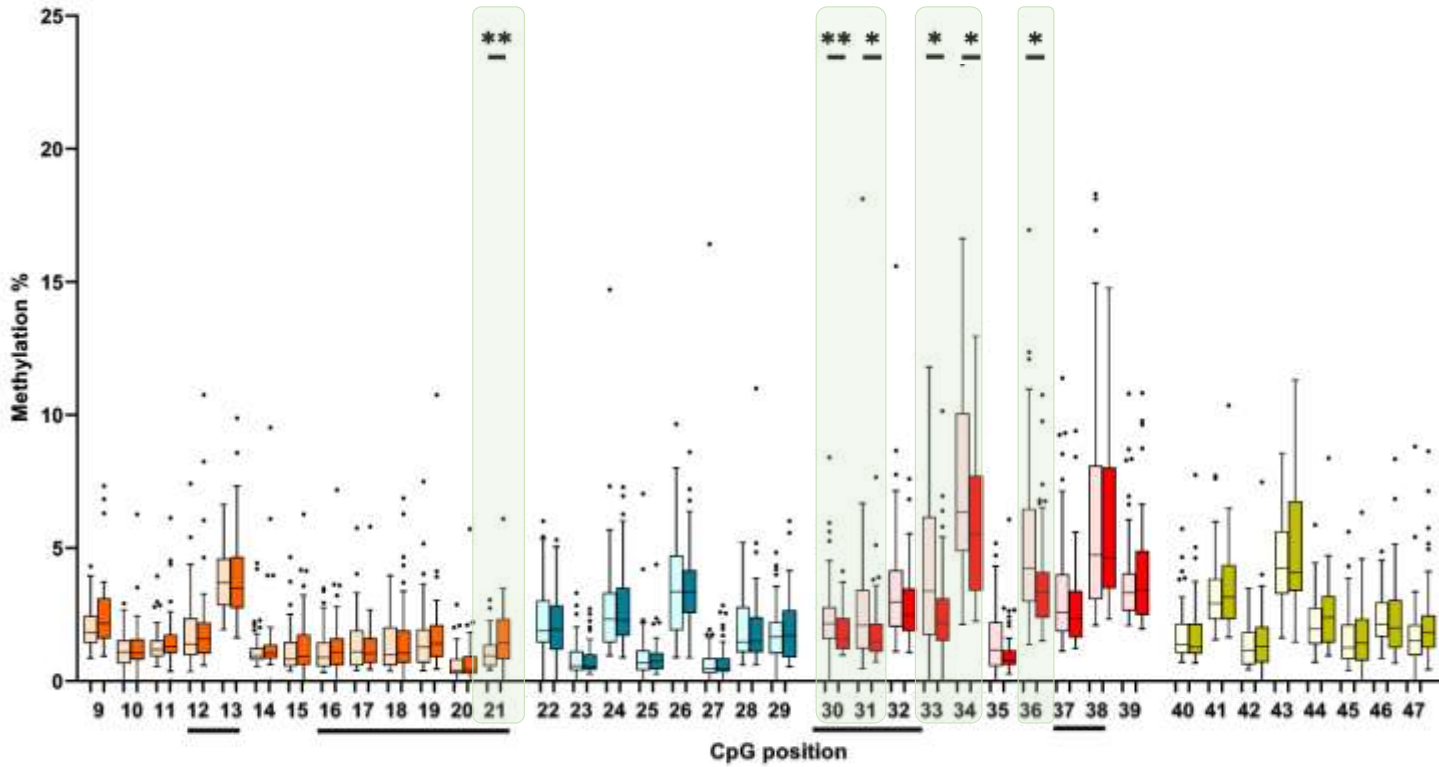


Bakusic J, Schaufell W, Cloes S, Godderis L. Stress, burnout and depression: A systematic review on DNA methylation mechanisms. *Journal of Psychosomatic Research*, 2017. 92:34-44.

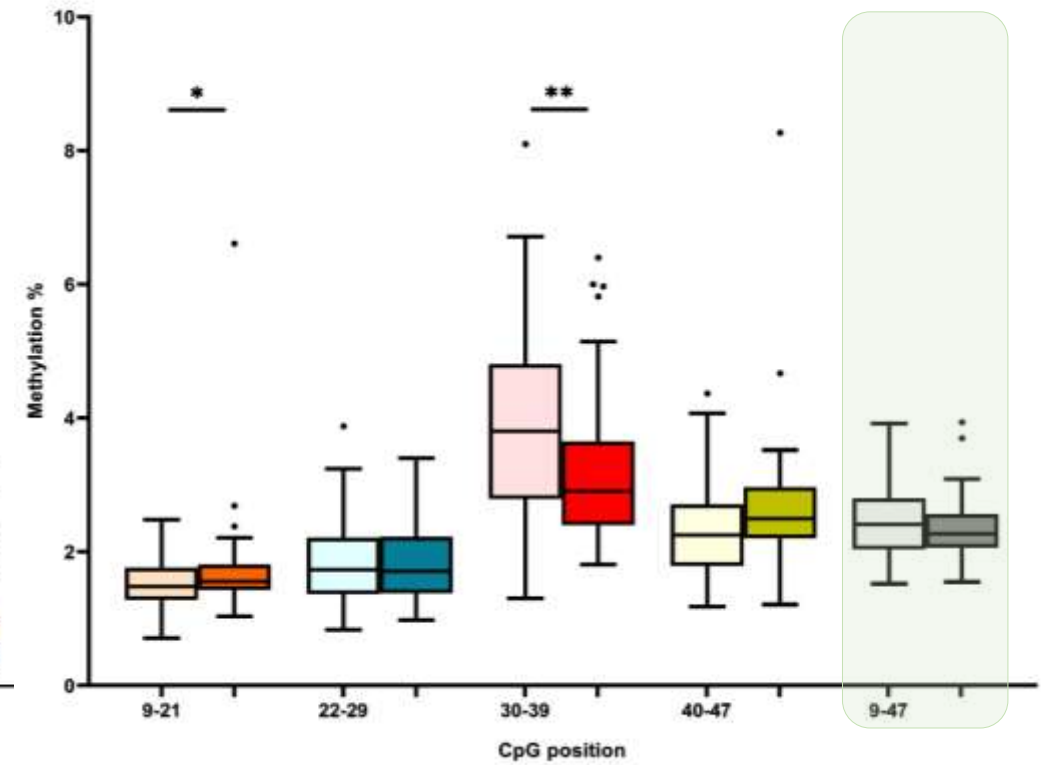
NR3C1

DNA methylation – between group comparison

Associated with **cortisone**
($p=0.009^{**}$)



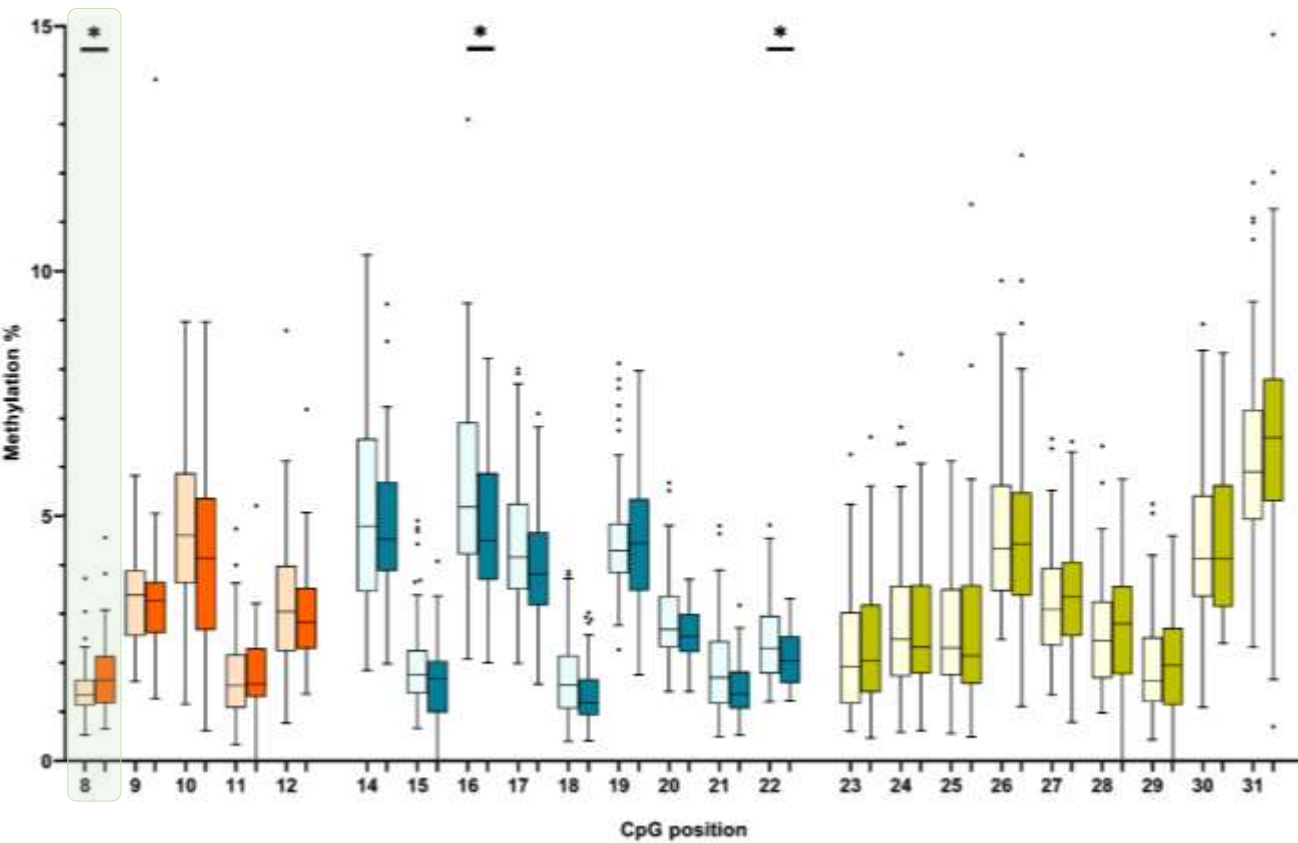
Control group – lighter shade



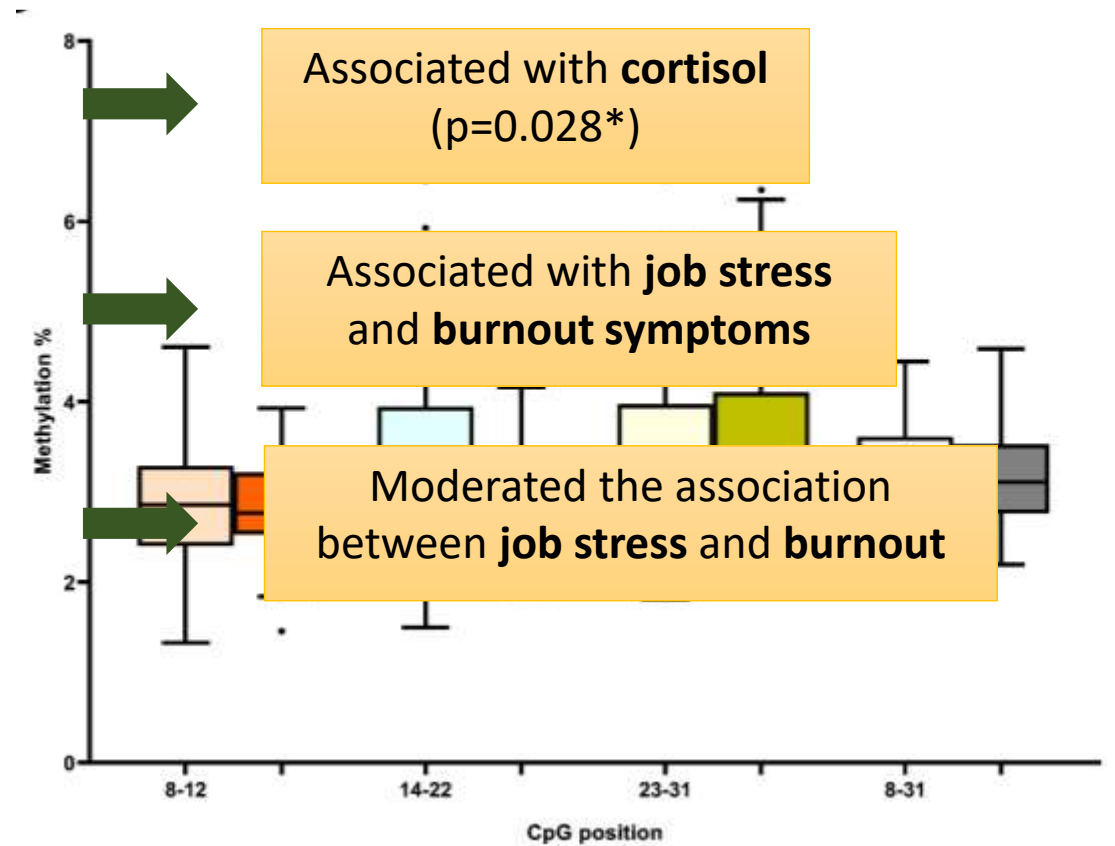
Burnout group – darker shade

SLC6A4

DNA methylation – between group comparison



Control group – lighter shade

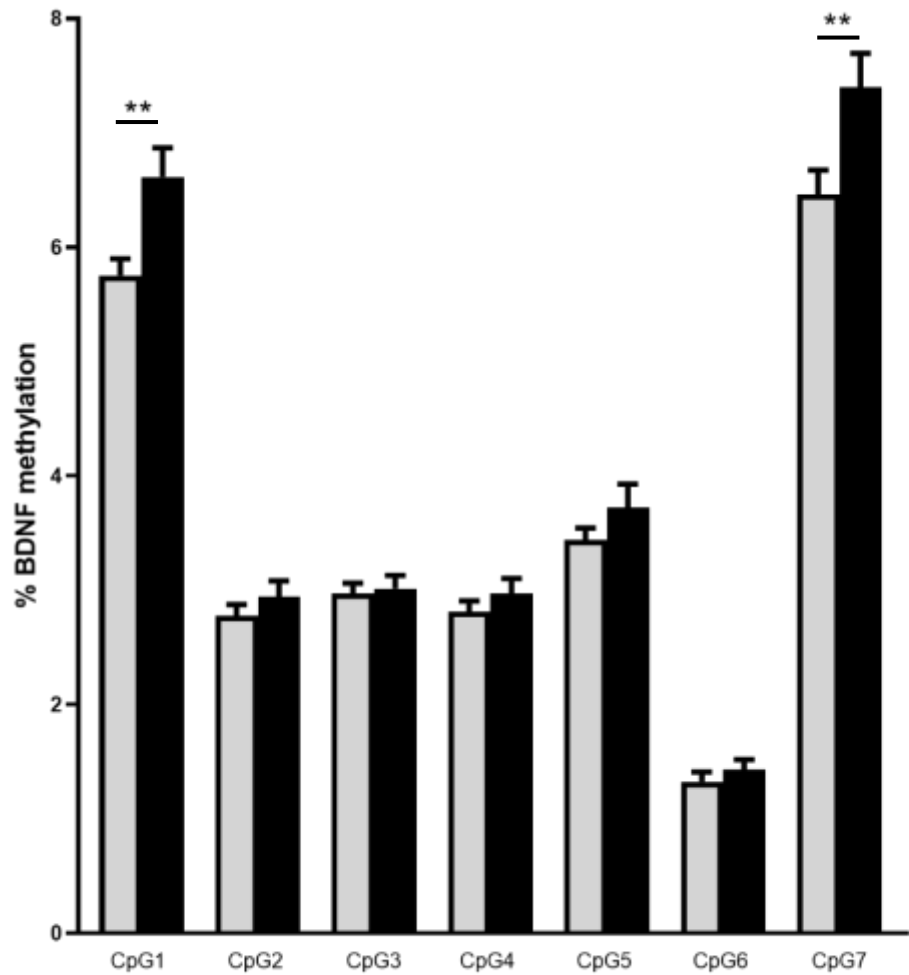


Burnout group – darker shade

Burnout symptoms

$\beta=0.16^*$

Promoter IV



$p=0.002^*$

MD=0.86

Burnout symptoms

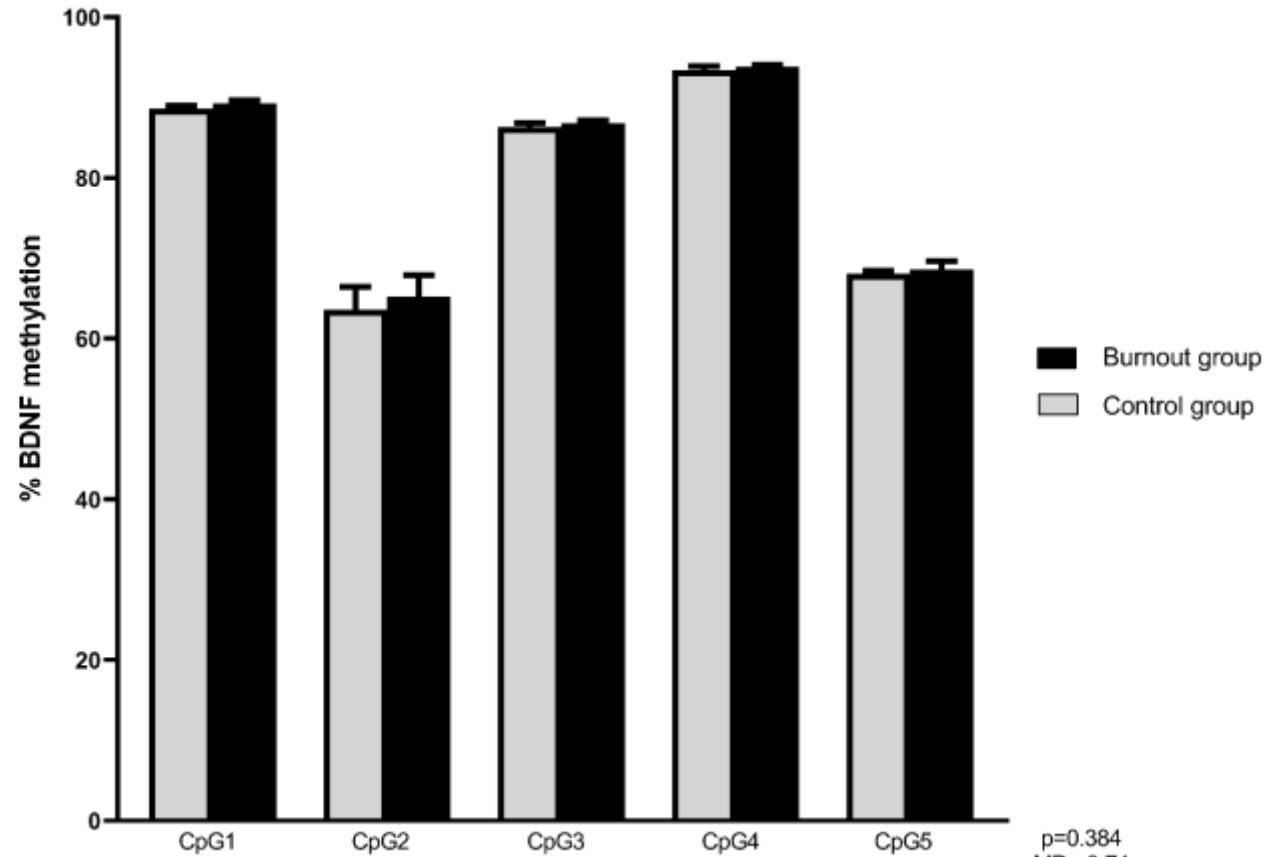
$\beta=0.26^{**}$



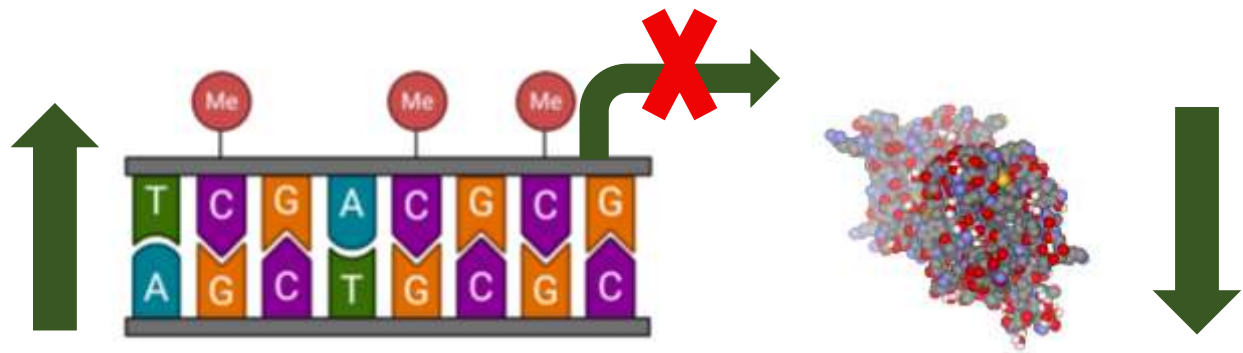
$p=0.001^*$

MD=0.94

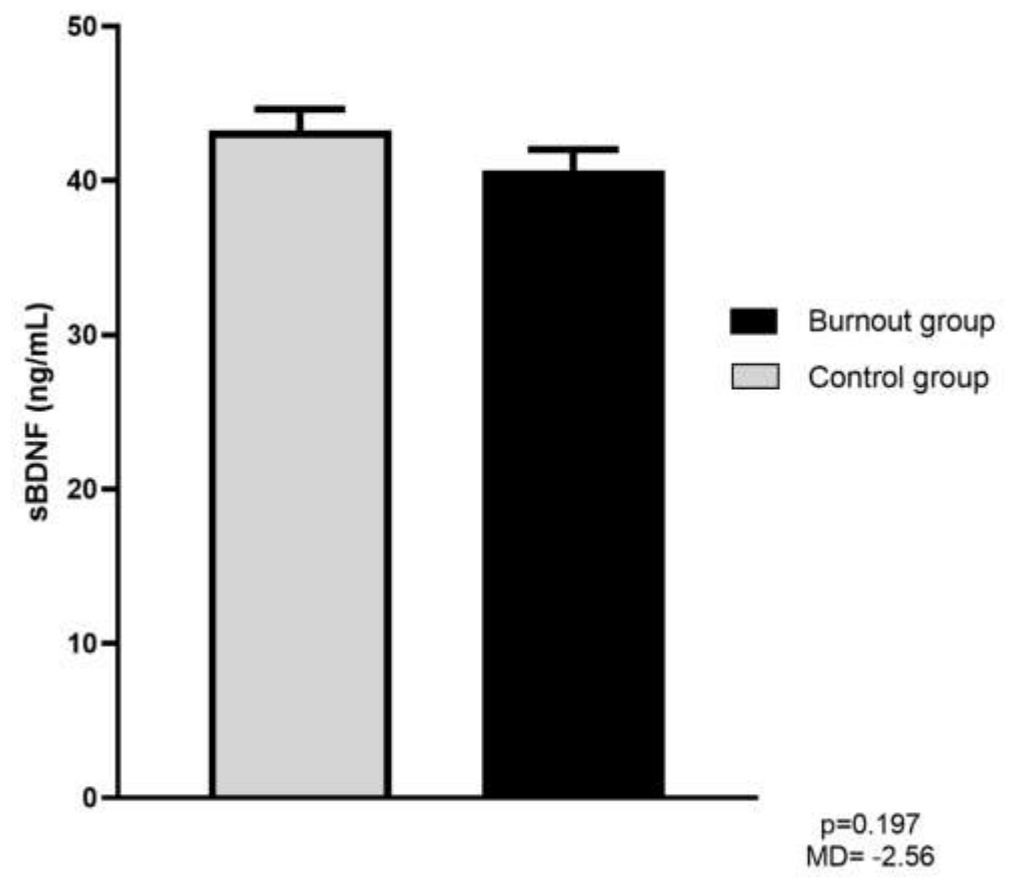
Exon IX



$p=0.384$
MD= 0.74



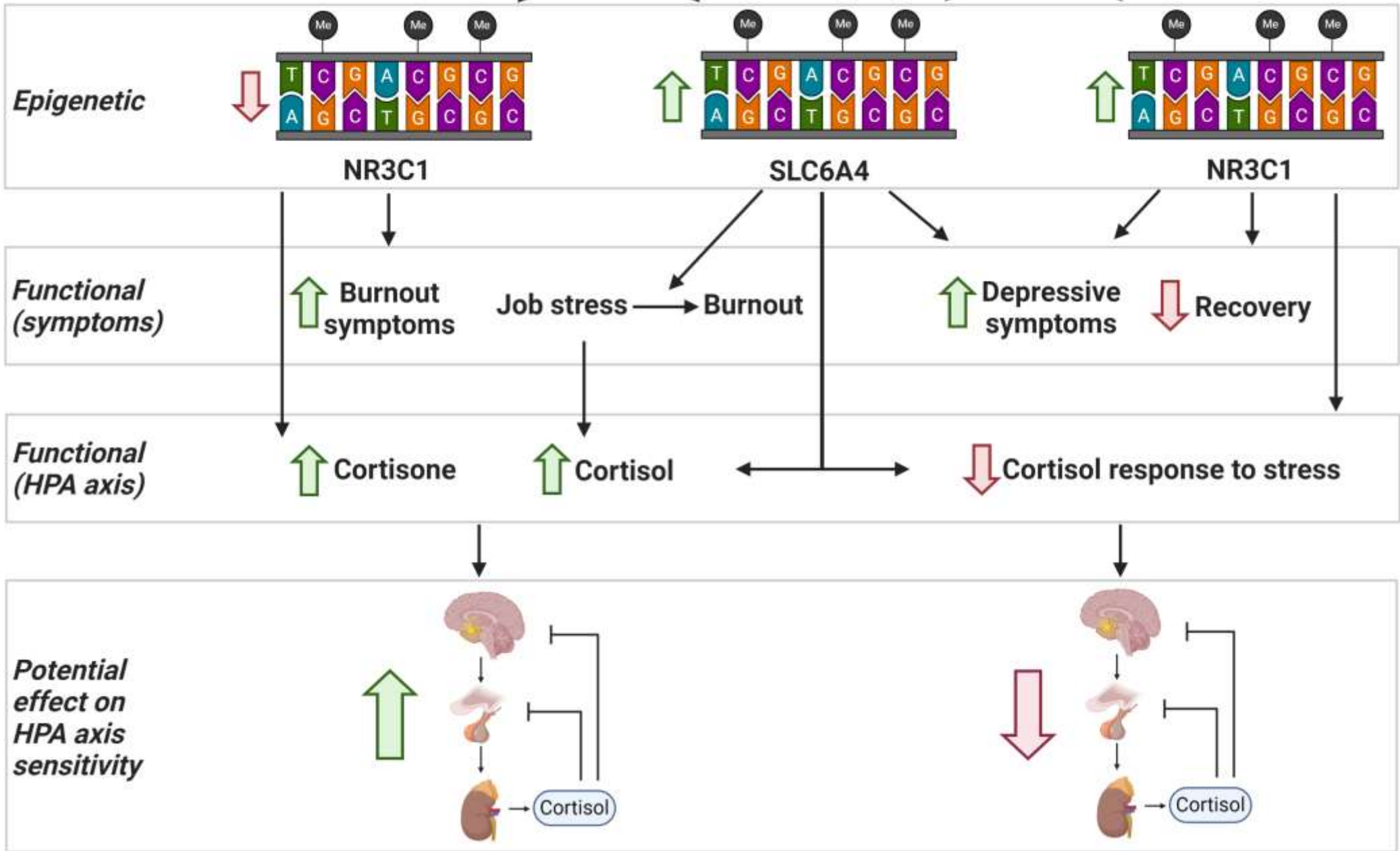
$\beta = -1,36$, $p < 0.001$



REGULATION LEVEL

BURNOUT

DEPRESSION





What is your soul
trying to tell you?

Thank you for your attention!

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