

Foreword

The emergence and diffusion of bacterial strains resistant to antibiotics is an international topic of concern in both human and veterinary medicine, which has raised a common awareness of a major health problem. A European Union conference on this “Microbial Threat” organised on 9–10 September 1998 in Copenhagen stated the problem of resistance to antibiotics as a priority for medical and veterinary microbiologists. The recommendations of this conference were to encourage numerous initiatives and studies in human and veterinary medicine, on education and surveillance, as well as fundamental research on the bacterial, genetic and ecological mechanisms involved.

In the veterinary field, the two main objectives are maintaining healthy animals and preventing hazards to public health. Recent European legislation has resulted in the curtailing of the list of drugs available for control and prevention of infectious diseases as well as for growth promotion, with dramatic consequences for some animal productions. However, animals still have to be treated with antibiotics to prevent and cure infectious diseases. Sound and prudent use of antibiotics and particularly of those most recently introduced onto the market is therefore a major issue in veterinary medicine.

Surveillance of antibiotic resistance is the first step of intervention. In some European countries, surveillance networks are already in place, while in others, they are in progress or being planned. This was the topic of a European Concerted Action (1998–2000), which considered the different bacterial species (veterinary pathogens, indicator bacteria, zoonotic bacteria) and drugs to be surveyed, standardisation and harmonisation of the methods used in the different countries (for example, the determination of breakpoints leading to the definition of susceptible, intermediate or resistant strains). Data reports must be harmonised to synthesise data at the European level by the means of common technical definitions, common levels and objectives of surveillance. Comparative evaluation of the situation in the different European countries and warnings about emerging risks will be possible, in such conditions.

Initiatives in the education and training of all the partners involved in the administration of antibiotics are developing. Fundamental research on mechanisms of resistance and on the conditions of emergence and diffusion of resistant strains, inside and outside farms, have been developed over the last decades and are currently intensified.

The use of specific antibiotics as growth promoters, for instance avoparcin, has been the subject of a lot of criticism due to the possible selection of genes/bacteria resistant to vancomycin (a therapeutic molecule closely related to avoparcin) and their subsequent diffusion to human where this drug appears to be the last available antibiotic for treating infections due to multiresistant *Enterococcus* and *Staphylococcus*. Recent decisions at the European level to withdraw avoparcin, bacitracin and drugs belonging to the large family of macrolides-streptogramins-lincosamides (tylosin, spiramycin, virginiamycin) make the current situation clearer concerning hazards to public health. Consequently, and as a wealth of recent literature deals with this topic, mechanisms of resistance and spread of genes/bacteria resistant to growth promoters will not be dealt with in the articles of this special issue.

The aim of this special issue is thus to summarise present knowledge on mechanisms of resistance of animal and zoonotic pathogens to the major antibiotics used in veterinary medicine. Special attention is paid to the role of mutations and mobile elements, such as plasmids, transposons, and integrons, in the emergence and diffusion of resistant genes/bacteria. The conditions of usage of antibiotics in animals and particularities of veterinary medicine are presented, for a better understanding by non-veterinary readers. Recent epidemiological data are also presented in the different papers. Since up to now, surveillance of resistance to antibiotics was mainly focused on cases of pathological episodes in animals, a review of studies on the normal flora of healthy animals – which represents a potential reservoir of resistant genes/bacteria – was of main interest. It also appeared important to present recent methods of bacterial typing and to discuss their relative relevance. Finally, as European legislation on the usage of antibiotics and surveillance has prominently evolved in the last few years, this was the opportunity to take stock of the situation. Instead of an exhaustive presentation of the available data on antibiotic resistance in animal strains, we wanted to present the main advances in the knowledge of resistance mechanisms in animal and zoonotic bacteria of prime importance:

- use of antimicrobials in veterinary medicine and mechanisms of resistance;
- resistance to antibiotics in the normal flora of animals;
- importance of integrons in the diffusion of resistance;
- resistance to trimethoprim and sulfonamides;
- quinolone resistance in *Escherichia coli*;
- epidemiology of resistance to quinolones in *Salmonella*;
- mechanisms of quinolone resistance in *Salmonella*;
- molecular characterization, spread and evolution of multidrug resistance in *Salmonella enterica* Typhimurium DT104;
- antimicrobial resistance of thermophilic *Campylobacter*;
- antimicrobial resistance in *Pasteurella* and *Mannheimia*: epidemiology and genetic basis;
- antimicrobial resistance in staphylococci from animals with particular reference to bovine *Staphylococcus aureus*, porcine *Staphylococcus hyicus*, and canine *Staphylococcus intermedius*;
- molecular tools for the characterisation of antibiotic-resistant bacteria;
- new trends in regulatory rules and surveillance of antimicrobial resistance in bacteria of animal origin.

The studies presented in this issue illustrate the large possibilities of spread of resistant bacteria or genes encoding mechanisms of resistance. The description of new resistant genes/bacteria in one country is frequently followed by similar descriptions in other countries, and we have numerous examples of simultaneous observations all over the world. Such an example of wide bacterial spreading is, over the last decade, the worldwide isolation in animals as well as in humans, of similar (if not identical) *Salmonella* Typhimurium DT104 resistant to five different antibiotics.

Resistance to antibiotics is a highly evolving subject. The last four decades have highlighted the unlimited ability of bacteria to escape the action of antibiotics. They have also shown the limited probability of seeing many new drugs introduced onto the market. In such a situation, the only solution consists in the reasonable and restricted use of antibiotics.

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