

Radomska-Pyrek, A., A. Kruszewska, Z. Matysiak and T. Chojnacki. Cytidylyltransferases in cholineless mutant strains and in the wild type of *Neurospora crassa*.

It was found by Horowitz et al. (1945 J. Biol. Chem. 159:145) and Horowitz (1946 J. Biol. Chem. 162:413) that two choline-less mutant strains of *Neurospora crassa*, *chol-1* and *chol-2*, are deficient in some enzymes of the methylation pathway leading to lecithin biosynthesis. The alternative pathway of lecithin biosynthesis, from CDPcholine and 1,2-diglyceride, was discovered in The existence of the same pathway was revealed by in vitro experiments with the wild type strain of *N. crassa* (Radomska-Pyrek et al. 1969 Acta Biochim. Polon. 16:357), as the synthesis of various cytidine nucleotides from cytidine triphosphates and appropriate phosphobases was observed. The formation of cytidine nucleotides is connected in *N. crassa* with phospholipid biosynthesis, as the phospholipid fraction become significantly labeled during incubation of a homogenate with radioactive cytidine diphosphate aminoethanols (unpublished results).

rot liver by Kennedy and Weirs (1956 J. Biol. Chem. 222:196). experiments with the wild type strain of *N. crassa* (Radomska-Pyrek et al. 1969 Acta Biochim. Polon. 16:357), as the synthesis of various cytidine nucleotides from cytidine triphosphates and appropriate phosphobases was observed. The formation of cytidine nucleotides is connected in *N. crassa* with phospholipid biosynthesis, as the phospholipid fraction become significantly labeled during incubation of a homogenate with radioactive cytidine diphosphate aminoethanols (unpublished results).

The present paper concerns the activities of cytidylyltransferases in the *chol-1* and *chol-2* strains of *N. crassa* as compared to those of the wild type strain. The metabolic blocks in the two cholineless mutants and the enzymic reactions studied are shown in Figure 1.

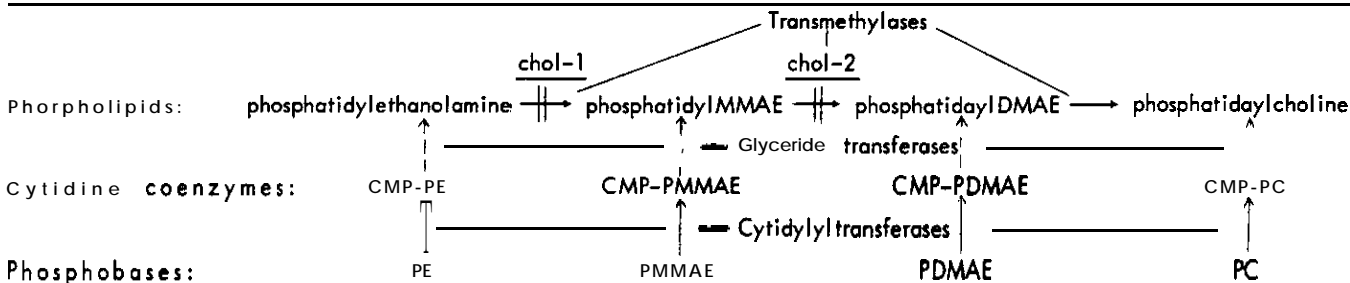


Figure 1: Two alternate pathways of lecithin (phosphatidylcholine) biosynthesis. The dashed arrows symbolize reactions which have not been studied yet in *Neurospora*. Abbreviations used: E = ethanolamine; MMAE = monomethylaminoethanol; DMAE = dimethylaminoethanol; C = choline. PE, PMMAE, PDMAE and PC are the phosphoric esters of the respective aminoethanols. CMP-PE, CMP-PMMAE, CMP-PDMAE and CMP-PC are the CMP derivatives of the respective aminoalcohol phosphates.

The following strains were used: wild type 74-OR-23-IA, *chol-1* (34484) a, *chol-2* (47904) A. Mycelia were grown at 30°C in liquid shake cultures in Vogel's minimal medium plus 1% sucrose. Where indicated (in table 1), this was supplemented with choline chloride (0.2 mmole/liter medium) or dimethylaminoethanol (0.1 mmole/liter medium). The culture of the *chol-2* strain in unsupplemented minimal medium was grown for 3 days. All other cultures were grown for 2 days. The methods of determination of the activity of cytidylyltransferases used in the present report were described previously (Radomska-Pyrek et al. 1969 *ibid.*)

Table 1. Cytidylyltransferase specific activities in 105,000 X g supernatants of the wild type, *chol-1* and *chol-2* strains cultivated in different media.

Substrate	wild type		<i>chol-1</i>		<i>chol-2</i>	
	minimal	min + cho	min + DMAE	min + chol	min + chol	minimal
PE	7.70	7.05	7.65	6.08	5.96	3.04
PMMAE	2.48	2.41	2.28	2.20	1.80	1.33
PDMAE	1.56	1.68	1.52	1.56	0.97	0.11
PC	2.84	2.92	4.04	4.12	3.20	0.17

Each entry in this table stands for nmoles of nucleotide formed per 1 mg protein/15min.

Table 1 shows the specific activities of cytidylyltransferases residing in the 105,000 X g supernatants of mutant strains and the wild type in a typical experiment. It is clear that in the case of the wild type strain no effect of choline in the culture medium was observed. The *chol-1* strain grown in the medium supplemented with choline or dimethylaminoethanolamine has PE- and PMMAE-cytidylyltransferase activities similar to those of the wild type, but the PC-cytidylyltransferase activity is slightly but consistently increased. The *chol-2* strain grown in unsupplemented medium

has about 50% of PE- and PMMAE-cytidylyltransferase activities and only 6% of PDMAE- and PC-cytidylyltransferase activities when compared with the wild type. The *chol-2* strain grown in the supplemented medium has PE- and PMMAE-cytidylyltransferase activities only slightly lowered, while the PC-cytidylyltransferase activity, similarly as in the *chol-1* strain, is slightly increased.

The results suggest that the limitation in amount of endogenous choline in the *chol-2* strain of *N. crassa* lowered markedly the activities of all cytidylyltransferases and, in particular, those after the block in the methylation pathway. The addition of exogenous choline for cultivation of this strain restored to a large extent the PE- and PMMAE-cytidylyltransferase activities and increased the activity of PC-cytidylyltransferase. Similar stimulation of PC-cytidylyltransferase activity was observed for the *chol-1* strain.

The present **results** indicate that the system studied is not repressed by the choline or **DMAE**, but on the **contrary**, that these **com-
pounds** could be the inducers of κ -^{and} **PMMAE-cytidylyltransferases**. ■ ■ ■ Institute of Biochemistry and Biophysics, Polish
Academy of Sciences, Warsaw 12, Rakowiecka 36, Poland.