Researchers pair experiments with computer models to peer into cells

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(Phys.org) —BBSRC-funded researchers have developed a new strategy that can give scientists a better insight into how complex molecular machineries function in living cells.

In research published in the journal *Molecular* Systems Biology, the team from the University of Warwick, Manchester Interdisciplinary Biocentre and Liverpool University showed how to extract in vivo information about how complex molecular systems in yeast cells are controlled.

By making small changes in a process called mRNA translation, a crucial step in the manufacture of proteins within a cell, the team was able to obtain important information without disrupting the system.

These data were used to set parameters for a detailed computational model of protein synthesis in cells, revealing a number of insights about the process which were previously unknown.

For example, the research showed how individual components in the mRNA translation process had co-evolved to share responsibility for controlling how fast proteins are made.

Professor John McCarthy, professor of molecular systems biology at Warwick University, said: "A major objective of systems biology is to move forward from analysis of individual cellular components to create accurate digital models that provide insight into how these components work together within living cells.

"Through this approach, we ultimately hope to understand the 'emergent properties' of molecular systems in cells that, for decades, have fascinated biologists but evaded proper explanation.

"Up to now, it has proved very difficult to obtain an accurate picture of how cells control the various processes that go on inside them, leaving us largely guessing how the properties of individual components relate to the behaviour of systems that are assembled from them within living cells.

"Using minimal perturbations of precisely targeted steps of specific cellular processes together with a large number of quantitative analytical measurements, we have now made a major first step towards obtaining detailed insight into how the living cell's protein synthesis machinery is managed at the system level."

The approach has potential as a platform for a wide range of future studies into the molecular systems biology of gene expression.

The researchers also believe the combined experimental and computational approach taken should be applicable to multiple processes in a range of organisms.

More information: Firczuk, H. et al. An in vivo control map for the eukaryotic mRNA translation machinery, *Molecular Systems Biology* 9 (2013) 635.

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