Science Citation Classic

Hirota, Y: Effect of acridine dyes on mating type in E. coli. Proc. Natl. Acad. Sci. USA. 46, 57-64, 1960. Department of Genetics, Stanford University, Medical Center, Palo Alto, California.

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ABSTRACT: Acridine dyes irreversibly convert F+(male) clones of E. coli into stable F-(female) forms directly without selective growth. Hfr(male) clones are resistant to the action. These results are accounted for by the dual nature of F, plasmid F and chromosomal F.

Text:

This paper is an extension of my two previous publications 1, 2, that was done when I had just started graduate research in Professor Hideo Kikkawa's Laboratory at the Department of Biology, Faculty of Science, University of Osaka, Japan. In these papers, I reported my discovery of an efficient genetic alteration of E. coli from F+(male) to F-(female): When F+ was grown under the presence of either cobaltus salt or acridine dye in the medium, large fraction of F+ bacteria was converted to F- (This phenomenon is known as "F elimination", "disinfection of F," or "acridine curing"). I correctly interpreted this phenomenon as follows: F (sex-factor) in F+ bacteria is an extra-chromosomal state replicating

autonomously, and these reagents specifically inhibits autonomous replication of extra-chromosomal F but does not inhibits chromosomal DNA replication of the host (E. coli). Upon growth of the host, F is diluted out from the F+ cell and F- bacteria evolve. However, alternative explanation was also possible: that is, spontaneously arized F- by rare mutational event is selected by these reagents. I needed to prove my hypothesis was correct one, however I did not have enough experience to achieve my task, and I desired to receive guidance of Professor Joshua Lederberg at the University of Wisconsin to prove my hypothesis. Upon my request, he warmly accepted me and taught me how to test my hypothesis by his elegant methods and I was able to prove my hypothesis. On 1959, Professor Lederberg moved to Stanford University, and I followed him. He communicated my work to the January 1960 issue of the Proceedings. 3. By this work, I received the degree of Doctor of Science at the University of Osaka. A friend of mine puts my discovery to the previous great achievements in E. coli genetics by Professors Lederberg, Jacob and Wollman, and said he: an American discovered sexuality of bacteria, two French men enjoyed the bacterial sex and a Japanese made bacteria enjoy two sexes. My thesis work became a Citation Classic due to the nature of the work. It describes a simple method for strain construction of E. coli which organism has extensively been used in the fields of Genetics, Microbiology, Molecular Biology and Recombinant DNA Technology. Also it was the first clear demonstration for the existence of bacterial extra-chromosomal factor which was named as plasmid, 4. Since publication of my work, acridine curing technique has been applied to wide varieties of bacterial species to test for the presence or the absence of the other plasmid. In addition, because of its description of the methods to

demonstrate direct conversion of F+ to F- without selective growth, and often it has been cited in the text books of bacterial genetics.

1. Hirota, Y. Artificial elimination of the F factor in Bact. coli K12. Naure, 178, 92, 1956.
2. Hirota, Y. and Iijima, T. Acriflavine as an effective agent for eliminating F factor in Escherichia coli K12. Nature, 180, 655-656, 1957.
3. Hirota, Y. The effect of acridine dyes on mating type in E. coli. Proc. Nat. Acad. Sci. USA. 46, 57-64, 1960.
4. Lederberg, J. Cell genetics and hereditary synbiosis., Physiol. Rev. 32, 403-430, 1952.