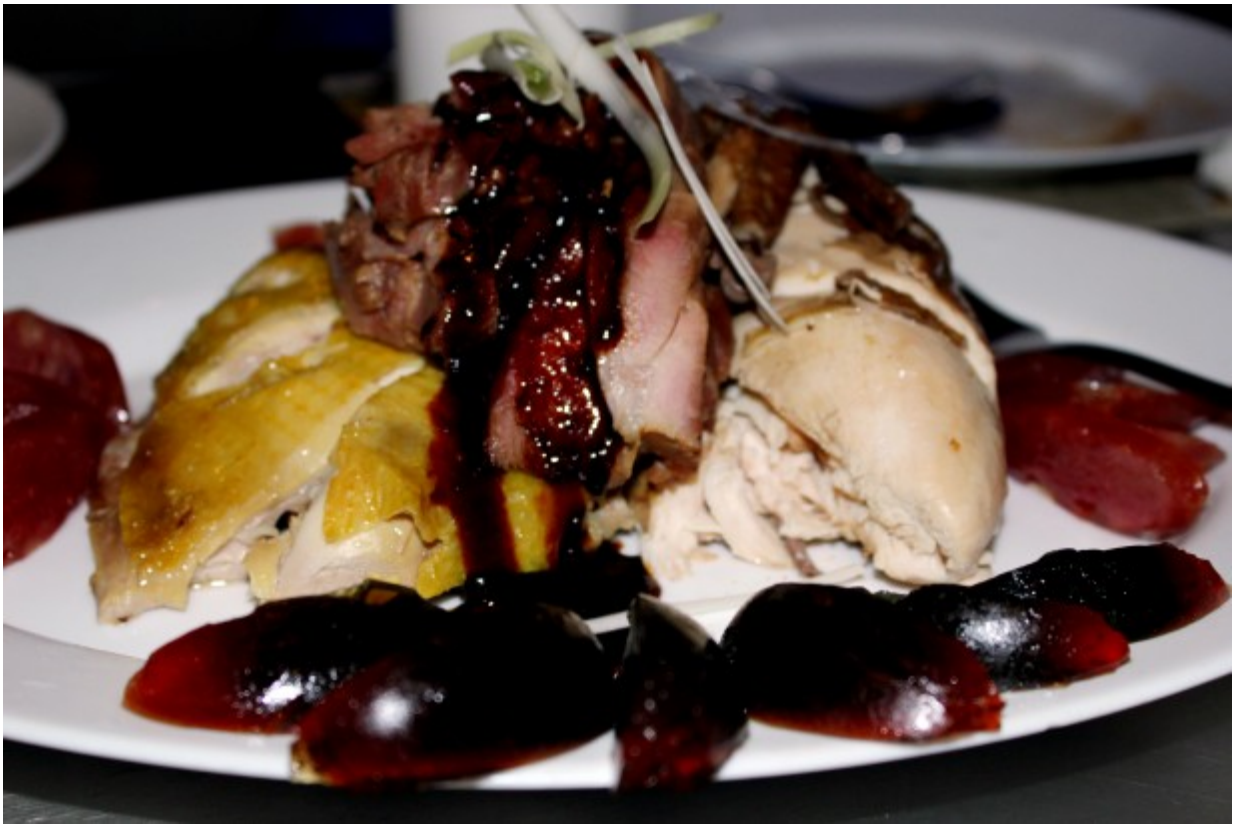
Deciphering the neural code that links food to aging

May 12 2015



Credit: Maliz Ong

Diet exerts a major impact on health and ageing. The nervous system plays an important role in this process but, thus far, how food signals are interpreted by the nervous system has been a mystery. This is an

important question because the perception of food by the nervous system impacts not just ageing, but also other processes associated with health and disease, including metabolism, reproduction, and development.

A new study published in *eLife* by researchers from the MRC Centre for Developmental Neurobiology (MRC CDN) at the Institute of Psychiatry, Psychology & Neuroscience (IoPPN), King's College London, in collaboration with engineers from the Georgia Institute of Technology (USA), has found that serotonin and TGF-beta hormone levels in specific neurons of *C. elegans* communicate information about food abundance in roundworms. These signals from the nervous system influence the animal's lifespan, thus mediating the effects of food on ageing.

This work resulting from an interdisciplinary collaboration, not only reveals the links from food to lifespan, it also sheds further light on how the nervous system processes information. In particular, an unexpectedly intricate regulation in this neural gene circuit that also alters the accuracy of its gene expression signals has been discovered. Thus, gene expression can also serve as an additional layer of computation in the nervous system. This work reveals how food signals are processed, and how the accuracy of its corresponding neural code is regulated.

"By having biologists work closely with engineers, we could bring to bear a combination of biology, automation, and computation on the issue of neural coding that's fundamental to neuroscience. It's the first time neural gene expression has been analysed with this level of detail in a multicellular animal, which was critical in calculating the accuracy of this neural gene expression code and how it was affected by different genes." said Dr. QueeLim Ch'ng, senior co-author of the study, from the IoPPN at King's College London. "Most people think about electrical activity when they think about encoding information in the nervous system. Our work shows that gene expression is an important, but

virtually unexplored aspect of information processing in the nervous system."

Both serotonin and TGF-beta pathways have been implicated in diverse human diseases, including cancer, mental disorders, diabetes, and obesity. The powerful genetic tools in the simple roundworm have already revealed many genetic pathways that underlie human physiology and disease, because many important genes function similarly in roundworms and humans.

"Our research will continue to illuminate the pathways and mechanisms that link diet to health and disease, while simultaneously uncovering general principles of information processing, which will be crucial for tackling complex gene-environment interactions that underlie many diseases."

Provided by King's College London