

11.127

Divide and Conquer Background Info

Introduction:

Welcome to Divide and Conquer! In this game, you'll learn how the life-sustaining processes in a cell work, as well as about some of the specific metabolic pathways that occur in a cell.

A metabolic pathway can be described as a sequence of chemical reactions that starts out with a set of chemicals and produces a new set of chemicals by the end; an enzyme is needed to lower the amount of energy needed to start the reaction, and energy is either gained or lost overall by the end of the reaction sequence. One can think of a metabolic pathway as similar to an assembly line: an assembly line starts out with a set of materials that go through several steps in the assembly line, and when the end of the assembly line is reached, a finished product is made. For a metabolic pathway, the set of materials that are used at the start, as well as those that are produced at the end, are called metabolites; in Divide and Conquer, examples of the metabolites used are proteins, lipids, glucose, and amino acids. These, plus all the other metabolites, are explained in more detail in the instructions.

In Divide and Conquer, there are several metabolic pathways that players can take part in, assuming they have the proper starting materials to do so. Below is the list of pathways, each describing the overall chemical reaction (using a formula and a general English description) and whether it uses or produces ATP (energy). Utilizing these pathways helps produce the necessary materials needed to win:

- **protein degradation:** proteins + ATP → amino acids (uses energy to break up proteins into the amino acids that make them up)
- **protein synthesis:** amino acids + ATP → protein or enzyme (uses energy to combine amino acids together to make proteins or enzymes)
- **amino acid metabolism:** amino acids + ATP → pyruvate (uses energy to convert amino acids to pyruvate)
- **glycolysis:** glucose → pyruvate + ATP (converts glucose to pyruvate, which produces energy)
- **fatty acid metabolism:** lipid + ATP → acetyl CoA (uses energy to convert a lipid to acetyl CoA)
- **pyruvate dehydrogenase:** pyruvate → ATP + acetyl CoA (converts pyruvate to acetyl CoA, producing energy in the process)
- **citric acid cycle and oxidative phosphorylation:** acetyl CoA → ATP (basically, converts acetyl CoA to energy)

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