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

IX – NUTRITION, STRESS AND PERFORMANCE

On the chaos that is Nutrition Science

- Everyone has their favourite diet and tests it against the standard American diet (MacDonald's, Burger king and worse).
  - Very few randomised trails
    - Extremely complicated to get people to follow a diet
    - Animal studies usually do not translate well
  - Mostly self-report data (highly unreliable)
- Mostly aimed at the treatment of disease rather than optimum function
  - Heart disease, obesity, diabetes
  - With the exception of sport's science, longevity research

The first question to ask:What are you aims?

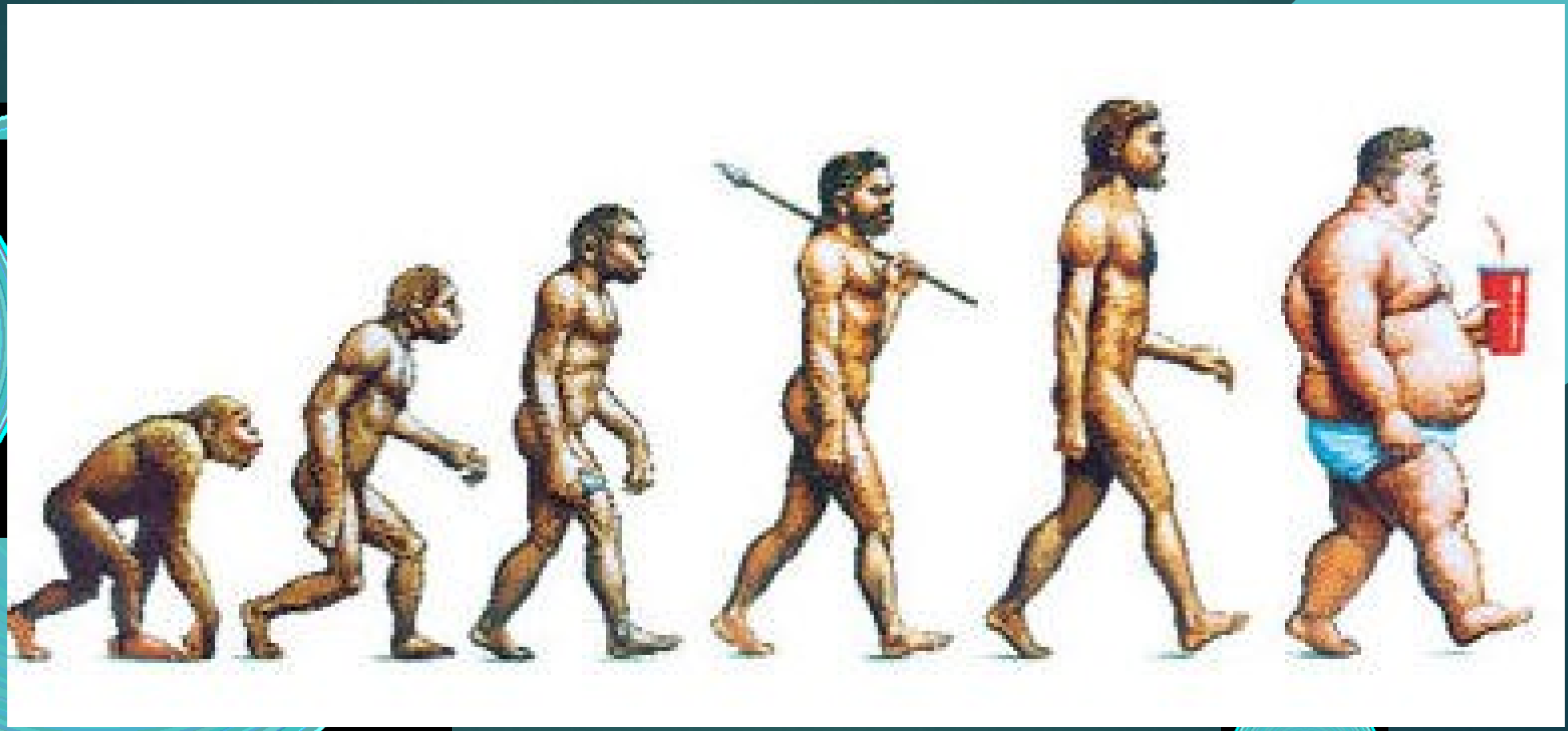
- Nutrition is probably not a question of ‘optimal’ function, but of optimisation for a specific outcome.
  - Longevity
  - Peak performance
  - Psychological stability

- Stress resilience and peak performance?

The second question: what else are you doing/willing to do?

- Nutrition does not exist in a vacuum.
  - Physical exercise
    - Link with carbohydrate consumption
  - Sleep
    - Affects leptin levels, amongst other endocrine and neuroendocrine systems.
  - Mental health
    - Your mental state may influence metabolism and vice versa.

The natural starting point: What did we evolve to eat?



How far back do we go?

- Which ancestral species?
  - The further back you go the more fruit and leaves based diet gets (humans are believed to have first appeared between 300 and 500 thousand years ago).
    - After the advent of meat eating (at least 2.6 million years ago)
      - Energy surplus
    - After the advent of cooking (300 000 – 2 million years ago)
      - Energy surplus + gut-size reduction
    - After the agricultural revolution (+/- 11 700 years ago)
      - Rise in population, organisation and culture

Wrangham, R. (2009). *Catching Fire: How Cooking Made Us Human*. New York: Basic Books.
Thompson, J. C., Carvalho, S., Marean, C. W., & Alemseged, Z. (2019). Origins of the human predatory pattern: The transition to large-animal exploitation by early hominins. *Current Anthropology*, *60*(1), 1–23. https://doi.org/10.1086/701477
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Changes in the food supply

- Many of the foods of the time do no longer exist
  - Selective breeding of food stuffs
  - All year round access
  - Climate change & the disappearance of species

Changes in consumption culture

- 3 meals a day with snacks
  - Throughout most of pre-agricultural history people went often through short periods (a few days) of food deprivation, but rarely through starvation.
- Non-stop availability
  - Obesity and diabetes
- High levels of food-processing
  - Excess levels of salt, sugar and unhealthy fats

What do we actually know about prehistoric diet?

- Atkins, paleo, raw, vegan, carnivore, keto … ????

- We actually know surprisingly little
  - Generalist (all types of food stuffs)
  - An aim at digestibility (cooking)

- But!!!! This diet was consumed in a highly physically active context!

Start of meat eating

- Climate change: more grass lands.
- Hunting is dangerous and hard. How do you start eating meat?
  - Scavenging (also rather dangerous but….. BONE MARROW!!!!)
    - Remains fresh for a few days because its encaged in a handy little box (bone)
    - Doesn't take complicated tools (a stone)
    - High in fat

Thompson, J. C., Carvalho, S., Marean, C. W., & Alemseged, Z. (2019). Origins of the human predatory pattern: The transition to large-animal exploitation by early hominins. *Current Anthropology*, *60*(1), 1–23. https://doi.org/10.1086/701477
Thompson, J. C., McPherron, S. P., Bobe, R., Reed, D., Barr, W. A., Wynn, J. G., … Alemseged, Z. (2015). Taphonomy of fossils from the hominin-bearing deposits at Dikika, Ethiopia. *Journal of Human Evolution*, *86*, 112–135. https://doi.org/10.1016/j.jhevol.2015.06.013

Hunting & endurance running

- Big game overheats quicker
- If you can cool more easily, hunting becomes easy.
  - No need for sophisticated tools
  - No need for extreme physical output

Pickering, T. R., & Bunn, H. T. (2007). The endurance running hypothesis and hunting and scavenging in savanna-woodlands. *Journal of Human Evolution, 53*, 434–437. https://doi.org/10.1016/j.jhevol.2007.01.012

Key nutrients

Macronutrients

- Carbohydrates (4cal/gram)
- Protein (4cal/gram)*
- Fat (9cal/gram)*

Micronutrients

- Vitamins
- Minerals

Micronutrients

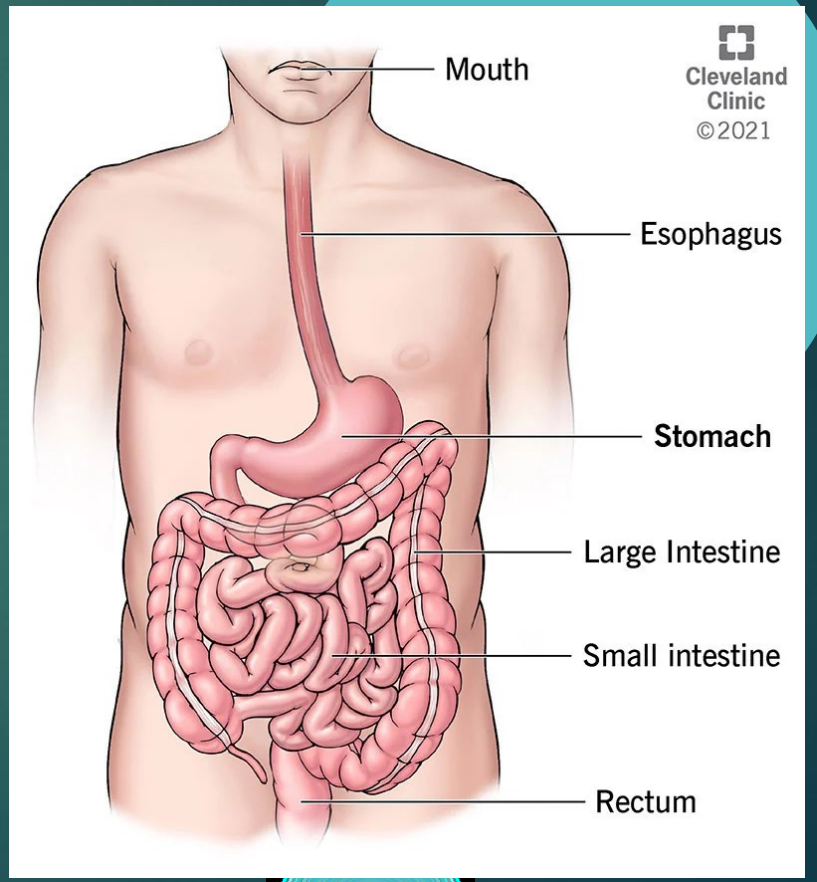
- Deficiencies, and in some cases excess, of a micronutrient may affect both the stress response and resilience. Regular bloodwork should tell you if you are deficient in anything.
  - Common deficiencies
    - Iodine
    - Calcium
    - Magnesium
    - Vitamins A, B12, D
    - Iron
  - Others to pay attention to:
    - Omega 3 fatty acids (anti-inflammatory)
    - Antioxidants

Macronutrients

- The main sources of fuel and building materials
- Fat and protein are essential
- We can survive without carbohydrates
  - Endogenous production of glucose for the brain

The digestive system has specific sensors for different nutrients

- Sugars
  - We like sweet things even if you numb taste buds
  - Stimulates endorphin secretion
- Amino acids (building blocks of protein)
  - We will eat until we have enough, not until we are full
    - L-tyrocine (dopamine precursor)
      - Chicken, turkey, fish, milk, yoghurt and almonds
    - Tryptophan (serotonin precursor)
- Fats (lipids)



The system simplified

- What you do not use, you store. But, not all macronutrients are stored the same way.
  - Insulin
  - Fat metabolism
- Stress releases stored energy
  - Cortisol
- Stress for no real reason
  - You dump a lot of energy on the system, remove it, dump it back in, remove it, etc.

Serotonin: the relax neuromodulator

- Carbohydrates stimulate serotonin secretion
  - Rest and digest – relax
- SSRIs – Common anti-depressants but serious side-effects
  - Blunted emotions
  - Diminished motivation
  - Diminished hunger
  - Diminished sex-drive

Fasting

- Autophagy
  - ketosis
- Longevity
- Regulation of insulin levels
- Neurogenesis

Mattson, M. P., Longo, V. D., & Harvie, M. (2017). Impact of intermittent fasting on health and disease processes. *Ageing Research Reviews*, 39, 46–58. https://doi.org/10.1016/j.arr.2016.10.005
Longo, V. D., Mitteldorf, J., & Skulachev, V. P. (2005). Opinion: Programmed and altruistic ageing. *Nature Reviews Genetics*, 6(11), 866–872. https://doi.org/10.1038/nrg1706