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Inhibition of ribosomal RNA synthesis without accumulation of guanosinetetraphosphate

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Abstract

Inhibition of ribosomal RNA synthesis

Alberghina, F. A. M. and E. Sturani. Inhibition of ribosomal RNA synthesis without accumulation of guanosinetetraphosphate.

The regulation of stable RNA (rRNA and tRNA) synthesis is a process highly integrated in the control of cellular growth, both in bacteria and in eucaryotic cells. In N. crassa, in a glucose to glycerol shift-down transition, during the diauxie lag which occurs after exhaustion of the glucose, a dissociation of macromolecular syntheses is observed: while DNA accumulation proceeds almost unaffected, and the rate of protein net synthesis is very little modified, RNA accumulation is strongly inhibited for at least two hours.

Experiments in which the incorporation from methionine $^{14}CH_3$ into phenol-extracted deacylated RNA was used to determine the rate of synthesis of stable RNA, show that the block of RNA accumulation is mainly due to inhibition of its synthesis. When the methyl-labeled, phenol-extracted RNA was analyzed by sedimentation on sucrose density gradients, it appeared that methylation of both stable RNA species is inhibited during the diauxie lag, but that methylation of rRNA is more strongly affected than is that of tRNA. These data strongly suggest that the syntheses of rRNA and tRNA can be dissociated in N. crassa, at least under conditions of unbalanced growth.

Guanosine 5'diphosphate, 2' (or 3') diphosphate (ppGpp) accumulates in bacteria in conditions of inhibition of RNA synthesis, and at the present it is considered a very likely mediator of the control of RNA synthesis in bacteria. Attempts to detect ppGpp accumulation in N. crassa during the described inhibition of rRNA synthesis were unsuccessful. Resolution by monodimensional and bidimensional thin layer chromatography of ^{32}P labeled nucleotides extracted both from exponential cells and from shifting-down cells, indicated that ppGpp is not present at the detection level of our experimental conditions: it is not present at a level above 0.5-1% of that of GTP; i.e., it is less than 2 pmoles/A_{450nm} unit.

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