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Section of Public Affairs	Hyo Jung Kim Section Chief (+82) 62-715-2061	Nayeong Lee Senior Administrator (+82) 62-715-2062
Contact Person for this Article	Professor Tae-Young Kim School of Earth Sciences and Environmental Engineering (+82) 62-715-3647	
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Professor Tae-Young Kim's research team develops a new high-efficiency analysis method for finding biomolecules related to diseases

☐ GIST (President Kiseon Kim) School of Earth Sciences and Environmental Engineering Professor Tae-Young Kim's research team uses metabolic heavy water labeling * to develop a method to measure the relative ratio of lipid present in healthy and normal cells at the molecular level with high efficiency.

> * metabolic heavy water labeling: heavy water is used to test the metabolic rate in humans and animals undergoing their normal activities with stable isotope labeling

- Lipids are a component of the cell membrane that make up our body and are responsible for energy storage and signal transmission. Changes in the type and amount of lipids are related to type 2 diabetes, rheumatoid arthritis, Alzheimer's disease, and various metabolic and immune disorders such as cancer. Therefore, the technique of measuring the amount of lipids in vivo plays a very important role in identifying the cause of diseases and in developing treatments.

☐ The research team published a new quantitative analysis method that allows the determination of isotopes * distributions by combining heavy water labeling and high resolution mass spectrometers to calculate the relative amount of biomolecules obtained from healthy and normal cells. The research team also developed its own program to automate and process large-capacity mass spectrometry data.

* isotopes: atoms of an element that have the same number of protons but different numbers of neutrons

- The team also labeled HeLa cells, a representative model cancer cell, and analyzed them by liquid chromatography-mass spectrometry at various ratios to determine quantitative accuracy and quantification range. As a result, a total of 100 individual lipids including fatty acyl, glycerolipid, glycerophospholipid, and sphingolipid were successfully quantified by a 100-fold difference.

- The team also confirmed the concentration of triacylglycerol * induced by hypoxia from the relative quantification of lipid obtained Hela cells and normal cells.

* triacylglycerol: the simplest lipids formed by fatty acids, which is made up of three fatty acids ester linked to a single glycerol

□ Professor Tae-Young Kim said, "While previously developed isotope-based relative quantification methods could only quantify specific biomolecules, the heavy water labeling developed in this study allows simultaneous relative quantification of several biomolecules, including proteins, sugars, nucleic acids, and metabolites as well as lipids. This research is expected to provide a systematic technology to study biologic changes caused by diseases in the future."

□ This research was led by GIST Professor Tae-Young Kim and carried out by Ph.D. student Jonghyun Kim and was supported by the National Research Foundation and the Korea Health Technology R&D project through the Korea Health Industry Development Institute. The research was published in *Analytical Chemistry* on June 27, 2019.

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