Module 13 / Metabolic Pathways

State the major differences between catabolic and anabolic pathways.

Describe the common features of metabolic pathways.

Describe a linear, branched, and circular pathway.

Degradative, or **catabolic**, pathways generally produce energy. They usually begin with a number of different compounds, each of which represents a branch at the beginning of the pathway. These branches meet at a common intermediate, and the remaining section of the pathway is usually a linear segment. In this way a number of complex compounds are converted to a common intermediate, reducing the number of unique steps in the degradation of complex molecules.

Synthetic, or **anabolic**, pathways generally consume energy. They usually consist of an initial linear segment, followed by branching to complex compounds at the end of the pathway. This strategy allows the use of common simple starting materials for the synthesis of a number of complex molecules.

Common features of all metabolic pathways are:

1. They contain multiple intermediates (e.g. compounds A, B, C, ...), with small molecular differences between the intermediates.
2. Each step, or conversion between intermediates, is catalyzed by an enzyme (e.g. E_1).
3. The pathway is regulated to optimize the use of resources.

It is possible to reverse the direction of a metabolic pathways, depending on the needs of the organisms; a degradative pathway can become a synthetic one. Many of the enzymes that catalyze reactions in one direction can be easily reversed, and thus function in both pathways. A small number of steps utilize different enzymes in the forward versus the reverse direction. These enzymes are regulated in a coordinated fashion such that a pathway operates in only direction at time.

Pathways can be:

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A is the substrate for the first enzyme (E_1) in the pathway, B is the product of the enzyme. The final product of the pathways is compound D. Note that this pathway can be reversed, using compound D to eventually synthesize compound A.

An example of a branched pathway. The direction of the arrows indicate that this pathways is an anabolic, or synthetic, pathway where complex biomolecules D and F are synthesized using the simpler molecule A as starting material. In the reverse direction, the complex molecules D and F would be converted to A, releasing energy.

In this circular pathway, compound A is transformed to compound B by the enzyme 1. A series of transformations eventually convert B back to A, restarting the cycle.

did I get this

Metabolic pathways are usually reversible

- Yes
- No

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