nation that level and efficiency of animal production in Great Britain has not been reduced by restricting the feed additive usage of antibiotics. Antibacterial agents not approved for use in the United States are used in Great Britain. Furthermore, direct comparisons of animal performance is needed in order to determine the relative efficiencies of production. Such information cannot be derived from an oral or written question and answer session.

We do need to thoroughly evaluate the human health implications of any biologically active drugs. When there are benefits, there is likely to be some risk involved. All the attention should not be directed to a single method of usage with the assumption that restricting that usage will appreciably alter the source or level of drug resistance. We should not jeopardize a plentiful food supply on the basis of indirect evidence and suspicions.

On the Wednesday prior to this symposium, July 22, the General Accounting Office sent a report to Congress titled: “Salmonella in Raw Meat and Poultry: An Assessment of the Problem”. Pointing to the data collected by the Food and Drug Administration which showed that 17% of 200 samples of raw meat and poultry purchased in 20 retail outlets in 10 metropolitan centers were contaminated with salmonella (chicken having the greatest contamination—31% and the beef samples not contaminated at all) and underscoring this point with estimates of 2 million cases of salmonellosis in man each year, the GAO report called for action to reduce this serious problem. You are aware of the problem and Dr. Finland has indicated that the salmonella problem has been recognized for some time for, while typhoid fever was steadily decreasing, “other salmonelloses increased steadily from 723 to 9,680 in 1962, but in 1963, when the CDC’s surveillance program became fully operative, the number jumped to 18,696”.

Because the cycle of salmonella infection is multifactorial involving animal feed, animal reservoirs, animal-to-animal transmission, contamination of the food chain to man, man as a vector and multiplier and, further, because each step of the cycle is so full of complexities, the essential data base necessary to evaluate the quantitative role of each factor and to measure the effects that might be achieved by manipulating conditions at each level of the cycle is not available. Thus, the present inability to supply categorical answers to the following questions has generated controversy with participants often resorting to sophism rather than science to support their biases. The questions

- literature cited


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are: What, if any, is the salmonella risk to man engendered by the low-level feeding of antibiotics to livestock and poultry for growth promotion? Would salmonellosis in man be reduced if this practice were discontinued?

Dr. Finland makes a pretense of answering these questions by an "unbiased interpretation" of available data, but, instead of a "documented and critical review of the literature", for the most part a series of biased quotations from various sources are presented as evidence. In addition, broad and valuable experience at Boston City Hospital is used to reflect the lack of risk to man of low level antibiotic feeding to animals. In discussing trends of enterobacterial bacteremia, Dr. Finland says,

"It is notable that there was some increase in number of cases and deaths in 1941 over those in 1935; effective sulfonamides had come into extensive use in the intervening years. The greatest increase, however, occurred in 1947 when both penicillin and streptomycin were already being used intensively, but before the first of the so-called broad-spectrum antibiotics, chlorotetracycline and chloramphenicol, had become available and before any antibacterial agents had been introduced for use as animal feed supplements. Additional, but relatively smaller increases were noted, particularly in the number of deaths, for most of the succeeding years of the study."

Although I cannot make the bridge from enterobacterial bacteremia at Boston City Hospital to the effect of low level antibiotics upon salmonellosis, I interpret his data differently. The increase of bacteremia after 1947 is not relatively smaller than the increase from 1935 through 1941 to 1947; the slope in the period before broad-spectrum antibiotics is significantly less than the slope after 1947. Dr. Finland himself, commenting on these same data in 1970, said after speaking of the increase in Staphylococcus aureus bacteremias,

"Even more impressive were the changing proportions of bacteremic patients and deaths due to enterobacteria. These organisms accounted for only one-eighth of the patients and about one-twelfth of all the deaths in 1935. Since 1947, from one-third to one-half of all the patients and from 40 to 55% of the deaths were due to these organisms. After 1957, these proportions have shown a steady increase."

Dr. Finland also uses the occurrence of salmonella bacteremia and shigellosis at Boston City Hospital through the years to demonstrate that these diseases have not increased at this institution. (2) salmonella typhi and Shigella have no direct relationship to animal reservoirs and are not pertinent to the argument. If typhoid fever is eliminated from the data, we find that in 1935 and 1941 no bacteremia was reported due to Salmonella, whereas in every year thereafter isolates of salmonella were cultured from the blood of patients. These isolates are few in number and represent not even the tip but a small calf of the iceberg of the total salmonella problem in man. In Dr. Finland’s words, “The data from Boston City Hospital offer no direct link of the serious infections observed there to the use of antibiotic feed supplements in animals and thus do not confirm the basis for the recommendations for withdrawing the use of animal feed supplements.” I agree that these data do have no direct link and do not confirm the recommendations—but they do not offer evidence to deny them either.

With the mutual admission that the hospital data presented are not directly germane to low level antibiotic feed use and its effect on the salmonella problem, let us examine the evidence that swayed the Task Force to make their unanimous recommendations. Although all points of the report are intertwined, only the assignment for this symposium, the salmonella problem in man, will be undertaken. Well referenced documentation of these summary points may be found in Appendix B (Human Health Hazards) of the Task Force Report.

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2. Salmonella occur commonly in foodstuffs.
3. Antibiotic feeding selects for resistant salmonella in animals.
4. Antibiotic feeding may increase the carriage, excretion and length of time of carriage and excretion of salmonella in man and animals.
5. Antibiotic feeding may increase the colonization potential and may reduce the infectious dose of salmonella in man and animals.
6. The dynamic composition of the bowel flora is affected by the small quantities of residue antibiotics which may be present in foodstuffs.

Additional experimental evidence bearing on these important considerations has become available since the Task Force Report. If you will, discount the change in $R$ transfer factors produced by low level feeding, discount the potential for virulence alterations, and accept the economic benefit of low level antibiotic feeding. Consider then only the above factors in terms of salmonella risk to man and the conclusion is evident—antibiotic feeding at low level should not be used unless it can be shown that the salmonella problem is not affected adversely.

May I clarify the confusion about the members of the Task Force who Dr. Finland says disagreed with the report. The Task Force Report was signed unanimously by each and every member of the committee. Two dissenting notes were sounded. One by the Human Health Problems Subcommittee who were not in favor of the quantitative aspects of the qualified economic values in the report. Consider then only the above factors in terms of salmonella risk to man and the conclusion is evident—antibiotic feeding at low level should not be used unless it can be shown that the salmonella problem is not affected adversely.

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### References