

HIROSHI OGAWARA : Antibiotic Resistance in Pathogenic and Producing Bacteria,
with Special Reference to β -Lactam Antibiotics.

Second Department of Biochemistry, Meiji College of Pharmacy, 35-23, Nozawa-1,
Setagaya-ku, Tokyo 154,
Japan

MICROBIOLOCAL REVIEWS, Vol. 45, 591-619, 1981.

INTRODUCTION	591
PRODUCTION OF β -LACTAM ANTIBIOTICS.....	591
MODE OF ACTION OF β -LACTAM ANTIBIOTICS.....	593
RESISTANCE MECHANISMS IN PATHOGENIC BACTERIA.....	597
RESISTANCE MECHANISMS IN STREPTOMYCES.....	604
CONCLUSION.....	610
LITERATURE CITED.....	610

INTRODUCTION

Antibiotic research is one of the most exciting fields in chemotherapy. As physicians and users of antibiotics, we demand that antibiotics be active against various pathogenic microorganisms with no harmful action upon the host. It therefore is expected that the pathogenic microorganisms will be susceptible to these antibiotics. However, as a natural consequence of selection under the pressure of antibiotics, resistant microorganisms are becoming prevalent in the environment. Under such circumstances, resistant mutants are selected much more effectively and rapidly, because only resistant mutants can grow and the resistant trait can easily be transmitted to susceptible microorganisms by conjugation and transduction, although the frequency of mutation remains unchanged. As manufacturers of antibiotics, we insist that they must be produced in the largest possible amounts without having deleterious effects on the producing organisms. For this purpose the producer organisms must be resistant to their own metabolites, at least during the producing period. Therefore, for users as well as makers of antibiotics, we demand that microorganisms have conflicting properties: susceptibility and resistance to antibiotics. Turning to the genetic material governing resistance properties, it is noteworthy that most of such traits in pathogenic bacteria are carried on extrachromosomal genetic elements. Therefore, such properties can be easily transmitted to susceptible organisms. Also, production of and resistance to antibiotics in producing organisms can be controlled, in

some cases, by extrachromosomal genetic elements, either directly or indirectly. Thus, the extrachromosomal genetic elements also demonstrate two conflicting properties: the resistance trait in pathogenic and producing bacteria and the production control trait in producing organisms. In this review, I have attempted to describe antibiotic resistance mechanisms and their interrelation in pathogenic and producing bacteria, taking, β -lactam antibiotics as an example.

A whole manuscript is available in “ <http://mibr.asm.org/content/45/4/591.long> “,