RELATIONSHIP BETWEEN THE EPIDEMIOLOGICAL FEATURES OF COMMUNICABLE DISEASES AND IMMUNOPROPHYLAXIS

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Communicable diseases are mostly classified according to the taxonomic assignment of their causative agents (viral, bacterial, parasitic and mycotic diseases). This is, however, of almost no practical interest, since control measures are not tailored to the biological group to which the pathogen belongs, but to the dangerousness and the epidemiological features of the disease in question. Even the classification of diseases according to their mode of transmission (e.g. food-borne, arthropod-borne, air-borne etc) is not sufficient enough for planning effective control measures.

A classification of communicable diseases according to their epidemiological features leads to a range from epizootic diseases, whose spread is unlimited in space, but limited in time, to enzootic diseases, whose spread is unlimited in time, but limited in space. Fig. 1 shows examples of epizootic (left) and enzootic (right) diseases with a wide variety of diseases ranging in between. Furthermore, Fig. 1 indicates the biological reasons for the location of the diseases on the scale and the consequences of this location for the prospects and limits of control measures (Fig. 1 next page).
The pathogens of the fast-spreading diseases on the left side of the scale are compulsory parasites, i.e. they are highly adapted to one or few closely related host species. From an evolutionary point of view, their survival as species is dependent on the existence of their host species. The single germ of this group of pathogens, however, has a high tenacity, which enables it to survive in or on vectors or fomites outside the host for a long time. Thus, these pathogens are easily conveyed over long distances, which results in the unlimited spread of the epizootic diseases. The evolutionary response to these highly virulent pathogens was the development of the ability of the host species to build up a strong and long-lasting immunity to the pathogen in question, which results in the limited spread in time of the epizootics.

The pathogens of the enzootic diseases are more or less facultative parasites, i.e. they are only weakly adapted to mostly more than one host species. Whereas the epizootic pathogens cause

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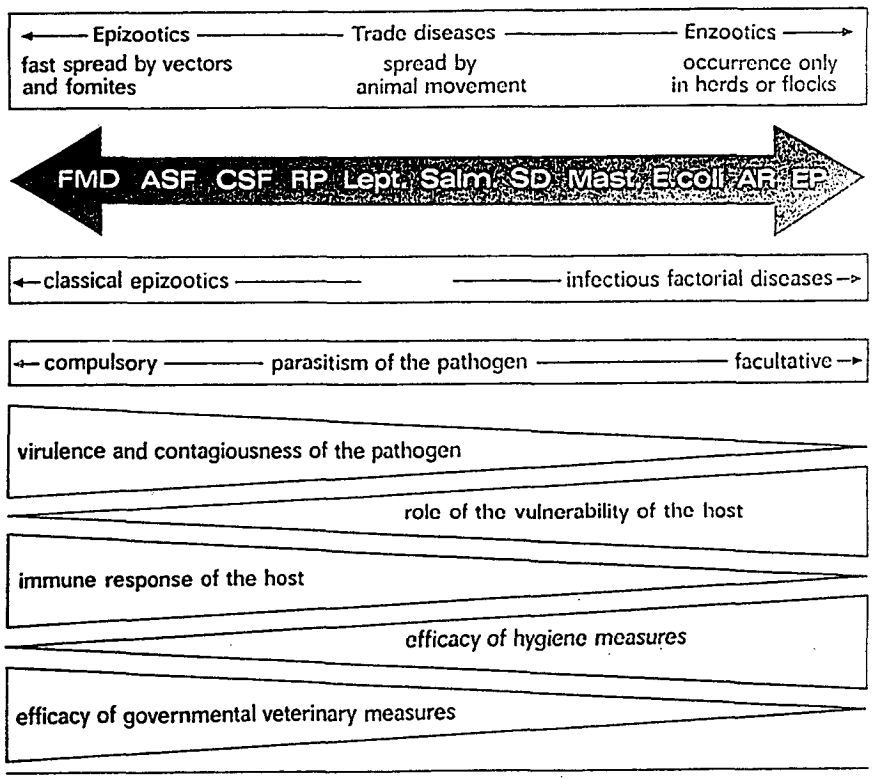
severe general diseases, the enzootic pathogens mainly cause diseases of single organ systems (respiratory, reproductive, enteric diseases etc), they are of only weak virulence and their survival as species does not entirely depend on the existence of one or two host species. Contrary to the epizootic pathogens, the tenacity of the single enzootic pathogen outside the host species is very low, so that they are hardly conveyed over long distances,

Fig. 1: Classification of communicable diseases according to their epidemiological behaviour



FMD = Food- and mouth-disease, ASF = African swine fever, CSF = Classical swine fever, RP = Rinderpest, Lept. = Leptospirosis, Salm. = Salmonellosis, SD = Swine dysentery, Mast. = Mastitides, E.coli = Coli-infections, AR = Atrophic rhinitis, EP = Enzootic pneumonia

which results in the limited spread of the enzootics in space. Due to the relative undangerousness of the enzootics, the evolution "did not see" any necessity to "teach" the host species how to respond with a strong immunity. The only weak, local and short-lasting immunity is the reason for the enzootic diseases being unlimited in time. Thus, enzootics are "only" herd health problems, but without being controlled or even eradicated they maintain themselves within the herd and contribute to the well-known deterioration of the animal health in big herds in the course of the years. The higher the stocking density the more severe is the influence of the enzootics on the economy.

Most communicable diseases, however, range in between the epizootics and the enzootics. The more to the right a disease is located on the scale of Fig. 1, the more are adverse environmental influences needed to turn the mere infection with the causative agent into the manifest infectious disease, and, the more it is this way, the less is the immune response of the infected and even the diseased host.

These remarkable differences in the pathogen - host - relationship should be taken into consideration, when the efficacies of vaccines are compared to each other. As long as conventional vaccines are used, the immune response to the vaccine can hardly be stronger than to the natural disease. Therefore, it is unjustified to expect of a vaccine against e.g. Mycoplasma hyopneumonia as strong a protection as that of a vaccine against e.g. FMD-virus. Users of vaccines should always pay attention to the fact that the more to the right a communicable disease is located on the scale of Fig. 1, the more any immunoprophylaxis has to be supported by organisational and most of all by hygienic maesures.

It may be in the near future that by means of biotechnology vaccines will be created which only consist of the immunogenic components of the pathogens in question. If so, it can be expected that the immunity due to such subunit vaccines is stronger and longer-lasting than the immunity due to the natural infection.