Checkpoint to Success
By:Emily Zhang, Sophomore majoring in Health and Humanity

A Passion for Science

Since the beginning of his high school career, Kevin Liu has always been interested in science. Although Kevin was born in the United States, he spent his childhood in both Taiwan and New Jersey, and eventually moved back to New Jersey during his high school years, attending Blair Academy in Blairstown. It was during this time that Kevin became highly interested in the field of science. "I believe that science is the basic denominator to all other fields of knowledge, including such fields such as art and business," states Liu, "and with this belief, I decided to pursue science, and essentially took every single science course that my high school offered." With newfound knowledge and a passion for science, Kevin was accepted into the University of Southern California as a part of the Class of 2013. However, due to his excellent academic achievements, Kevin will be graduating this spring.

Induced Pluripotent Stem Cells (IPS)

Currently, Kevin is a student researcher in Professor Francesca Marianai's stem cell research lab. Professor Francesca Marianai's current research focuses on a key characteristic of pluripotent stem cells that can aid in the identification of the successful transition of somatic cells to pluripotent stem cells, a type of stem cell known as induced pluripotent stem cells (IPS). By definition, pluripotent stem cells are cells that have the potential to differentiate into specialized cells in the human body. However, such stem cells cannot develop into a complete organism. The idea of IPS revolves around the concept that somatic cells, or regular cells in the human body, can be manipulated to become a pluripotent stem cell. Essentially, the process of the creation of IPS involves the reprogramming of somatic cells into stem cells by the addition of particular genes. Which genes are inserted into the somatic cell depends on what type of somatic cell the newly formed pluripotent cell is destined to become. This reprogrammed cell is then placed into specific environments that will allow the manipulated somatic cell to become any cell in the body. In this way, the controversial issues of embryonic stem cells can be eliminated, since these pluripotent cells are generated from the somatic cells of a fully grown human being. Professor Francesca Marianai's research hopes to further understand and support this process. Her research involves a special type of lysosomes found only in pluripotent stem cells. Such, the success of Professor Marianai's research will serve as a way to further identify

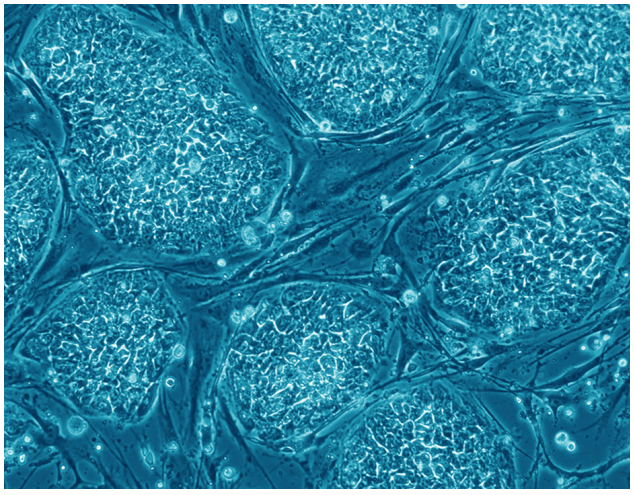

Figure 1 Pluripotent stem cells have the ability to become any cell in the human body. However, this type of stem cell cannot develop into a complete organism as embryonic stem cells can.
network.nature.com

the success or failure of newly produced IPS, much like a cell checkpoint in order to insure that the produced IPS are truly usable pluripotent cells.

Using Lysosomes as a marker to find IPS

In order to gain further understanding of the process of the development of IPS, Liu performs immunocytochemistry to confirm the presence of enlarged lysosomes in pluripotent cells. This is important due to the fact that professor Marianai's research data finds that enlarged lysosomes are only present in pluripotent stem cells. Therefore, the presence of such lysosomes can be used as an identifier for pluripotent stem cells. By confirming the presence of enlarged lysosomes in pluripotent stem cells through immunocytochemistry, Liu works to increase the supportive data for this hypothesis.

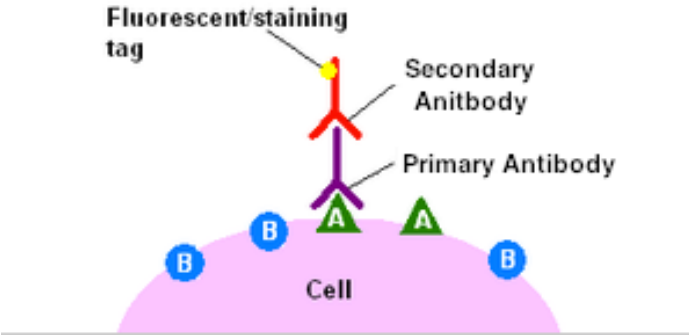

Figure 2 Immunocytochemistry refers to the process of detecting antigens (usually proteins) in cells of a tissue section by using the principle of certain antibodies binding specifically to certain types of antigens in biological tissues.

Immunocytochemistry is the process of specifically adding fluorescent colors to the cell or parts of a cell of interest. In the case of Professor Marianai's research, the target is the enlarged lysosomes found in pluripotent stem cells. Since enlarged lysosomes are hypothesized to be found only in pluripotent stem cells, the fluorescent markers used in the immunocytochemistry should only show up in pluripotent stem cells. When viewed under the microscope, the lysosomes of pluripotent cells put through the process of immunocytochemistry should glow, therefore making the lysosomes easy to detect. Liu uses a fluorescent marker known as lysotracker in order to detect enlarged lysosomes. To date, the research data collected by Liu supports Professor Marianai's hypothesis.

Results

Liu's results supports the hypothesis that enlarged lysosomes are found only in pluripotent stem cells. This information is critical because it can be used as a way to identify either the success or failure of IPS. If cells that have gone through the process of becoming an IPS do not show the presence of enlarged lysosomes, then it would be safe to suggest that the process failed. Such reprogrammed cells are not fit to be used in stem cell treatment for human patients. Similarly, if cells that go through the process of becoming an IPS do show the presence of enlarged lysosomes, then it can be suggested that the reprogramming of somatic cells has worked. Thus, Professor Marianai's research can become a tool for identification of pluripotent stem cells that can help researchers to further develop their understanding of the level of success of IPS, and how the process can be improved as a whole. The results can also have an impact on the development of stem cell use, which is important in medical treatment today, since the promise and benefits of stem cell use are extraordinary. "Stem cells hold the key to the treatment of many different diseases," states Liu, "and I believe that it is important to understand how they work and how they can be used in medicine." Indeed, stem cells give hope to the treatment of diseases such as Parkinson's disease, arthritis, heart disease, and spinal cord injury, just to name

a few. “It’s an important field of science to understand, and I am very happy to be able to be a part of such an amazing opportunity.”