



## Editorial

## Understanding tumor cell metabolism: The secret to winning the war (burg) on cancer?

Many years ago, when Otto Warburg first discovered that cancer cells consume glucose at an extraordinarily high rate and preferentially utilize glycolysis under aerobic conditions, he likely had no idea how his discovery would shape cancer research in the years ahead. Over the past few years, Warburg's ideas about cancer metabolism have been resurrected and now comprise the basis of a variety of well-funded investigator-initiated research programs. In addition, Warburg's initial discoveries have forced scientists to think about metabolism in cancer cells in a variety of distinct ways. While Warburg's discoveries were focused on glucose metabolism, it is now widely appreciated that other types of metabolic activity are differentially regulated in cancer cells as well. The plethora of information on cancer cell metabolism that has been gleaned over these past few years has led investigators to consider the possibility that cancer cells could be therapeutically eliminated through metabolic modulation. This idea is driving research on metabolic regulation in cancer cells in fascinating new directions and has even caught the attention of pharmaceutical companies.

In this issue, we have attempted to cover a variety of distinct topics in the field of cancer metabolism and have solicited contributions from outstanding scientists across the field. The issue begins with a thorough review on the abundance of recent studies aimed at understanding the "Warburg effect" at a molecular level. Following this contribution, you will find a review on glutamine metabolism which discusses how glutamine consumption now rivals glucose metabolism as the most fundamental metabolic difference between normal and cancer cells. Recent studies have also revealed the possibility that certain metabolites may actually function as "oncometabolites" and this topic, as well as a discussion of metabolic enzymes in cancer cells, is covered comprehensively in the 3rd review of this issue. We then shift gears to cover one of the most important signaling pathways involved in the

regulation of metabolism in cancer cells: PGC-1 $\alpha$ . This contribution is followed by an examination of how tumor cells adapt to hypoxic environments through signaling from HIF-1. Our issue concludes with three reviews that focus on the connection between cancer cell metabolism and cell death. These reviews include a discussion of the complex role autophagy plays in tumorigenesis and an analysis of the recently described link between extracellular matrix attachment and metabolic regulation. Lastly, the possibility that *Xenopus* oocytes can serve as an outstanding model system for the study of cancer cell metabolism is discussed. We apologize for any colleagues' whose work we were not able to include due to space constraints. We hope you enjoy this fascinating collection of insights into cancer cell metabolism.

Zachary T. Schafer\*

Department of Biological Sciences, University of Notre Dame, 222 Galvin Life Science Center, Notre Dame, IN 46556, USA

Leta K. Nutt<sup>1</sup>

Department of Biochemistry, MS 340, St. Jude Children's Research Hospital, 262 Danny Thomas Place, Memphis, TN 38105, USA

\*Corresponding author. Tel.: +1 574 631 0875; fax: +1 574 631 7413.

E-mail addresses: [zschafe1@nd.edu](mailto:zschafe1@nd.edu) (Z.T. Schafer), [Leta.Nutt@STJUDE.ORG](mailto:Leta.Nutt@STJUDE.ORG) (L.K. Nutt)

<sup>1</sup> Tel.: +1 901 595 6530; fax: +1 901 525 8025.

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