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Editorial

Staphylococci and Infection Immunity

The history of our knowledge concerning staphylococci and staphylococcal diseases could be written as an essay on paradox. The *Staphylococcus* was one of the first human pathogens to be recognized and cultivated; many precise details are known concerning its cellular structure, its growth requirements, its chemical and biological activities; yet there is no agreement as to what makes it pathogenic. It can cause a great variety of pathological processes, affecting most organs; yet experimental infections in man and animals can be produced only by the use of laboratory artifices. It served as the test object for the discovery of penicillin; yet most staphylococcal infections are now resistant to treatment with this drug. It is becoming one of the most disturbing agents of bacterial disease, at a time when other bacterial diseases are decreasing in importance. A few decades ago, monographs after monographs were being written on each and every one of the bacterial pathogens, from the tubercle bacillus to the meningococcus. Today these books rest almost undisturbed on library shelves, but staphylococci provide endless material for symposia, reviews, and encyclopedic treatises. In the English language alone, highly competent discussions of this most studied, least understood, and highly paradoxical organism can be found in recent references.¹⁻⁶

The writing of the present editorial was stimulated by a series of papers dealing with certain epidemiological and immunological aspects of staphylococcal infections in newborn infants.⁷⁻¹² The claims of the authors of these articles are extremely simple, and to this reviewer at least they appear well supported by clinical, epidemiological, and serological evidence. In brief, it was found that the colonization of human infants with virulent staphylococci (in nurseries) could be prevented or retarded by early contamination (nasal or umbilical) of these infants with very small inocula of a coagulase positive strain of *Staphylococcus* (502A), selected because of its great susceptibility to penicillin and its very low virulence. Not only did the attenuated 502A strain become lastingly established in the artificially contaminated infants; it also spread to other human contacts. The over-all effect was to limit the dissemination of more virulent staphylococci. Identification by serological and phage techniques made it possible to distinguish the 502A strain from other *Staphylococcus* strains in the nursery environment and provided evidence for its lack of pathogenicity under the conditions of the clinical tests.¹²

Although similar studies carried out with strain 502A in New York, Ohio, Louisiana, and Georgia have all given approximately the same encouraging results, it is much too early of course to formulate an opinion concerning the practical value of the implantation technique for the control of staphylococcal infections. Whether implantation of an attenuated strain would protect in the face of a really severe epidemic remains to be demonstrated. Furthermore, additional information is needed concerning the ultimate pathological consequences of introducing the 502A strain. In its present state of development, the study under review is therefore

more convincing as a contribution to the natural history of infectious diseases, than as a description of a method for the control of staphylococcal epidemics.

Uncertainties concerning the practical aspects of implantation of the 502A strain do not in any way affect the broad theoretical implication of the findings, namely that the presence in the tissues of an attenuated living microbial agent interferes with colonization of another strain of the same species. It is worth recalling here the earlier claims that hospital strains of virulent, drug-resistant staphylococci, do not readily become established in persons who are *Staphylococcus* carriers.^{13,14} The authors of the articles under review have elected to refer to the protective effect which they have observed by the word "interference." Their findings probably correspond to what the early French immunologists called "premunition" and the English immunologists "infection immunity."

The orthodox immunochemical attitude at present is to believe that development of immunological techniques of protection will have to wait on a better understanding of basic immune mechanisms. Although this attitude may represent the ideal scientific approach, the fact is that administration of living attenuated agents remains at the present time the most practical and in several cases the only effective technique of protection against certain microbial diseases. For this reason, it might be useful to extend the principle of infection immunity to other bacterial species. Perhaps worth mentioning here is the fact that animals and human beings carrying *Escherichia coli* do not readily become superinfected with other strains of this bacterial species,¹⁵ a form of resistance which may constitute another example of infection immunity.

Surprisingly enough, nothing precise is known concerning the mechanisms of infection immunity, even though the phenomenon has long been recognized with regard to several microbial species. One of the useful results of the finding that implantation of the strain 502A protects against colonization with virulent staphylococci might be to stimulate renewed scientific interest in this unorthodox, much neglected but highly interesting field of immunological theory.

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