Doing more means changing less when it comes to gene response, new study shows

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An international team led by scientists at the University of Turku in Finland studied thermally-adapted fish populations to discover that the more biological functions a gene has, the less it responds to environmental change. "In addition to having important implications for climate change adaptation, these findings could radically change the way we study gene responses to any external stimulus like for example to drug treatments", the authors suggest. Their findings are reported on June 3 2014 in the journal *Nature Communications*.

When organisms need more of a gene's product, typically a protein, the gene is 'turned up' and the opposite occurs when less protein is needed (the gene is 'turned down'). For years, biologists have used this knowledge to identify genes that are important for certain conditions. The logic behind is simple: among genes, those that are 'turned up' or 'turned down' the most will also be the most important. Correct? Not exactly, according to the latest findings.

In their study, Papakostas and co-authors studied the responses to temperature for more than 400 genes in grayling populations (grayling is a relative of Atlantic salmon). "We used state-of-the-art molecular tools that allowed us to measure gene responses directly at the protein level", the authors explain. The breakthrough came when they examined how much each the gene was 'turned up' or 'turned down' in comparison to how many biological functions each gene is known to have. "We found a very clear correlation between how much protein amounts changed in response to temperature and the number gene biological functions. The

more the gene biological functions, the less was the protein expression change", S. Papakostas, the primary author of the study explains.

How do these findings change our current view about gene responses? "When it comes to gene expression responses, there is no one simple universal solution and our study shows exactly that. Gene expression changes could not be judged solely based on the magnitude of change because genes with more biological functions simply cannot change as much as genes with fewer biological functions. We need to develop ways that take this into account. We believe the present study represents the first step forward to a whole new direction for molecular and evolutionary biologists", the authors conclude.

More information: "Gene pleiotropy constrains gene expression changes in fish adapted to different thermal conditions." Spiros Papakostas, et al. *Nature Communications* 5, Article number: 4071 DOI: 10.1038/ncomms5071 . Received 21 February 2014 Accepted 08 May 2014 Published 03 June 2014

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