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E. COLI MAP†

Location of the *metA* Gene on the Physical Map of *Escherichia coli*

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The *metA* gene of *Escherichia coli* catalyzes the conversion of homoserine to succinyl homoserine (3) and is located at 90.5 min on the *E. coli* genetic map (1). The gene has been cloned (11) and sequenced (5, 9), and its position on the physical map of the *E. coli* chromosome was determined by using a gene-mapping membrane kindly provided by Katsumi Isono. The membrane contained the 476-clone miniset that includes the entire *E. coli* genome (8).

The probe used was the 980-bp *Bam*HI-*Pvu*II fragment derived from plasmid pMA-6 containing the *metA* gene (9, 10). There was only one positive clone, no. 630 (5F12). As there was no hybridization with either of the two adjacent plaques, 629 (18C4) and 631 (6G10), it is possible to conclude that the *metA* gene is located at about kb 4294 on the physical map (8). This conclusion is in agreement with the physical map of the *metA* gene (9–11) and with the physical map of the region (Fig. 1).

In wild-type *E. coli* K-12 the *metA* gene is adjacent to the *rrnE* gene. The Kohara physical map is of strain W3110, which is characterized by a chromosomal inversion resulting from a recombination event between the *rrnE* (90.4 min) and *rrnD* (72.1 min) genes (6). Since the *metA* gene, which is the nearest neighbor of *rrnE* on the genetic map (1, 4), is separated from *rrnE* on the physical map of W3110 (kb 4294 and 3495, respectively [8; this paper]), it can be used to define the limits of the inversion. pMA-6 (*metA*) has two *Pvu*II restriction sites, 2.7 kb apart, followed by an *Eco*RI site. One of these *Pvu*II sites is in the middle of the *metA* gene and must be located at approximately kb 4294, thus placing the second *Pvu*II site at about kb 4291 and the *Eco*RI site at kb 4290. On the physical map of W3110 the next *Pvu*II site is at kb 4289, and this one originates from *rrnD* gene, which has been located at kb 4290 (2). Thus, the limit of the inversion can be defined between the *Eco*RI and *Pvu*II restriction sites located at about kb 4290 and 4289, respectively (Fig. 2). This point is close to the crossover point which was calculated from the overlapping cosmid clones of Knott et al. to be at kb 4287 (7).

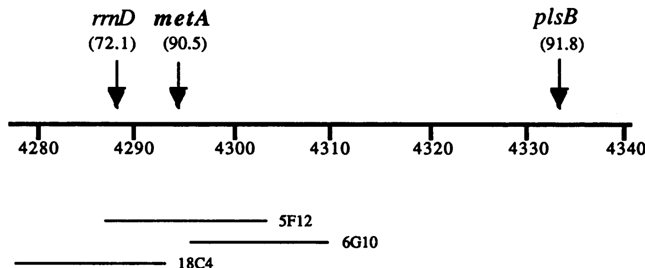

FIG. 1. Location of the *metA* gene on the physical map of *E. coli*. A portion of the digital *E. coli* restriction map (8) is shown with the relevant miniset clones.

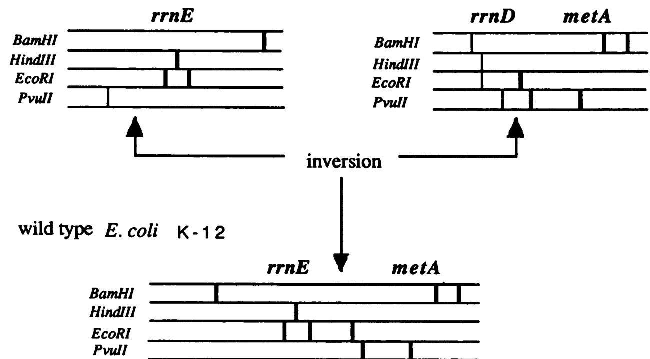

FIG. 2. Digital restriction map of the regions containing *metA*, *rrnE*, and *rrnD* of strain W3110 (8) and wild-type *E. coli* (4, 5, 9–11). The thick lines represent restriction sites that could be identified in the *metA* region, and the arrows indicate the presumed sites of the inversion.

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REFERENCES

1. **Bachmann, B. J.** 1990. Linkage map of *Escherichia coli* K-12, edition 8. Microbiol. Rev. **54:**130–197.
2. **Boros, I., A. Kiss, and P. Venetianer.** 1979. Physical map of the seven ribosomal RNA genes of *Escherichia coli*. Nucleic Acids Res. **6:**1817–1830.
3. **Cohen, G. N., and I. Saint-Girons.** 1987. Biosynthesis of threonine, lysine, and methionine, p. 429–444. *In* F. C. Neidhardt, J. L. Ingraham, K. B. Low, B. Magasanik, M. Schaechter, and

H. E. Umbarger (ed.), *Escherichia coli* and *Salmonella typhimurium*: cellular and molecular biology, vol. 1. American Society for Microbiology, Washington, D.C.

4. **de Boer, H. A., S. F. Gilbert, and M. Nomura.** 1989. DNA sequences of promoter regions for rRNA operons *rrnE* and *rrnA* in *E. coli*. Cell **17:**201–209.
5. **Duclos, B., J. C. Cortay, F. Bleicher, E. Z. Ron, C. Richaud, I. Saint-Girons, and A. J. Cozzone.** 1989. Nucleotide sequence of the *metA* gene encoding homoserine trans-succinylase in *Escherichia coli*. Nucleic Acids Res. **17:**2856.
6. **Hill, C. W., and B. W. Harnish.** 1981. Inversion between ribosomal RNA genes of *Escherichia coli*. Proc. Natl. Acad. Sci. USA **78:**7069–7072.
7. **Knott, V., D. J. Blake, and G. G. Brownlee.** 1989. Completion of the detailed restriction map of the *E. coli* genome by the isolation of overlapping cosmid clones. Nucleic Acids Res. **17:**5901–5912.
8. **Kohara, Y., K. Akiyama, and K. Isono.** 1987. The physical map of the whole *E. coli* chromosome: application of a new strategy for rapid analysis and sorting of a large genomic library. Cell **50:**495–508.
9. **Michaeli, S., M. Mevarech, and E. Z. Ron.** 1984. Regulatory region of the *metA* gene of *Escherichia coli* K-12. J. Bacteriol. **160:**1158–1162.
10. **Michaeli, S., and E. Z. Ron.** 1984. Expression of the *metA* gene of *Escherichia coli*. FEMS Lett. **23:**125–129.
11. **Michaeli, S., E. Z. Ron, and G. Cohen.** 1981. Construction and physical mapping of plasmids containing the *metA* gene of *Escherichia coli* K-12. Mol. Gen. Genet. **182:**349–354.