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FIRST PERSON

First person – Nioosha Nekooie Marnany

First Person is a series of interviews with the first authors of a selection of papers published in Journal of Cell Science, helping researchers promote themselves alongside their papers. Nioosha Nekooie Marnany is first author on 'Glucose oxidation drives trunk neural crest cell development and fate', published in JCS. Nioosha conducted the research described in this article while a PhD student in Dr Sylvie Dufour and Dr Jean-Loup Duband's lab at Institut Mondor de Recherches Biomédicales, Université Paris-Est Créteil, France. Currently, she is a postdoc in the 'Institut de Biologie, Ecole Normale Supérieure (IBENS)' in Paris, at Hervé Le Hire's lab where she is working on the relationship between the exon junction complex (EJC) and metabolism.

Nioosha Nekooie Marnany

How would you explain the main findings of your paper in lay terms?

At the cellular level, the development of tissues and organs is tightly dependent on metabolism, a chemical process which converts nutrients into energy. Metabolism is key to stem cell fate decisions through roles in chromatin remodeling and regulation of gene expression. In vertebrate embryos, neural crest cells (NCCs) constitute a remarkable population of progenitor cells, which give rise to both neural and mesenchymal tissues. The developmental potential of NCCs requires metabolic environmental cues and epigenetic remodeling. Thus, we looked into a general view of roles of glucose metabolism in avian trunk NCCs. We uncovered that trunk NCCs display glucose oxidation as a prominent metabolic phenotype, in contrast to cranial NCCs, which instead rely on aerobic glycolysis. In addition, only one pathway downstream of glucose uptake is not sufficient for trunk NCC development. Indeed, glycolysis, oxidative phosphorylation (OXPHOS) and the pentose phosphate pathway are all mobilized and integrated for the coordinated execution of diverse cellular developmental programs through regulation of specific gene expression. This study also depicted the negative influence of an OXPHOS inhibitor (oligomycin) on embryonic development, especially of NCCs. Therefore, it might be important for society and health service systems to consider effects of antibiotic consumption (oligomycin) during pregnancy. In the absence of glucose, OXPHOS fueled by pyruvate failed to promote trunk NCC adaptation to environmental cues and affected cell fate decision making. These findings highlight the need for the trunk NCCs to utilize glucose to meet the high metabolic demands during development.

Were there any specific challenges associated with this project? If so, how did you overcome them?

Determination of threshold for both oxygen consumption rate (OCR) and extracellular acidic rate (ECAR) to produce a metabolic map describing all four metabolic phenotypes of cells (Quiescent, OXPHOS, glycolytic and energetic) was the main challenge for me. By running several Seahorse assay experiments, I could measure the difference in OCR of a single neural tube explant cultured in starved conditions (without glucose and pyruvate) versus in presence of one or both nutrients. This helped me to define the OCR threshold distinguishing OXPHOS from quiescent metabolic phenotypes in the quartered metabolic map. For defining the ECAR threshold, I referred to the fact that OCR/ECAR<4 is the main parameter characterizing the glycolytic group. Thus, by knowing the OCR threshold, I could define the ECAR border between cells with quiescent or glycolytic status.

Why did you choose Journal of Cell Science for your paper?

The Journal of Cell Science is a well known non-profit journal in basic sciences of cellular and developmental biology.

Have you had any significant mentors who have helped you beyond supervision in the lab? How was their guidance special?

I have been privileged to be the student of Dr Sylvie Dufour and Dr Jean-Loup Duband at the University of Paris. They encouraged me to get passionate about metabolism in embryonic development during my internship. I successfully graduated as a top student and have been awarded a 3-year grant to continue my PhD thesis work. Apart from my PIs, Dr Roberta Foresti and Dr Roberto Motterlini trained me to work with the Seahorse machine and helped me with analysis of results from Seahorse assays. Another mentor was Prof. Relaix who was extremely generous through offering provision of my salary after my PhD defense, which allowed me to cover all the experiments requested by the referees.

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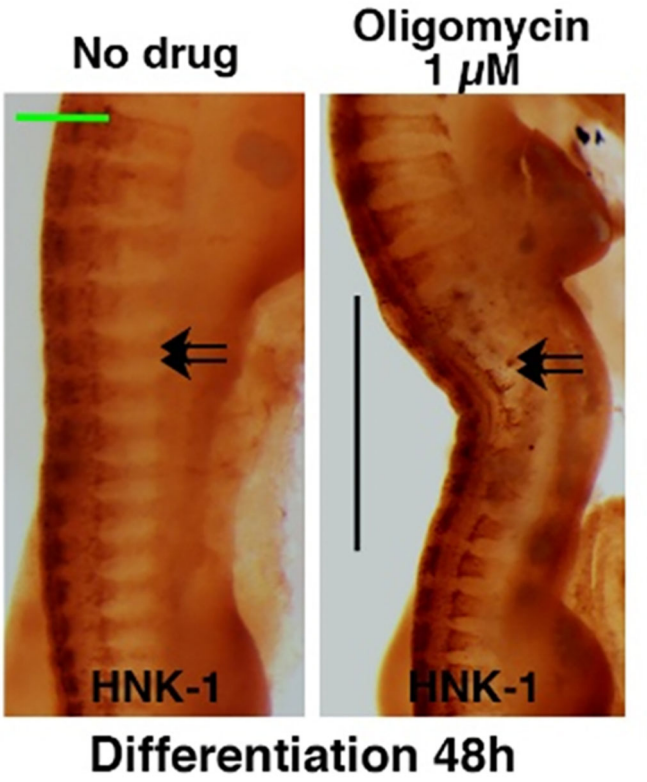

The long-term metabolic impact on embryonic development. The metabolic inhibitor (oligomycin) negatively affects the pattern of NCC derivatives.

What motivated you to pursue a career in science, and what have been the most interesting moments on the path that led you to where you are now?

I think that there is no more interesting job than being a scientist. It is extremely interesting to discover something that nobody else knows. My bachelor's degree in microbiology opened up an unknown world to me in figuring out the critical role of microorganisms in our survival on the planet. Next, I pursued my Master's degree in cellular and molecular biology at Shiraz University in Iran. After graduation, I worked as a research assistant in the Acquired Immunodeficiency Research Center (AIRC) in Esfahan, Iran, under supervision of Dr Roya Sherkat, studying the etiologies of the Mendelian susceptibility to mycobacterium disease (MSMD). In collaboration with Professor J.L. Casanova's lab at Necker Hospital in Paris, I succeeded in screening three newborn babies with MSMD mutations in either IL12 receptors or TYK2. Then, I decided to leave Iran and move to Europe for my second Master's degree in Tissue, Cellular and Genetic Biotherapies (BTCG) at the University of Paris in Creteil, France.

Who are your role models in science? Why?

All the scientists awarded the Nobel prize are my role models in science, because all of them marked a milestone toward improving human life. I believe that this is the most crucial and invaluable job in the world. As an Iranian, my dream of a research career was also inspired by ancient Persian physicians such as Avicenna and Zakariya Razi, who have made many impactful discoveries.

What's next for you?

What brightens my life horizon is research. I believe that the rest of my life will be filled with science and research to uncover unknown cellular or metabolic pathways, with the goal of service to human society.

Tell us something interesting about yourself that wouldn't be on your CV

An interesting point about myself is regarding my childhood dream. When I was a child, my dreams of research and inventions were inspired by the cartoon character Professor Baltazar. This animated inventor who generates new devices to resolve problems in his surroundings sparked my interest in science.

Reference

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