Brain connections for stress -- lessons from the worm

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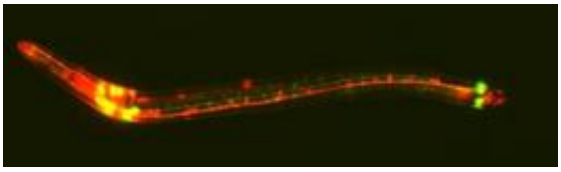

The entire nervous system is marked with red fluorescent protein and a subset of sensory and interneurons marked with green fluorescent protein Credit: Roger Pocock

Did you ever wonder how you are able to perform complex tasks - even under stress? And how do emotions and memories mould your ability to live your everyday lives? The answer is just beginning to be understood and lies in hidden circuits in the brain.

Pioneering work by Roger Pocock, a newly arrived Group Leader at the research centre BRIC, University of Copenhagen, reveals the remarkable ability of organisms to activate latent neuronal circuits under stressful conditions. It is suggested that such circuits form part of an escape response that enables animals to sense their environment and adapt their behaviour under unfavourable conditions. This work is being published in the journal *Nature Neuroscience* on April 18.

The human brain contains billions of neurons that build trillions of connections making it very complex to study behaviour at the level of

the single neuron. Therefore, the Pocock laboratory uses the simple nervous system of the microscopic worm, *Caenorhabditis elegans*, to model how our environment modifies gene function, neuronal circuitry and behaviour. Using *C. elegans*, which contains just 302 neurons, Dr Pocock has identified a hidden neuronal circuit that modulates sensory perception under stress. Specifically, this work discovered that physiological detection of hypoxic (low oxygen) stress results in the activation of a hidden neuronal circuit involving the neuromodulators serotonin and the neuropeptide Y receptor.

This work implicates that mechanisms coupling hypoxia, serotonin and neuropeptide signaling also modifies behaviour in mammals. In fact, hypoxic stress enhances serotonin and neuropeptide production in specific regions of the mammalian brain, however, the functional output of this is poorly understood.

Roger Pocock did the experiments for this article at Columbia University, New York, where he worked as a researcher before coming to Denmark. He has previously published novel findings in *Nature Neuroscience* and his strong research potential within this field was essential for his recruitment as a Group Leader at BRIC.

"These and other studies in the burgeoning field of environment-gene-neuron interactions will hopefully enable us to better understand how to cope with stress in our every-changing and busy lives" says Roger Pocock.

As Charles Darwin himself said 'Man is but a worm'!

More information: Hypoxia activates a latent circuit for processing gustatory information in C. elegans. Roger Pocock & Oliver Hobert, Nature Neuroscience, April 18, 2010.

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