

The 12 Key Intermediates

Slide 2 As we go through this course, remember that we are interested in understanding the similarities among apparently very different organisms. What do a bacterium and an elephant have in common? On a cellular level it turns out that they have quite a bit in common. One very important thing that all cells share is that they all use the same 12 key compounds in their metabolic pathways. Another way of saying this is that when any organism takes in “fuel”, that fuel is broken down in various steps to produce some of these 12 key compounds, and then those compounds are used as the building blocks to make all the macromolecules that all cells use.

Slide 3 The 12 key intermediates, as these compounds are sometimes called, will appear in many places as we delve into various aspects of biology. Memorizing chemical structures is not the main focus of this course, so just take a look at the names and the number of carbon atoms in each of these compounds.

Just to give you an idea of where some of these compounds are used in your body, glucose is the sugar that all cells break down for energy in a process called glycolysis, pyruvate is important in pyruvate oxidation, producing acetyl CoA which feeds into the citric acid cycle where alpha-ketoglutarate, succinyl CoA, and oxaloacetate are major players. We'll get to these names and cycles later in the course. What you need to understand from the beginning is that these processes, in whole or part, are used by every kind of organism on the planet.

Slide 4 So what's the point of talking about these compounds? Why are the same compounds found in all kinds of organisms from bacteria (where they were first recognized) to giant redwoods? The reason is that the same processes are found in all kinds of organisms. Even plants use many of the same cycles for their metabolic processes. The message here is that these processes, using and producing these 12 key intermediates, evolved early in the history of life and haven't been improved upon greatly. You've heard the expression, “If it works, don't fix it.” Metabolism works, and most mutations that alter it have not survived because they don't give organisms an advantage.

During the course of introductory biology (and every other kind of biology for that matter) keep looking for the similarities among organisms, and think about why those similarities exist. Keep your eye out for the 12 key intermediates, too – they pop up all over the place.