Chewing over the aging process

October 5 2015

Could scientists use the Second Law of Thermodynamics on your chewing muscles to work out when you are going to die? According to research published in the *International Journal of Exergy*, the level of entropy, or thermodynamic disorder, in the chewing muscles in your jaw increases with each mouthful. This entropy begins to accumulate from the moment you're "on solids" until your last meal, but measuring it at any given point in your life could be used to estimate life expectancy.

The Second Law of Thermodynamics states the precise opposite of the optimistic phrase "things can only get better". In fact, the disorder in a closed system, its entropy, always increases…eventually. In other words, things can only get worse. Castles of stone or sand eventually collapse, the bodies of those who build such castles ultimately decay, in the meantime the food they eat is broken and only temporarily rebuilt into muscles. The masseter muscles, for instance, strong and the most prominent chewing muscles in the jaw that are particularly powerful in herbivores, but all mammals use these muscles to chew.

While we live and breathe our bodies have repair systems for mending damaged tissues, but they do suffer wear and tear, mainly through friction. Nevertheless, Mustafa Özilgen of the Department of Food Engineering, at Yeditepe University, in Istanbul, and colleagues, point out that the lifespan entropy concept suggests that organisms have a limited capacity for generating disorder, entropy, during their lifetime. When that limit is reached, the organism dies, essentially "of natural causes".

A person living out their three score years and ten, or perhaps more realistically in the modern era, 76 years on average will generate 10 kilojoules per degree Kelvin of entropy in their masseter muscles as they chew from out of the cradle and into the grave. An obese person, who may be taking up 10 percent more nutrients than their slim friend, may generate that same amount of entropy five years earlier. A more efficient body, and specifically more efficient muscles will take longer to generate entropy. As such, the team says, it should be possible to determine entropy of the masseter muscles under laboratory conditions by recording precise energy measurements of the tissue while a person chews and so provide an estimate of lifespan based on likely quantities of food they eat each day through their lives.

More information: "Lifespan entropy generated by the masseter muscles during chewing: an indicator of the life expectancy?" *International Journal of Exergy* DOI: 10.1504/IJEX.2015.072056

Provided by Inderscience Publishers