Visualizing Metabolic Processes at the Single-Cell Level - Using Genetically Encoded Biosensor and Biomarker

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Visualizing Metabolic Processes at the Single-Cell Level - Using Genetically Encoded Biosensor and Biomarker Alireza Heidari<sup>1,2,3,4\*</sup>, Elena Locci<sup>1,2,3</sup> and Silvia Raymond<sup>1,2,3</sup>

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#### Abstract

Understanding cellular metabolism (how cells use energy) can be key in treating a wide range of diseases, including vascular disease and cancer. Although many techniques can measure these processes in tens of thousands of cells, researchers have not been able to measure them at the single-cell level. Researchers have used a genetically encoded biosensor with artificial intelligence to measure glycolysis. (Process of converting glucose to energy, single endothelial cells, blood vessel cells).

**Keywords**: Cancer; Cells; Tissues, Tumors; Prevention, Prognosis; Diagnosis; Imaging; Screening; Treatment; Management

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#### Introduction

Endothelial cells usually form a strong layer inside the blood vessels, but if we need the help of the immune system, we can contract and rupture in this layer. Abnormal contraction can cause blood vessels to leak, leading to a heart attack or stroke. Such contractions in the blood vessels around the lungs can also cause fluid leakage, which occurs in acute respiratory distress syndrome. (This often happens in patients with severe cases of Covid-19.) To better understand how the cell metabolizes in this state of contraction, the researchers turned to resonant energy transfer sensors, genetically encoded biosensors that can measure the amount of lactate inside cells. Lactate is a byproduct of glycolysis. Although the researchers did not develop the sensors, by pairing the sensors with machine learning algorithms, we developed an even more powerful technique that allowed them to image cells, analyze data, and glycolysis reactions at

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the cellular and subcellular levels. We can examine the details inside the cells, such as certain areas of the cells where there is an increase in glycolysis; this is a key innovation in technology. We were able to measure the amount of glucose cells during contraction and movement, and also found a new mechanism for glucose transport through the cell cytoskeleton (a receptor called GLUT3) that these cells use to absorb glucose [1-510].

## **Results and Discussion**

Understanding how glycolysis works at the cellular level can ultimately lead to therapies that inhibit this process if useful; For example, in the case of leaking blood vessels in patients with atherosclerosis. It can also help patients whose immune systems have reacted strongly to Covid-19 and need help closing the endothelial cell gap around the lungs. If we can find a way to control the contraction, we can reduce the acute respiratory distress syndrome in Covid-19 patients. This method also has important consequences in the treatment of cancer. Endothelial migration and proliferation due to glycolysis are the main cellular processes involved in vascular growth that are essential for tumor survival and growth. Understanding exactly how this works can help researchers kill tumors and prevent them from growing. It can also be used to treat T CAR cells, which the immune system uses to prepare itself for tumors. While this treatment has been lifesaving for some, many patients do not respond. Because endothelial cells are important for T cells to penetrate tumors, and cellular metabolism plays an important role in T cell function, researchers believe that modulating cellular metabolism could help build a better immune system. Researchers are currently testing such inhibitors to treat acute CVD-19 acute respiratory distress syndrome at Cancer Research Institute (CRI) of California South University (CSU).

#### Conclusions

We found that when these cells moved and contracted, we used more glucose, and we also found that the cells absorbed glucose through an unknown receptor. Understanding this trend could lead to better treatments for cancer and vascular disease. including Covid-19. Understanding cellular metabolism is of global importance. By measuring unicellular metabolism, we have a potentially new way of treating a wide range of diseases. This is the first time we can visualize cellular metabolism at different temporal and spatial scales, even at the subcellular level, which could change the language and approach of researchers to study cellular metabolism.

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Nanomolecules for Synthesis of  $Au_{144}$ xAg<sub>x</sub>/xCu<sub>x</sub>[(SR)<sub>60</sub>, (SC<sub>4</sub>)<sub>60</sub>, (SC<sub>6</sub>)<sub>60</sub>, (SC<sub>12</sub>)<sub>60</sub>, (PET)<sub>60</sub>, (p-MBA)<sub>60</sub>, (F)<sub>60</sub>, (Cl)<sub>60</sub>, (Br)<sub>60</sub>, (I)<sub>60</sub>, (At)<sub>60</sub>, (Uus)<sub>60</sub> and (SC<sub>6</sub>H<sub>13</sub>)<sub>60</sub>] Nano Clusters as Anti-Cancer Nano Drugs. J Nanomater Mol Nanotechnol. 6: 3.

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Methylenecyclopentyl)-1H-Purin-6(9H)-One

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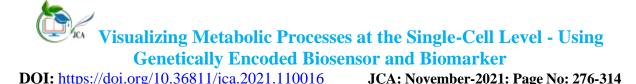
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