



Review

Metabolic reprogramming in cancer: Unraveling the role of glutamine in tumorigenesis

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ABSTRACT

Increased glutaminolysis is now recognized as a key feature of the metabolic profile of cancer cells, along with increased aerobic glycolysis (the Warburg effect). In this review, we discuss the roles of glutamine in contributing to the core metabolism of proliferating cells by supporting energy production and biosynthesis. We address how oncogenes and tumor suppressors regulate glutamine metabolism and how cells coordinate glucose and glutamine as nutrient sources. Finally, we highlight the novel therapeutic and imaging applications that are emerging as a result of our improved understanding of the role of glutamine metabolism in cancer.

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Abbreviations: Gls, glutaminase; GDH, glutamate dehydrogenase; PC, pyruvate carboxylase; GFAT, fructose-6-phosphate amido-transferase; GSH, glutathione; GlcNAc, N-acetyl-D-glucosamine; PRPP, 5-phospho- α -D-ribose 1-pyrophosphate; AOA, aminooxyacetate; EAA, essential amino acids; DON, 6-diazo-5-oxo-L-norleucine; IDH, isocitrate dehydrogenase; 2-HG, 2-hydroxyglutarate; SDH, succinate dehydrogenase; FH, fumarate hydratase; PHD, prolyl hydroxylase; HIF-1 α , hypoxia inducible factor-1 α ; MRS, magnetic resonance spectroscopy; DNP, dynamic nuclear polarization; Got, glutamate: oxaloacetate transaminase; Gpt, glutamate: pyruvate transaminase.

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