

AMP-activated protein kinase (AMPK)

AMPK is a key kinase that controls many cellular processes, particularly pathways involved in cellular energy status. AMPK is activated during metabolic stress, where it then can either activate energy-producing pathways or inhibit energy-consuming pathways. For these reasons, it has been termed a “fuel gauge” of the cell.

mTOR pathway

Mammalian target of rapamycin (mTOR) is a kinase that is a member of the phosphatidylinositol kinase family. The mTOR pathway functions as a key signaling pathway involved in the control of cell growth and proliferation. mTOR is activated in response to a number of upstream signaling molecules, including insulin and growth factors such as IGF-1 and IGF-2. The term mTOR arose since rapamycin was originally shown to inhibit the mTOR pathway.

PGC-1 α

Peroxisome proliferator-activated receptor- γ coactivator-1 α (PGC-1 α) is a transcription co-activator that plays a key role in the regulation of cellular energy metabolism. Activation of PGC-1 α increases mitochondrial biogenesis. In muscle PGC-1 α activation results in a muscle that is more oxidative and less glycolytic.

PPAR α

Peroxisome proliferator-activated receptor α (PPAR α) is a nuclear receptor involved in the transcriptional regulation of proteins. This includes the transcription

of key proteins involved in the control of fatty acid oxidation.

Proteasomes

Proteasomes are large protein complexes inside cells that function to degrade damaged proteins. Proteases in the proteasome degrade these proteins into short amino acid peptides.

SERCA2

Sarcoplasmic/endoplasmic reticulum calcium ATPase 2 (SERCA2) is the enzyme primarily responsible for the transport of calcium into intracellular sarcoplasmic reticulum (SR) and endoplasmic reticulum (ER). SR is an intracellular organelle in heart and skeletal muscle that stores calcium. During excitation-contraction coupling, release of calcium for the SR is the major source of calcium that initiates contraction. SERCA2 initiates relaxation of muscle by re-sequestering the calcium back up into the SR.

Ubiquitination

Ubiquitination is a process in cells in which proteins are “tagged” with a small protein called ubiquitin. This can lead to further ubiquitination of the protein, which then targets the protein for degradation by proteasomes.

Ubiquitin ligases

Ubiquitin ligases are enzymes in cells that catalyze the ubiquitination reaction. These ubiquitinated proteins are then targeted for degradation by proteasomes. As a result, ubiquitin ligases are key enzymes involved in cellular protein degradation. •