Oxidative phosphorylation

Mitochondria are often referred to as the “powerhouses” of the cell because they play a critical role in generating energy in the form of adenosine triphosphate (ATP) through a process called oxidative phosphorylation.

The cerebral metabolic rate of oxygen consumption (CMRO2) arises from neurons utilizing energy for two functions:

1) maintenance of cell integrity (homeostasis) which normally accounts for ≈ 40% of energy consumption, and 2) conduction of electrical impulses. The occlusion of an artery produces a central core of ischemic tissue where the CMRO2 is not met. The oxygen deficiency precludes aerobic glycolysis and oxidative phosphorylation. ATP production declines and cell homeostasis cannot be maintained, and within minutes irreversible cell death occurs; a so-called cerebral infarction. Surrounding this central core is the penumbra, where collateral flow (usually through leptomeningeal vessels) provides marginal oxygenation which may impair cellular function without immediate irreversible damage. Cells in the penumbra may remain viable for hours.