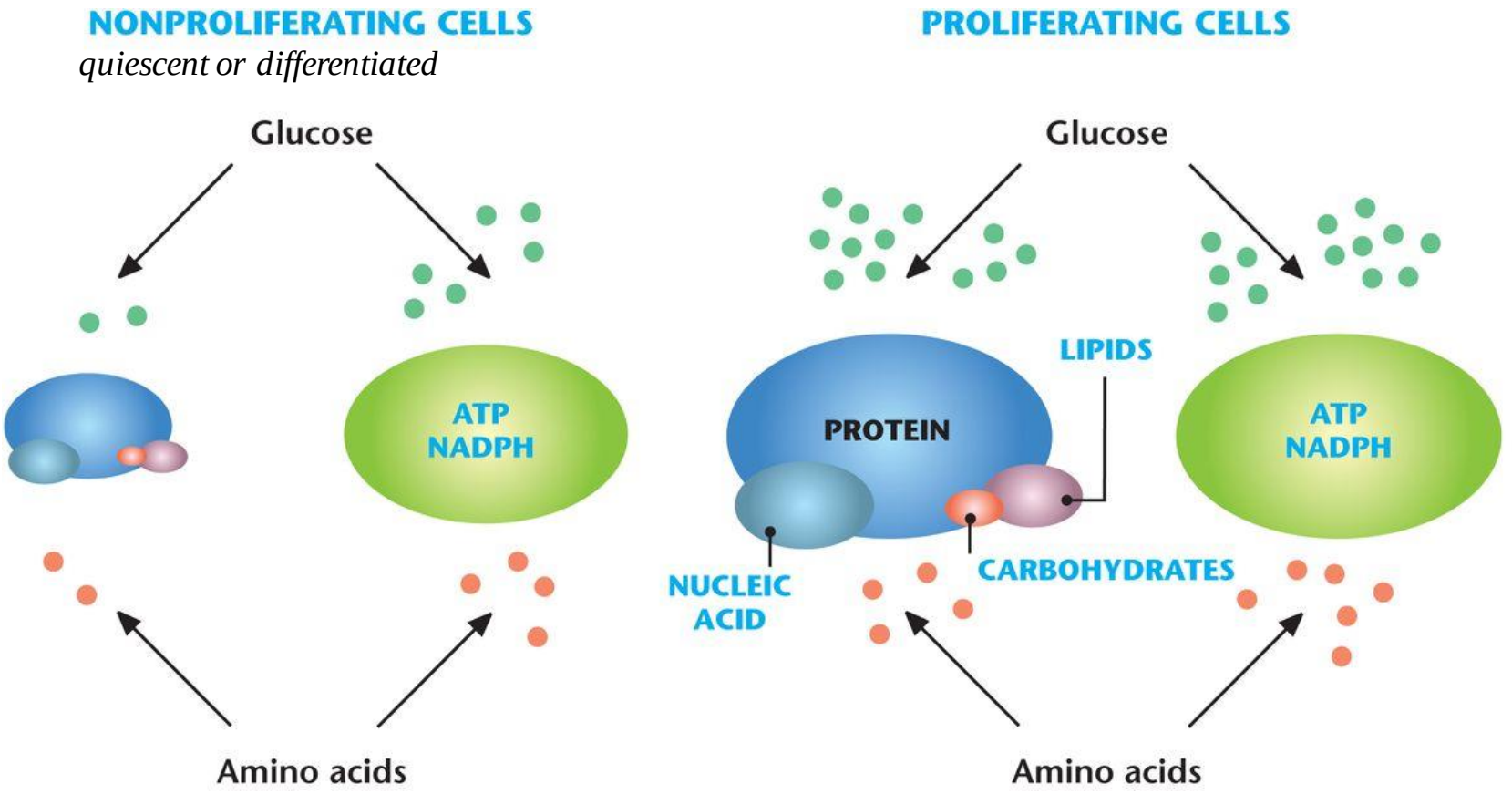
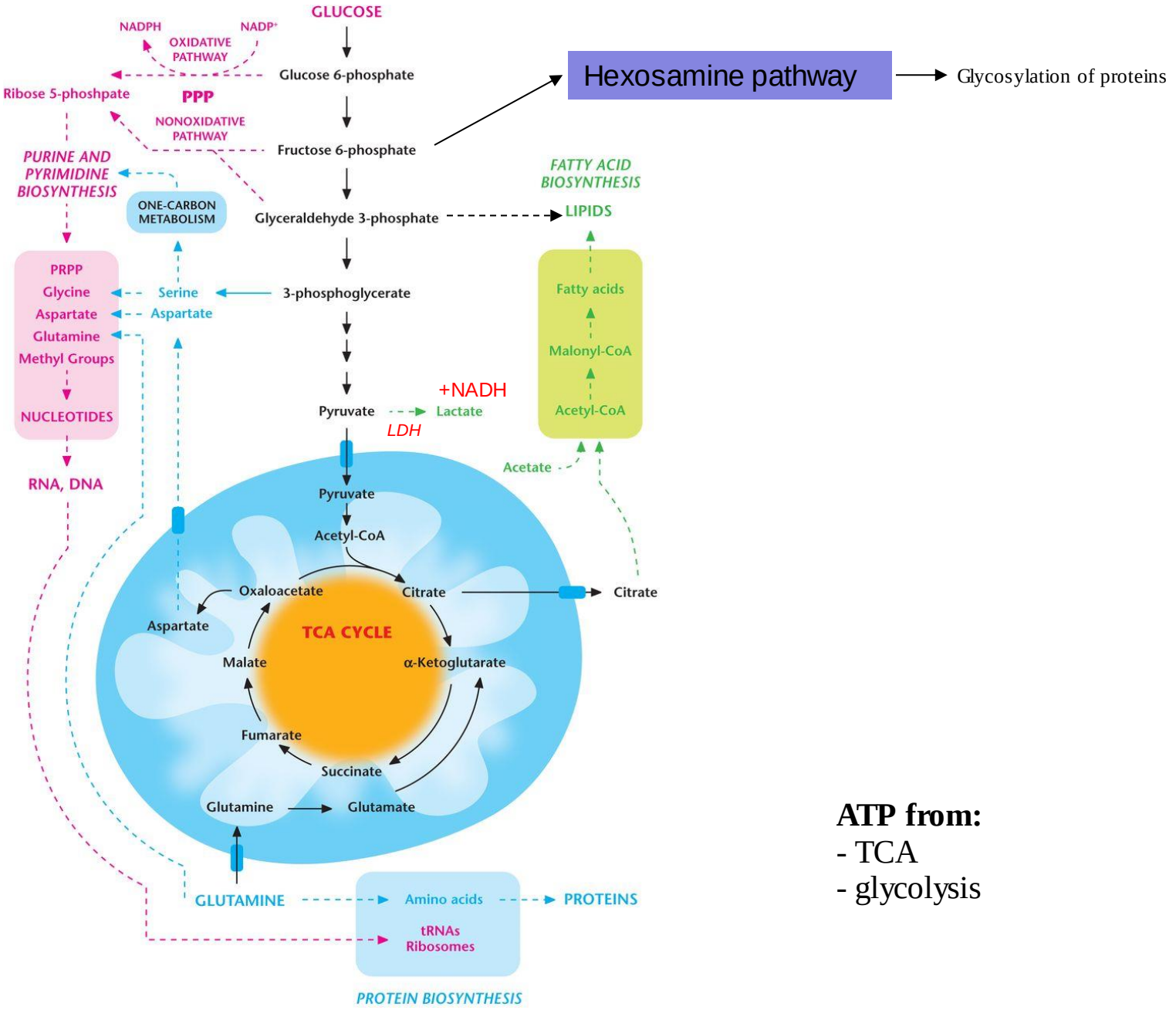
Proliferating versus nonproliferating cells have different metabolic needs.



Housekeeping functions

Housekeeping functions + anabolic reaction + antioxidant functions

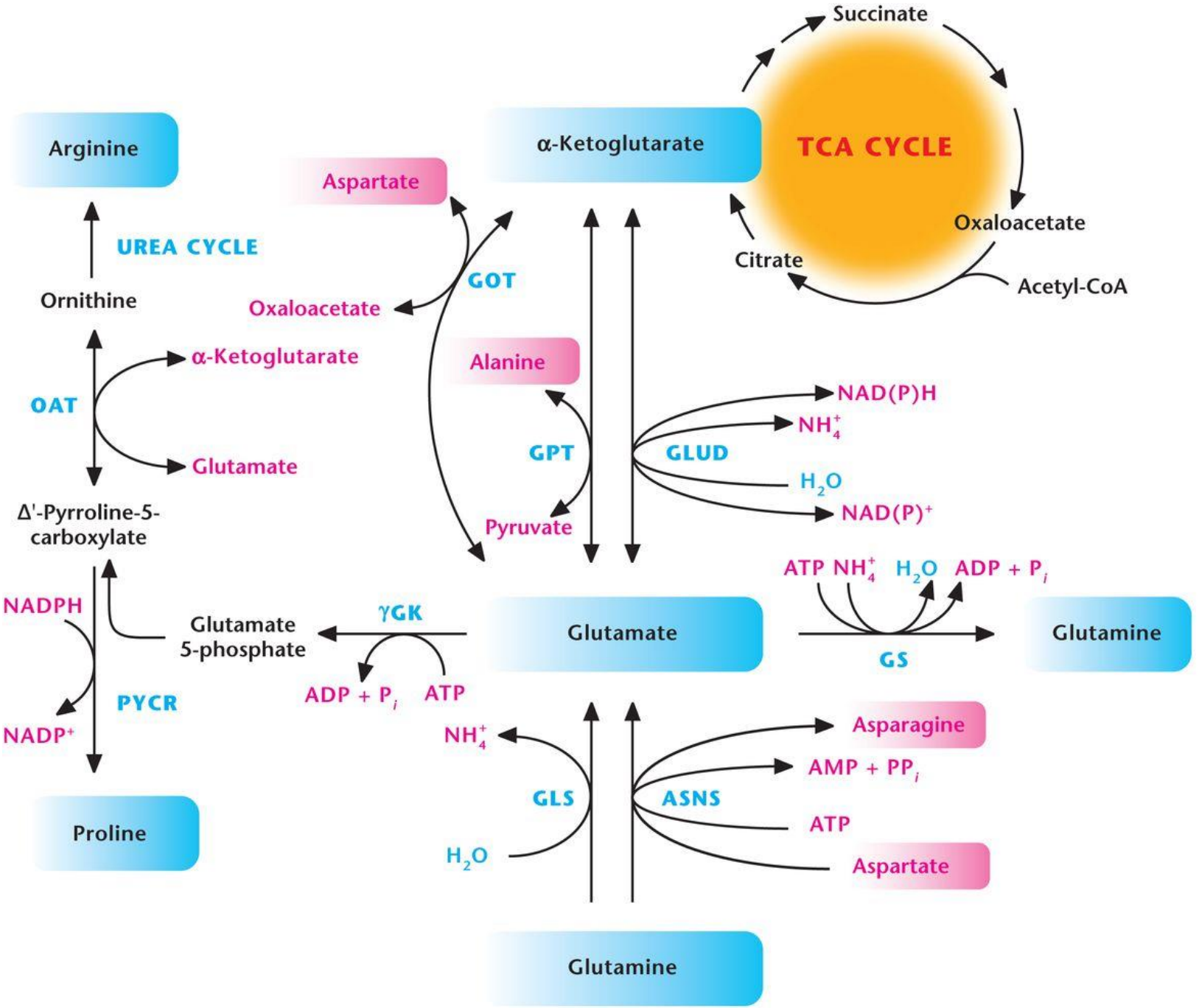
Proliferating cells require glycolysis (aerobic glycolysis) and mitochondrial metabolism



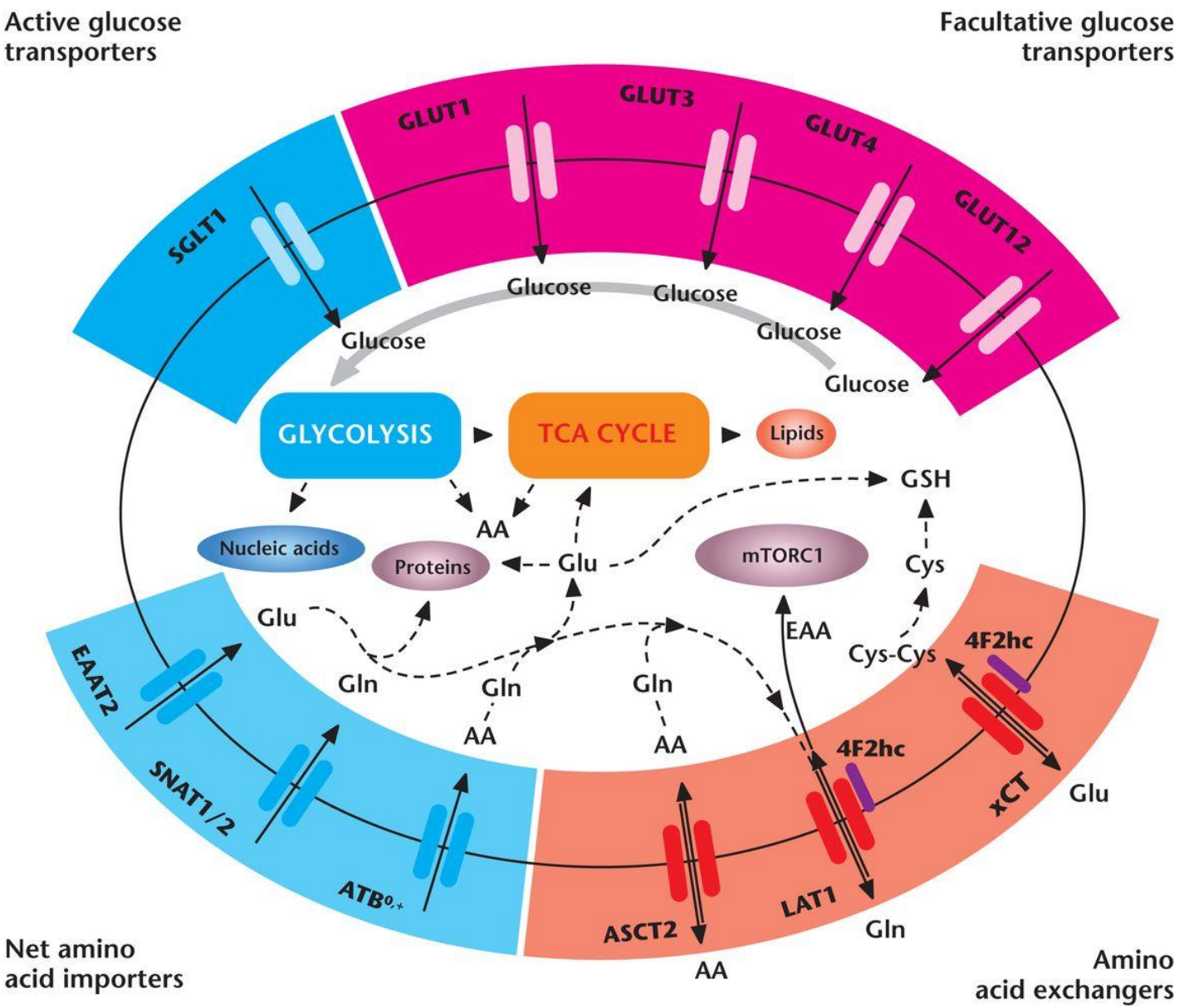
NADPH from:
- PPP
- One carbon metabolism
- IDH
- Malic enzyme

ATP from:
- TCA
- glycolysis

Glutamate generates multiple amino acids.



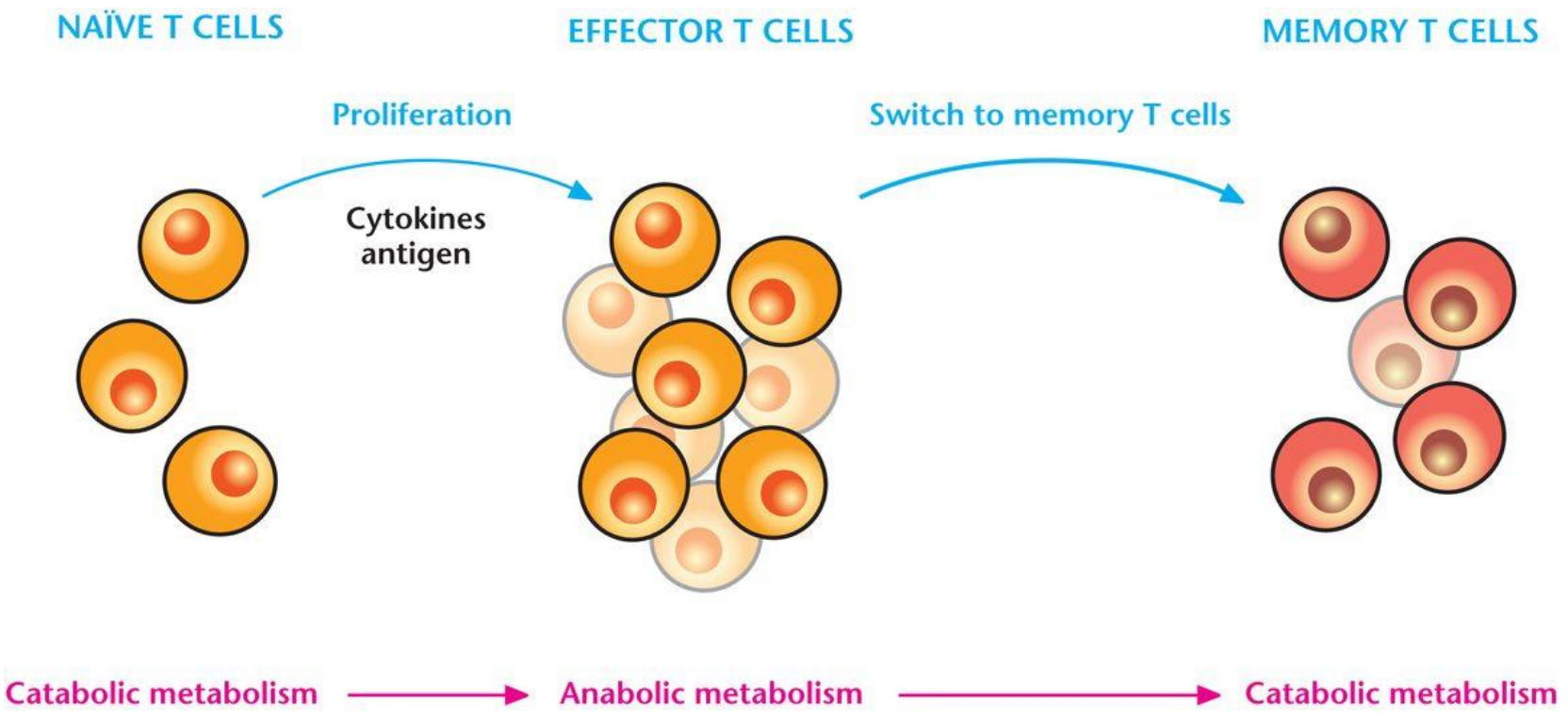
Cell proliferation requires nutrient transporters



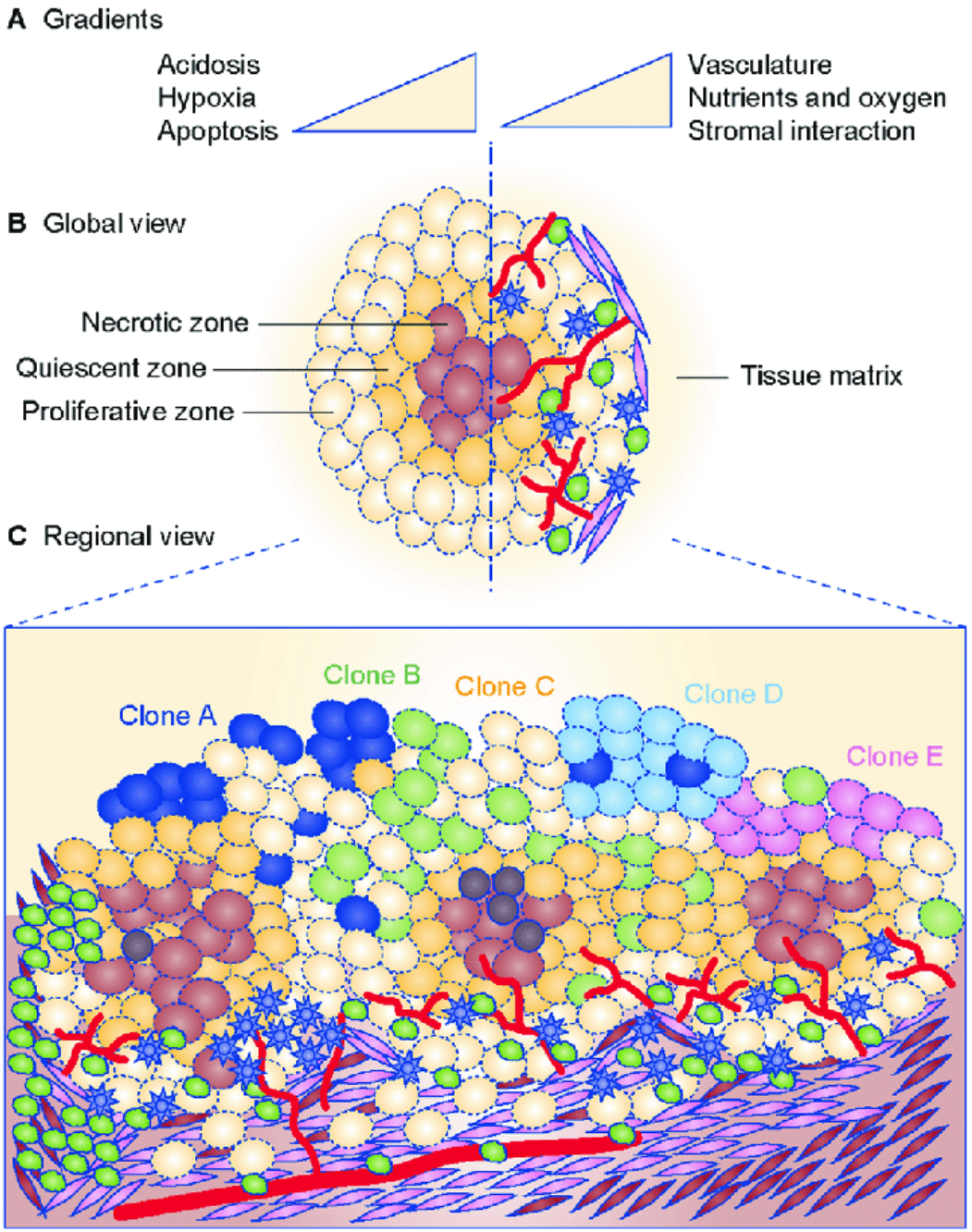
GLUTs: Glucose transporters

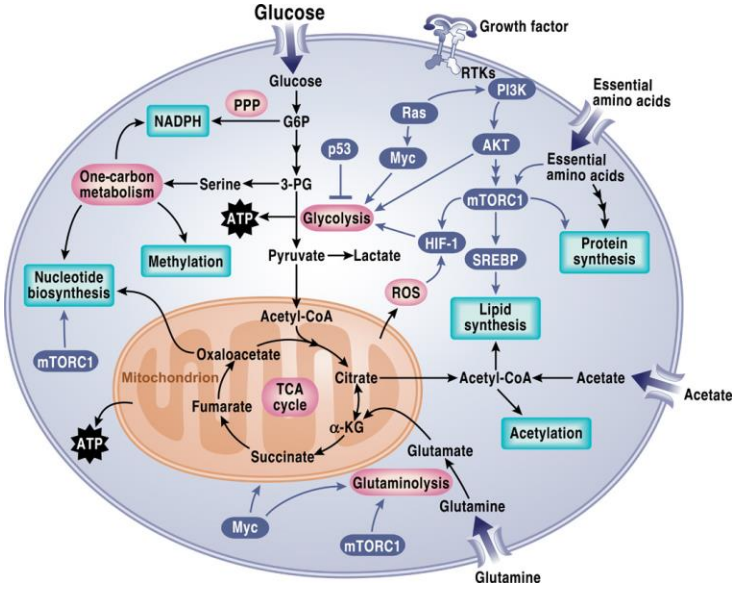
Name	Distribution	Notes
GLUT1	Is widely distributed in fetal tissues. In the adult, it is expressed at highest levels in erythrocytes and also in the endothelial cells of barrier tissues such as the blood–brain barrier. However, it is responsible for the low level of basal glucose uptake required to sustain respiration in all cells.	Levels in cell membranes are increased by reduced glucose levels and decreased by increased glucose levels. GLUT1 expression is upregulated in many tumors.
GLUT2	Is a bidirectional transporter, allowing glucose to flow in 2 directions. Is expressed by renal tubular cells, liver cells and pancreatic beta cells. It is also present in the basolateral membrane of the small intestine epithelium. Bidirectionality is required in liver cells to uptake glucose for glycolysis and glycogenesis, and release of glucose during gluconeogenesis. In pancreatic beta cells, free flowing glucose is required so that the intracellular environment of these cells can accurately gauge the serum glucose levels. All three monosaccharides (glucose, galactose, and fructose) are transported from the intestinal mucosal cell into the portal circulation by GLUT2.	Is a high-frequency and low-affinity isoform.[12]
GLUT3	Expressed mostly in neurons (where it is believed to be the main glucose transporter isoform), and in the placenta.	Is a high-affinity isoform, allowing it to transport even in times of low glucose concentrations.
GLUT4	Expressed in adipose tissues and striated muscle (skeletal muscle and cardiac muscle).	Is the insulin-regulated glucose transporter. Responsible for insulin-regulated glucose storage.
GLUT14	Expressed in testes	similarity to GLUT3 [12]

T cells engage in different types of metabolism depending on their functions

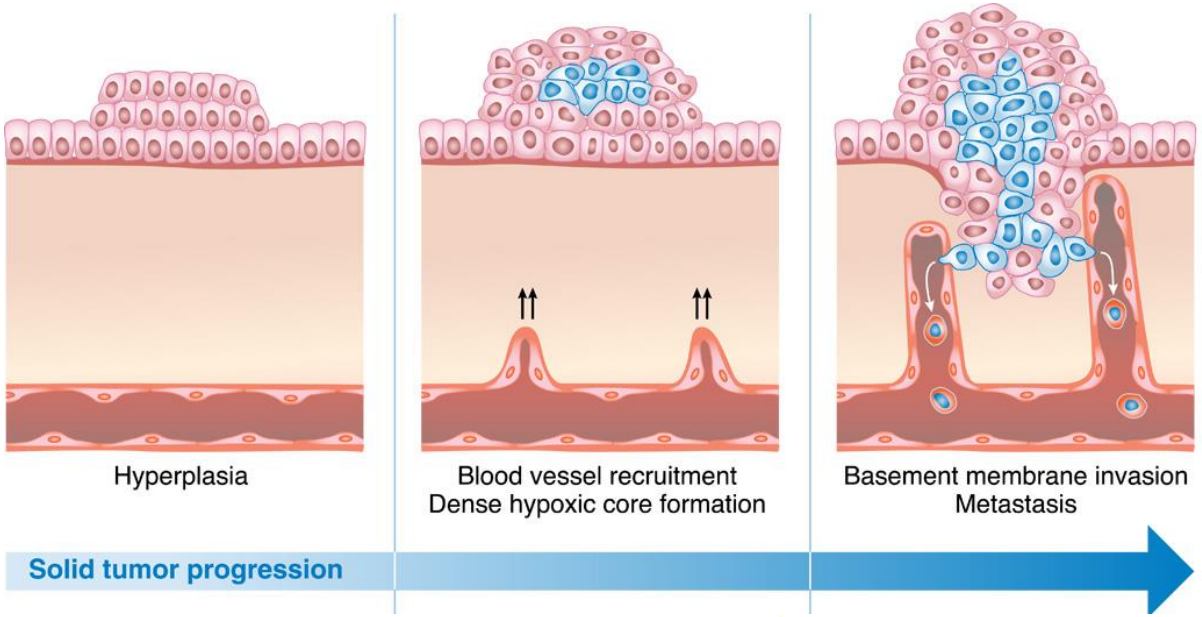


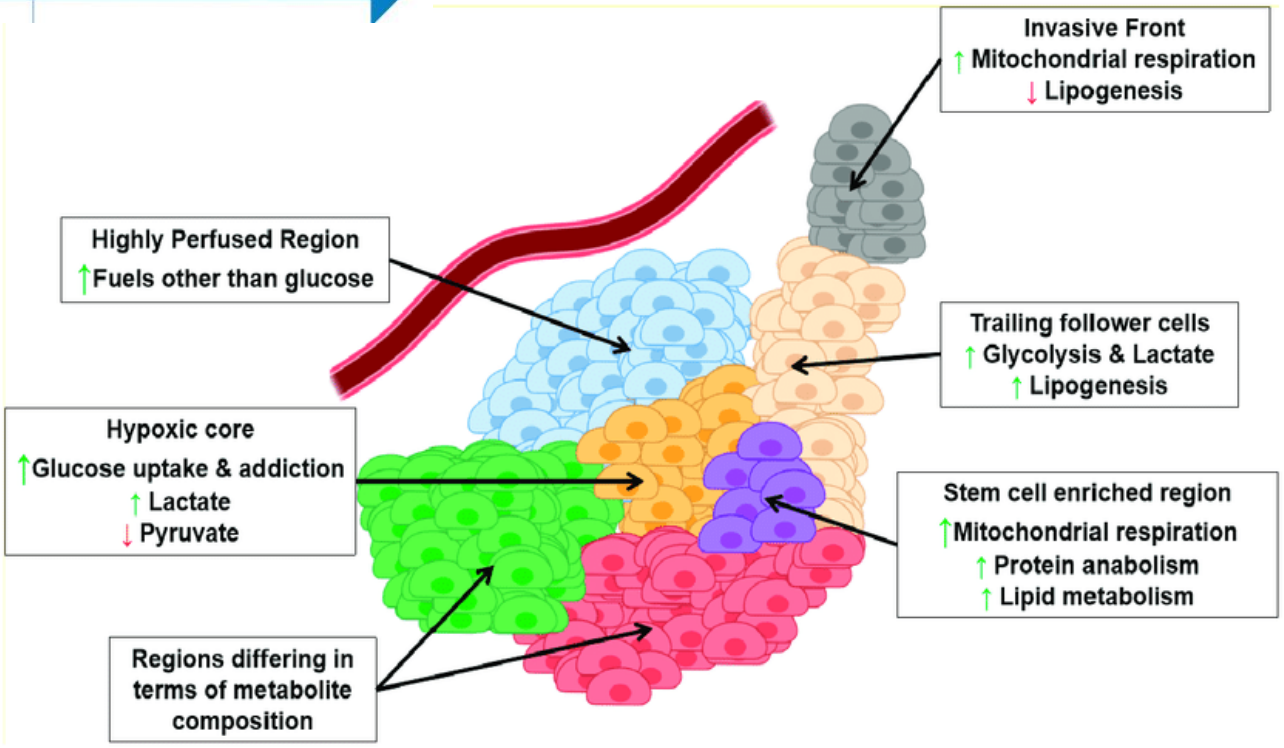
Cancer metabolism heterogeneity



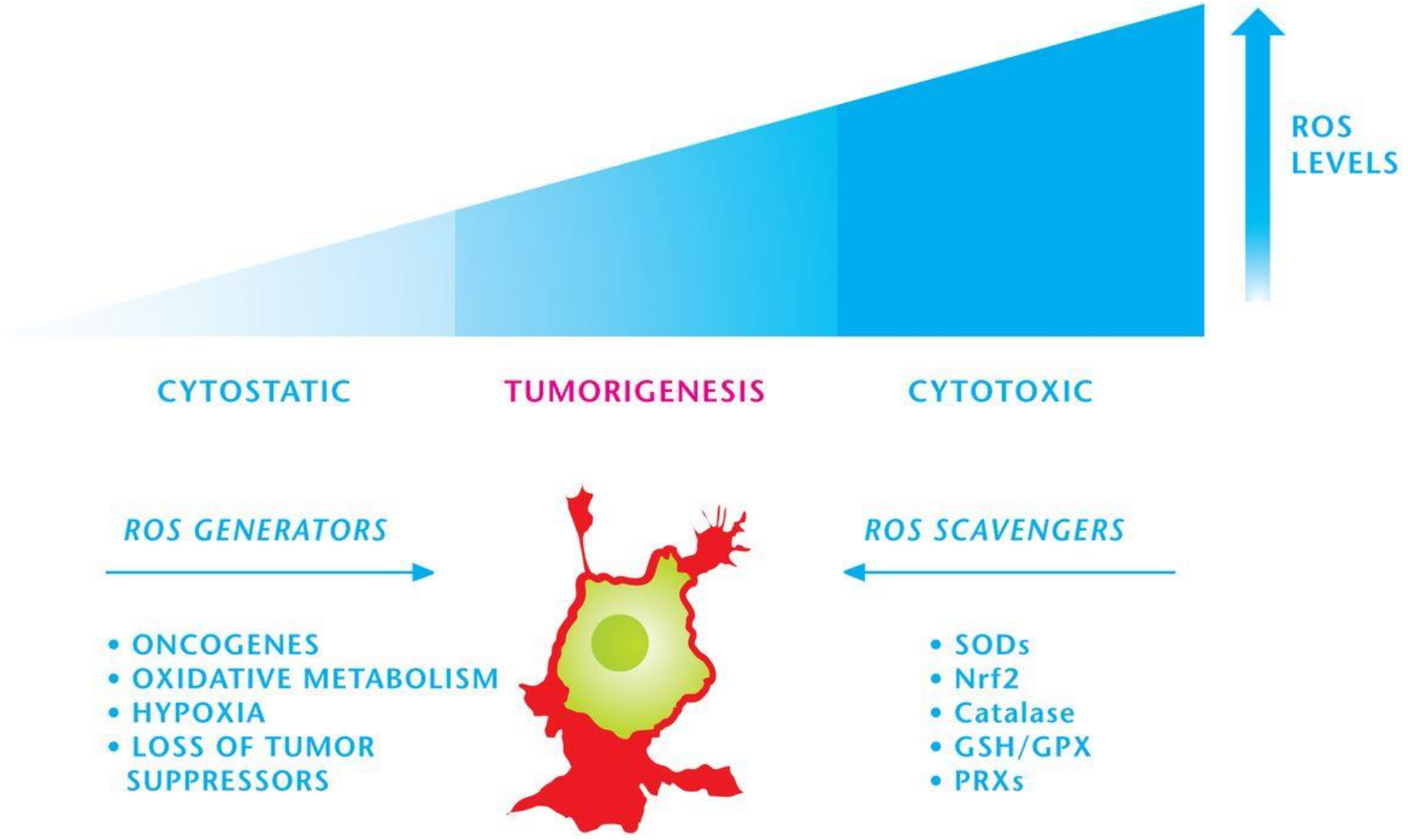


Other example cancer metabolism



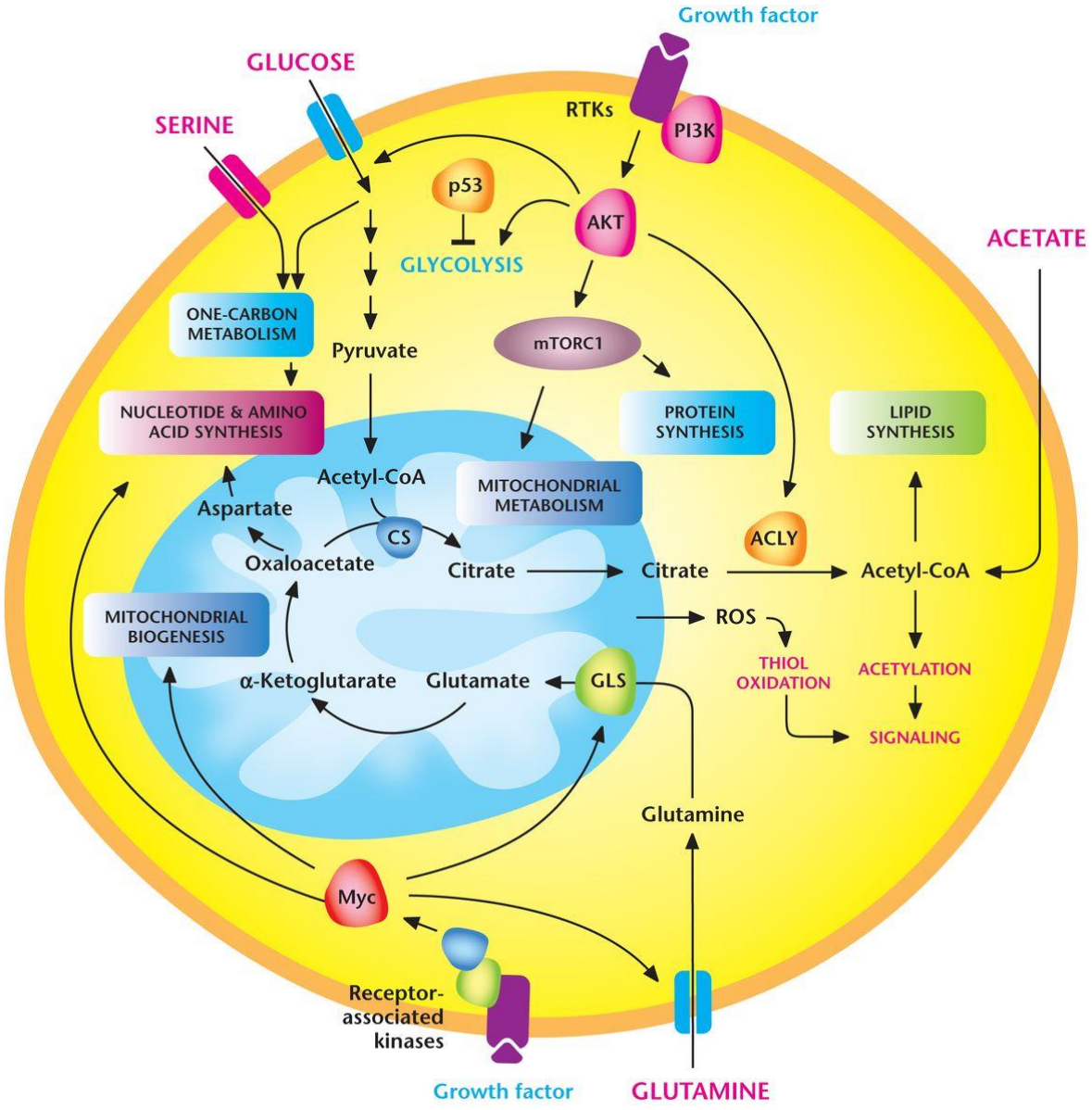


Cancer cells maintain redox balance

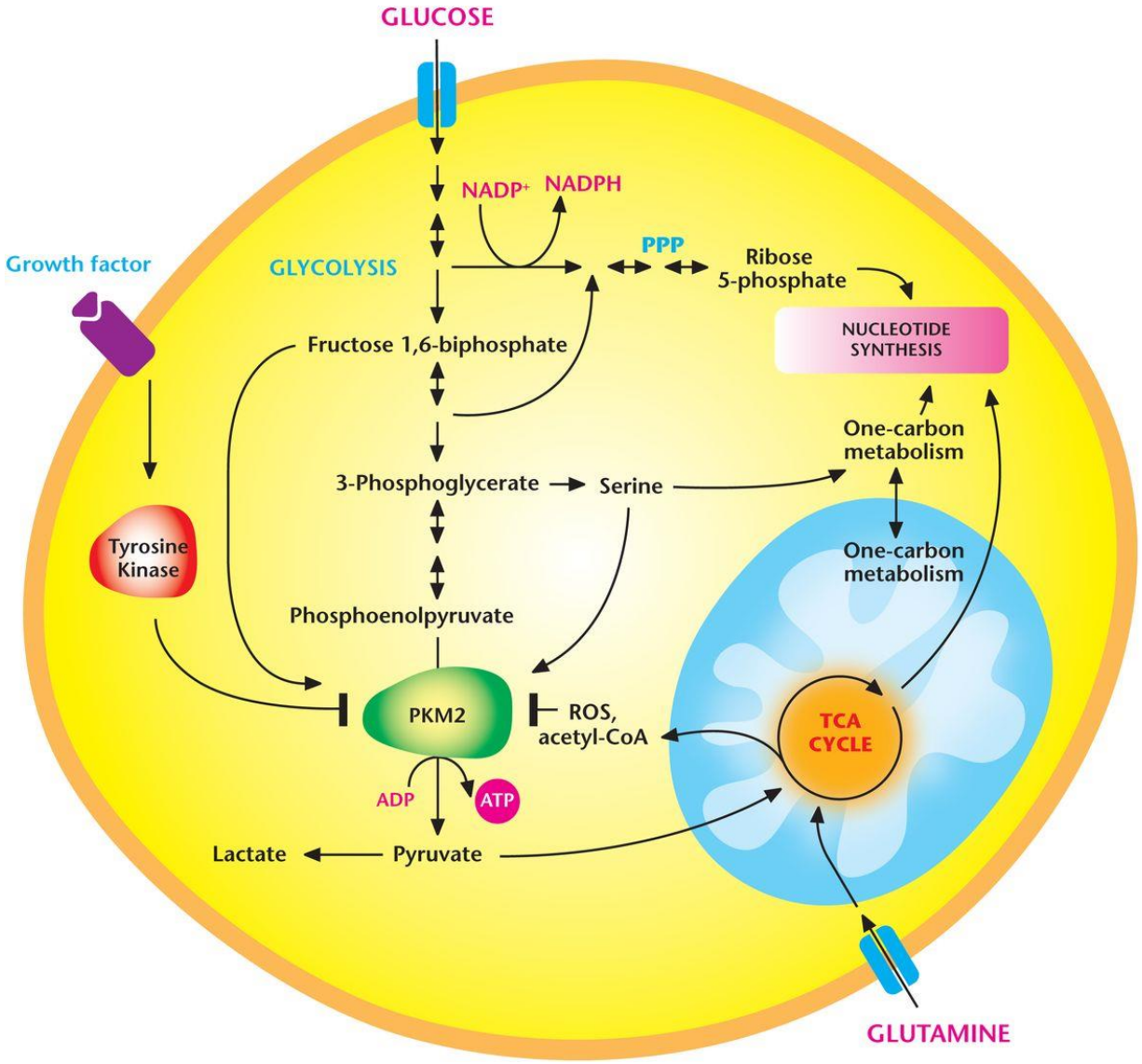


Signaling pathways that regulate cancer cell metabolism

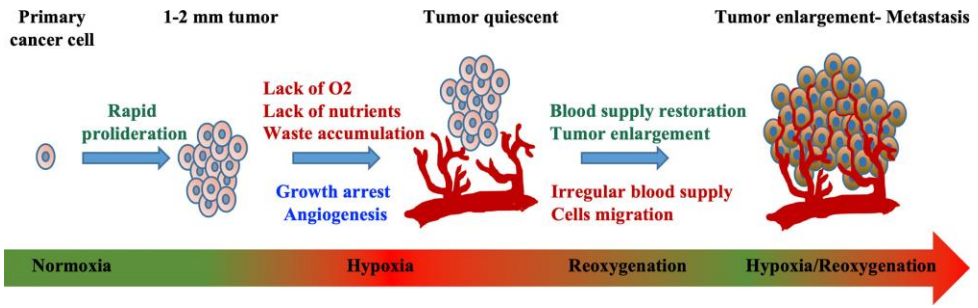
mTOR
Kras
Myc

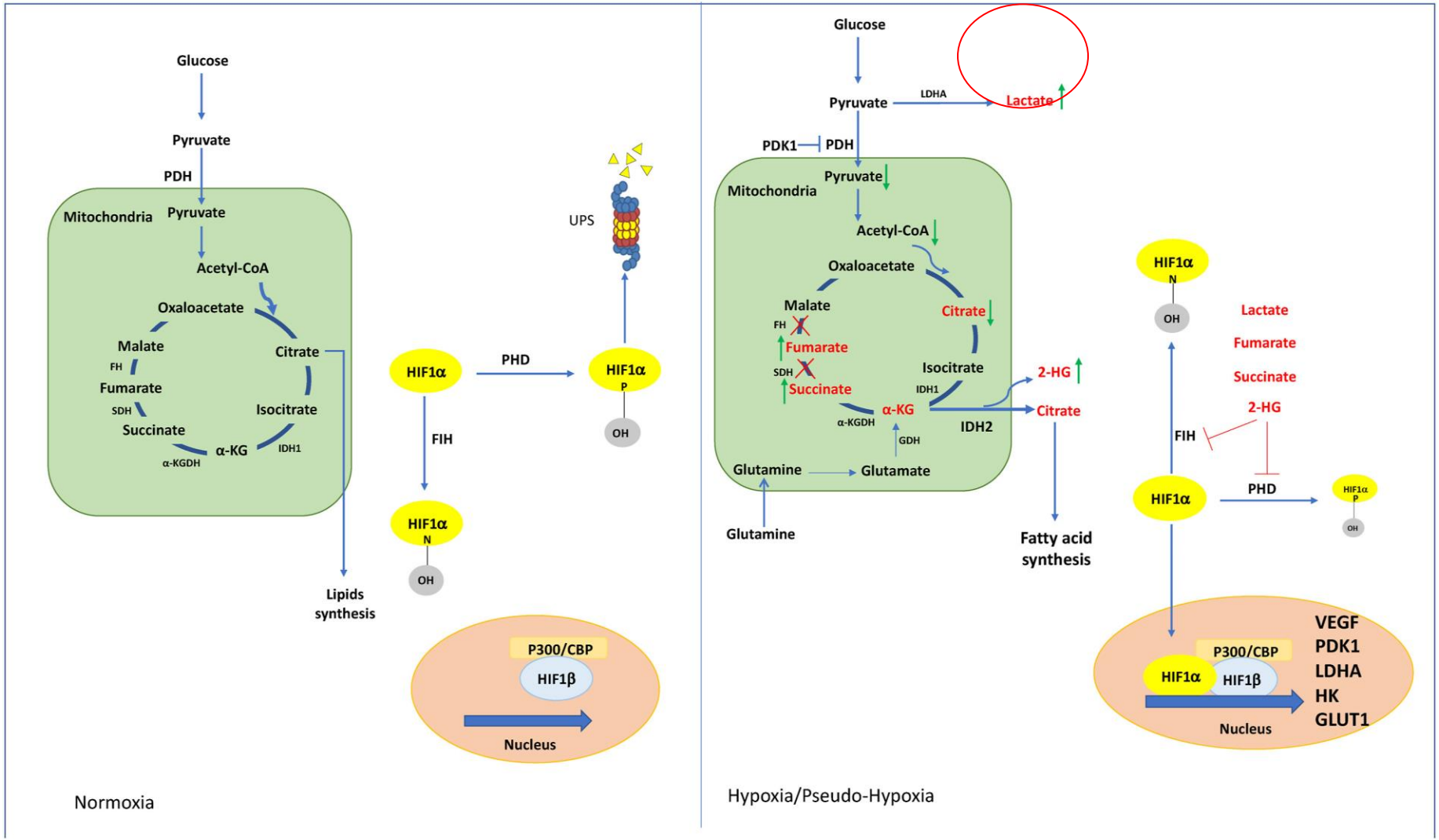


Proliferating cancer cells express PKM2 to regulate glycolysis

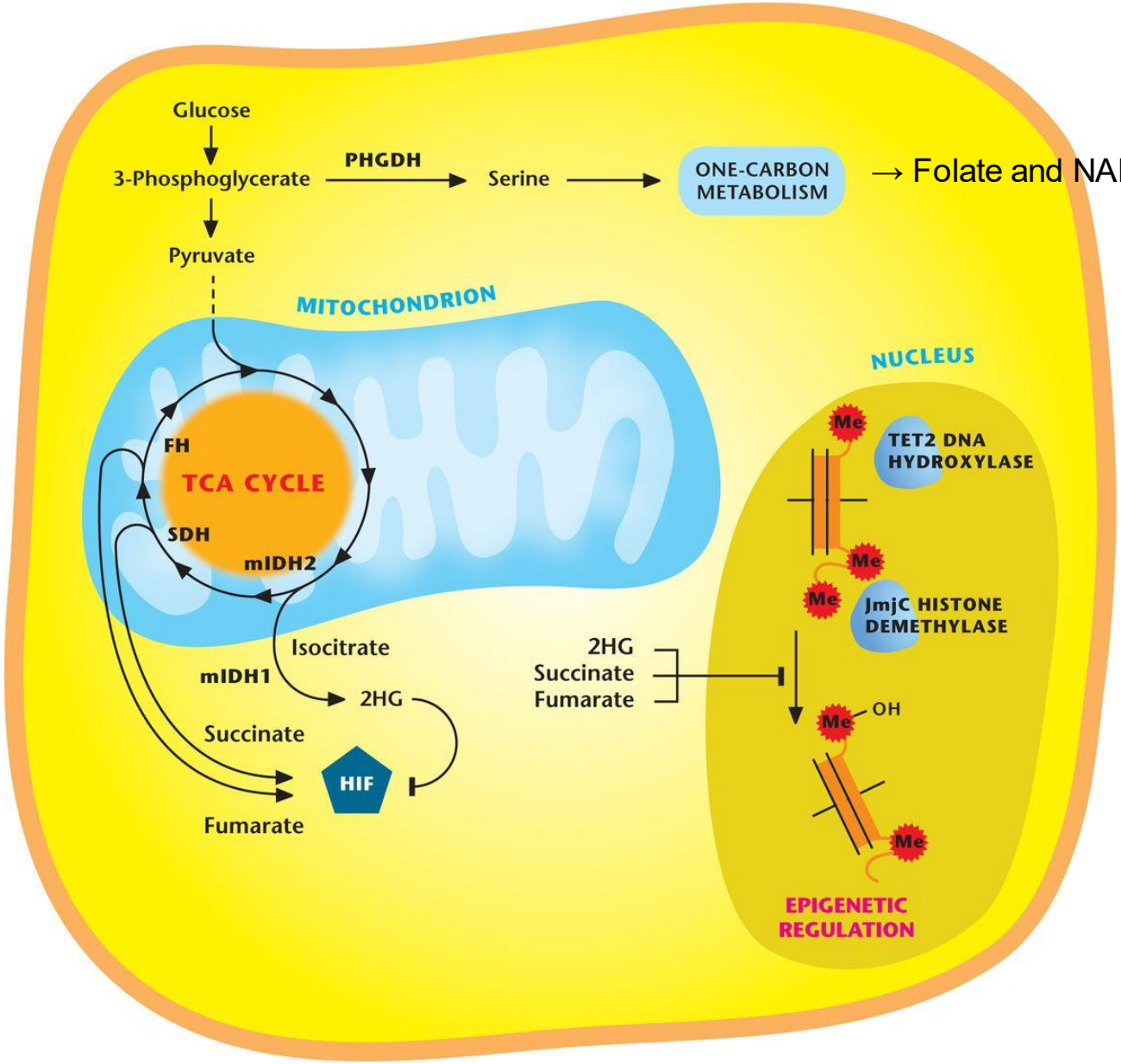


Metabolic adaptation in hypoxia

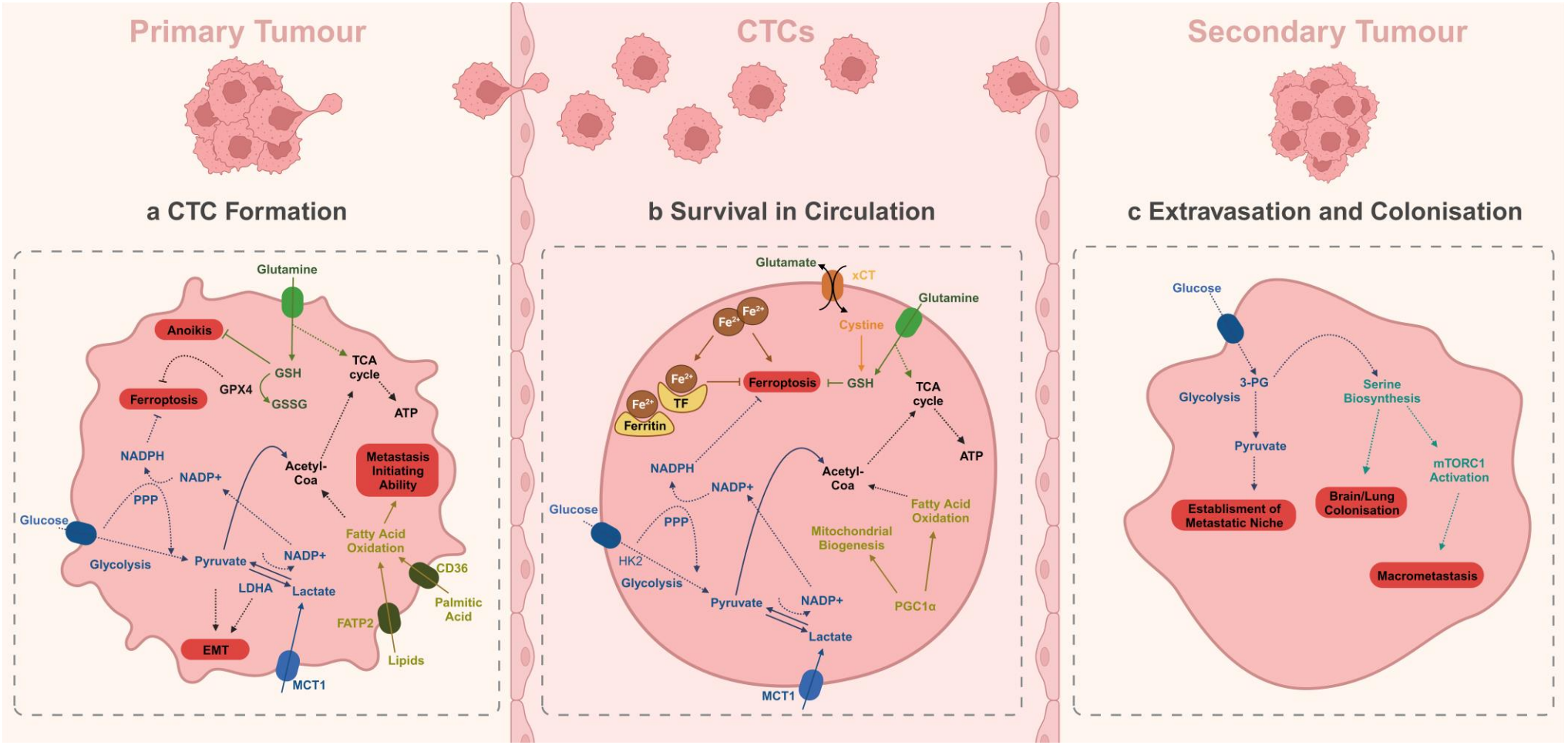




Alterations in certain metabolic enzymes drive cancer



Metabolism and cancer spreading



Metabolism can be targeted for cancer therapy

Repurposing the antidiabetic drug metformin to reduces tumorigenesis through multiple mechanisms