Diauxic growth

Bi-phasic or diauxic growth is often observed when microbes are grown in a chemically defined medium containing two sugars (for example glucose and lactose). Typically, the two growth stages are separated by an often lengthy phase of arrested growth, the so-called lag-phase. Diauxic growth is usually interpreted as an adaptation to maximise population growth in multi-nutrient environments. However, the lag-phase implies a substantial loss of growth during the switch-over. It therefore remains unexplained why the lag-phase is adaptive.

Diauxic growth is the phenomenon whereby a population of microbes, when presented with two carbon sources, exhibits bi-phasic exponential growth intermitted by a *lag-phase* of minimal growth.

*Escherichia coli* can use many different sugars. E. coli utilize glucose first. It would be wasteful to induce enzymes for using other sugars when glucose is available, because *E.coli* grows faster on glucose than on other carbon sources. **Catabolite repression** is a mechanism of global control that controls the use of carbon sources if more than one is present.

When cells of *E.coli* are grown in a medium that contains glucose, the synthesis of enzymes needed for the breakdown of other carbon sources (such as lactose or maltose) is repressed, even if other carbon sources are present. Thus, the presence of a favored carbon source represses the induction of pathways that catabolite other carbon sources. **Catabolite repression** is sometimes called “glucose effect” because glucose was the first substance shown to cause this response. But, catabolite repression is not always linked to glucose, the key point is that the favored substrate is better carbon and energy source than other available carbon sources. Thus, catabolite repression ensures that the organisms uses the best carbon and energy source first.

Why is catabolite repression called global control? In *E.coli* and other organisms for which glucose is the best energy source, catabolite repression prevents expression of most other catabolite operons as long as glucose is present.

One consequence of catabolite repression is that it may lead to two exponential growth phases, a situation called ***Diauxic growth.*** If two usable energy sources are available, the cells grow first on better source. Growth stops when the better source is depleted, but then following a lag period, it resumes on the other energy source. In diauxic growth, *E. coli* grow on a mixture of glucose and lactose. The cells grow more rapidly on glucose than on lactose. Although glucose and lactose are both excellent energy sources for *E. coli,* glucose is superior and growth is faster.

**