Imaging unveils temperature distribution inside living cells

February 1 2013

A research team in Japan exploring the functions of messenger ribonucleic acid (mRNA) – a molecule that encodes the chemical blueprint for protein synthesis – has discovered a way to take a close look at the temperature distribution inside living cells. This discovery may lead to a better understanding of diseases, such as cancer, which generate extraordinary intracellular heat.

This breakthrough is the first time anyone has been able to show the actual temperature distribution inside living cells. The team will present its findings at the 57th Annual Meeting of the Biophysical Society (BPS), held Feb. 2-6, 2013, in Philadelphia, Pa.

Conventional temperature imaging methods lack spatial resolution and sensitivity, which means these methods are incapable of imaging extremely tiny temperature differences inside living cells. To overcome these issues, the team developed a new imaging method that combines a highly sensitive thermometer with an incredibly accurate detection technique, enabling the creation of detailed intracellular temperature maps.

"Our imaging method allows us to clearly see the temperature inside living cells, and we found that the temperature differs greatly depending on the location in the cell," says Kohki Okabe, an assistant professor at the University of Tokyo's Laboratory of Bioanalytical Chemistry, Graduate School of Pharmaceutical Science. "We discovered that the temperature difference is related to the various stages of the cell cycle."

This research provides a novel point of view: Temperature not only regulates biological molecules, but it actually contributes to cellular functions.

"By incorporating cellular temperature mapping into the analysis of any kind of cellular event, we can achieve a deeper understanding of cellular functions," Okabe explains. "It is our hope that by using this method of temperature imaging, the pathogenesis of diseases known to generate significant heat within cells, such as cancer, can be clarified. We believe this may help lead to future cures."

Next, Okabe and colleagues plan to explore how temperature contributes to cellular functions in even greater detail, as well as investigating differences in the intracellular temperatures of various living cells.

More information: Presentation #1033-Plat, "Imaging of temperature distribution in a living cell," will take place at 11:45 a.m. on Monday, Feb. 4, 2013, in the Pennsylvania Convention Center, Room 113AB. ABSTRACT: tinyurl.com/b6dnae6

Provided by American Institute of Physics