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Circadian periodicity in acetate non-utilizing mutants

R. Halaban
State University of New York at Albany

J. F. Feldman
State University of New York at Albany

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Abstract

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In our efforts to understand the molecular basis of circadian rhythms, we are interested in whether or not deficiencies in certain metabolic pathways impair the function of the biological clock. We report here observations on the circadian rhythm of conidiation in the acetate non-utilizing mutants of Flavell and Fincham (1968 J. Bacteriol. 95: 1056). The enzyme deficiency in each of these mutants is as follows: acu-1, unknown; acu-3, isocitrate lyase; acu-5, acetyl-coenzyme A synthetase; acu-6, phosphoenolpyruvate carboxykinase; acu-7, α-ketoglutarate dehydrogenase. The rhythm was examined in growth tubes using Gray's medium (5% glucose, 0.7% yeast extract, 0.5% KH_2PO_4) as originally described by Brandt (1953 Mycologia 45: 194). A slow stream of air was passed through the tubes to enhance banding (Sargent and Kaltenborn 1972 Plant Physiol. 50: 171).

Table 1. Periodicity and growth rate on Gray's Medium in constant darkness at 25°C.

Strain	Period length in hrs.	Growth rate (mm/day)
acu-1	no conidiation	
acu-3	21.7 ± 2.5	68.4 ± 4.8
acu-5	no conidiation	
acu-6	21.1 ± 1.4	72.6 ± 4.7
acu-7	20.5 ± 2.2	95.5 ± 3.1
band	21.5 ± 0.7	47.7 ± 3.1
patch	21.4 ± 0.9	40.6 ± 4.4
wild type	1.8	115

Table 1 shows that the period length of rhythm in acu-3, acu-6, and acu-7 was not significantly different from that in band or patch, two strains whose circadian rhythm has been previously studied (Pittendrigh et al. 1959 Nature 184: 169; Sargent et al. 1966 Plant Physiol. 41: 1343). Since acu-1 and acu-5 did not conidiate under these conditions, they were also tested on Vogel's (1956 Microbial Genet. Bull. 13: 42) minimal medium with 2% sucrose and air: acu-1 failed to conidiate on this medium, too, but acu-5 did band with a periodicity of about 21 hours, not significantly different from band or patch. Therefore, we tentatively conclude that mutations in acetate utilization, the glyoxylate cycle, and one part of the Krebs cycle do not affect the periodicity of the circadian clock in Neurospora when such mutants are grown on media in which conidial banding is expressed.

- - - Department of Biological Sciences, State University of New York at Albany, Albany, New York, 12222.