



# Performing under Pressure; on the Biology, Psychology and Sociology of stress in high-performance professions

II - ON THE PHYSIOLOGY OF STRESS



# Nature selects for speed

- ▶ Speed over accuracy

- ▶ It matter less where you run than that you run as quickly as possible

- ▶ Limited time frame (5 min)

- ▶ Most negatives effects of stress are the result of turning on the system for way longer than the approximately 5 minutes it usually takes.

Sapolsky, R. M. (2004). Why zebras don't get ulcers: A guide to stress, stress related diseases, and coping. In *Natural History*.

<https://doi.org/10.3389/fnins.2014.00150>

Heitz, R. P. (2014). The speed-accuracy tradeoff: History, physiology, methodology, and behavior. *Frontiers in Neuroscience*, 8(8 JUN), 1–19. <https://doi.org/10.3389/fnins.2014.00150>

# Both the lion and the gazelle need the same acute processes to survive

- ▶ Transport energy (fuel + oxygen) to those parts of the body that you need to survive
  - ▶ Legs
  - ▶ Upper body
- ▶ Hyper cognitive focus on the task at hand (fight or flight)
- ▶ Down-regulation of non-essential processes

# Energy

- ▶ Oxygen in-take and transport to the relevant muscle groups
  - ▶ Increased respiration rate
  - ▶ Increased blood pressure / increased heart rate
- ▶ Release of glucose from glycogen stores and transport to the relevant muscle groups
  - ▶ Cortisol
  - ▶ Increased blood glucose levels
  - ▶ Increased blood pressure / increased heart rate



# Important cognitive changes

- ▶ Mild stress

- ▶ Enhanced cognitive function; implicit memory & declarative tasks
- ▶ Enhanced task oriented focus

- ▶ High acute or chronic stress

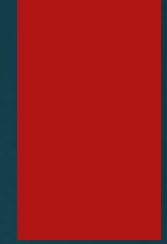
- ▶ Impairs the formation of complex memories: enhances implicit memory
- ▶ Repetitive tasks

# Downregulated functions

▶ Growth

▶ Reproduction

▶ Digestion



Yamamora, D. L. R., & Reid, R. L. (1990). Psychological stress and the reproductive system. *Seminars in Reproductive Endocrinology*, 8(1), 65–72. <https://doi.org/10.1021424>

Toyoda, A., Iio, W., Matsukawa, N., & Tsukahara, T. (2015). Influence of chronic social defeat stress on digestive system functioning in rats. *Journal of Nutritional Science and Vitaminology*, 61(3), 280–284. <https://doi.org/10.3177/jnsv.61.280>

Oroian, B. A., Ciobica, A., Timofte, D., Stefanescu, C., & Serban, I. L. (2021). New Metabolic, Digestive, and Oxidative Stress-Related Manifestations Associated with Posttraumatic Stress Disorder. *Oxidative Medicine and Cellular Longevity*, 2021. <https://doi.org/10.1155/2021/5599265>



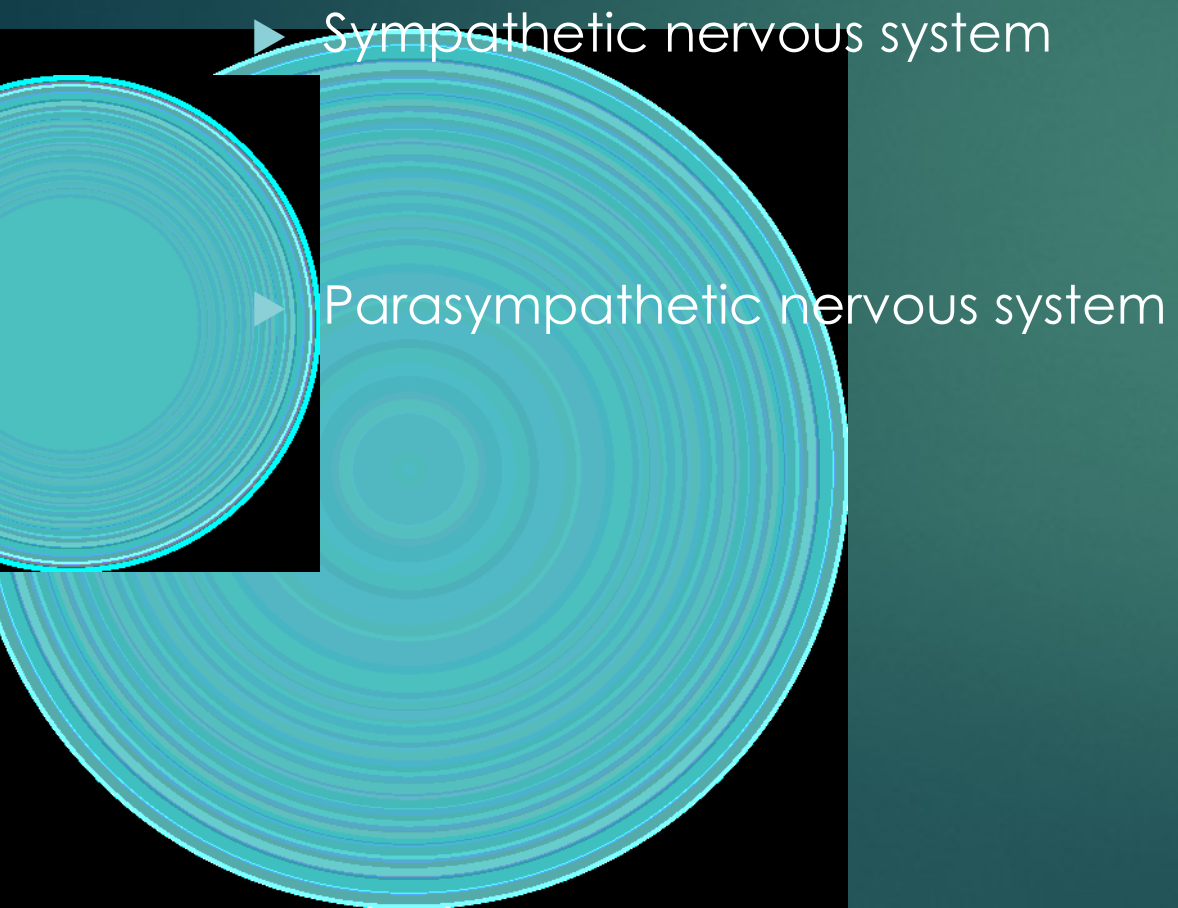
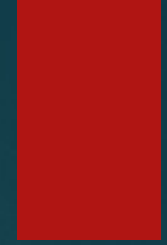
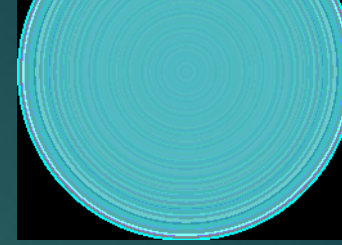
# Processing stimuli; the hardware

- ▶ A stimulus is detected by one of our senses
- ▶ The amygdala relays signals if the stimulus is threatening
  - ▶ Locus coeruleus (Norepinephrine)
  - ▶ Hypothalamic adrenal axis (Cortisol)
  - ▶ Ventral tegmental area (Dopamine)
  - ▶ Medial prefrontal cortex (is this really a problem?)





# Autonomic nervous system

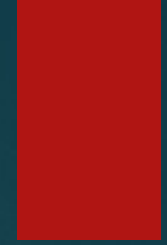
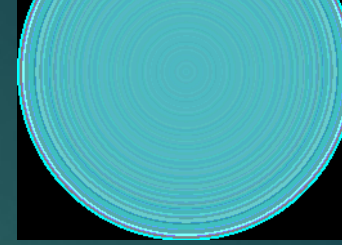


# (nor-)adrenaline / (nor-)epinephrine

- ▶ Setting the system up for movement
  - ▶ Blood pressure / heart-rate
  - ▶ Respiration rate
  - ▶ Task related focus and memory
- ▶ Heightened alertness & stressor related memory
- ▶ Three behavioural stages of nor-adrenaline
  - ▶ Movement
  - ▶ Erratic movement (panic)
  - ▶ Shutdown

# Cortisol

- ▶ Release glucose (fuel) from glycogen stores
- ▶ Highest in the morning
  - ▶ Nightmares
  - ▶ Interaction with nutrition
- ▶ Suppress inflammation
- ▶ Blood pressure



# What does dopamine do to the stress response

Dopamine: the great motivator (NO, it does not do reward!!)

- ▶ Training
- ▶ Uncertainty

