Variation in Three Staphylococcal Typing Phages

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A standard set of staphylococcal typing phages is now used in practically all laboratories where a staphylococcal typing service has been established. Comparison of the phage patterns encountered in different laboratories is valid only to the extent that the phages used in those laboratories have remained stable and have retained their original patterns of lytic activity. This is especially important when one attempts to determine the geographic distribution of strains of *Staphylococcus aureus* showing a specific phage pattern. It is conceivable that although the same strain might be encountered in several different laboratories, it would not be regarded by some laboratories as being identical if variation had affected the lytic patterns of the phages concerned.

That variation in patterns of lytic activity may occur was demonstrated by Wahl (*1*), who noted that from phage 44A, which has a rather limited lytic spectrum, a mutant phage developed which exhibited a wide range of activity. The mutant was designated as "phage 68."

We have obtained evidence which suggests that variation in lytic activity has taken place in certain staphylococcal typing phages that are currently being used in the United States. The phages involved are those designated as "52," "42B," and "44A."

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Phage 44A appears to have undergone variation in the direction of a wide host range, in a manner comparable to that observed by Wahl. It often occurs in the phage pattern of strains of staphylococci in any of the broad phage groups, and thus appears to be of little differential value.

Soon after the report by Bynoe, Elder, and Comtois (*2*) of the existence of a strain of *S. aureus* which was susceptible only to the recently described phage 81, it was found that apparently similar strains isolated in the United States were lysed by phages 52 and 42B as well as by phage 81. We suspected that this could probably be attributed to the fact that the phages 52 and 42B employed in laboratories in the United States had undergone some variation in lytic activity in the direction of a slightly wider host range. In most instances these phages had been supplied by Dr. Blair.

To determine whether variation in lytic activity had occurred, we examined a number of strains of *S. aureus*, isolated both in Canada and the United States, which were known to be susceptible to phage 81. The stock phages and propagating strains of our laboratories were exchanged and the following preparations were made in each laboratory: Laboratory of Hygiene ("LH") phages were propagated on LH strains of *S. aureus;* LH phages were prepared on Hospital for Joint Diseases (HJD) strains; HJD phages were propagated on LH strains; and HJD phages were prepared on HJD strains. The cultures to be examined were then typed in the usual manner with each of the four phage preparations.

The results obtained in both laboratories showed essentially mutual confirmation. Canadian strains of *S. aureus* that had been lysed only by the LH stock phage 81 showed only the pattern 81 when typed with LH phages prepared on either LH or HJD propagating strains. When typed with HJD phages prepared on either LH or HJD propagating strains, they showed the pattern 52/42B/81. Strains isolated in the United States that had originally shown the pattern 52/42B/81 with the HJD stock phages were lysed only by phage 81 when typed with LH phages prepared on either LH or HJD propagating strains. When typed with HJD phages prepared on LH or

HJD propagating strains, these strains showed the pattern 52/42B/81.

It seems clear that phages 52 and 42B, as maintained in the laboratory of the Hospital for Joint Diseases, had undergone variation to the extent that they were able to lyse cultures of "type" 81. Variation apparently has not gone beyond this point, for both phage 52 and phage 42B have appeared only in other patterns in which they might normally be expected to occur.

The cultures, stock phages, and propagating strains from both laboratories were submitted to Dr. R. E. O. Williams in the Central Reference Laboratory in London, who examined them in a manner similar to that described above and in a personal communication reported confirmation of our results.

Bynoe and his associates have reported that phage 80, which was developed in Australia by Rountree and Freeman (*3*), appears to be closely similar to phage 81, and that cultures of *S. aureus* which are susceptible to phage 81, are nearly always lysed also by phage 80 (*2*). This has been the experience in the laboratory of the Hospital for Joint Diseases.

There would appear to be little question that the strains of *S. aureus* which now are being widely encountered in Canada and the United States and which have been reported, respectively, to show the patterns 81 or 52/42B/81 are identical. In the interest of uniformity of reporting and to remove any confusion that might exist in the minds of the readers of the literature as to the identity of these strains, the authors propose that such strains now be designated as 80/81, the designation given them by the International Typing Reference Center at the Central Reference Laboratory.

To insure results that are more nearly comparable to those obtained at the Central Reference Laboratory, Dr. Blair has obtained from Dr. Williams new specific lots of phages 52, 42B, and 44A, which he plans to include in sets of phages for future distribution and to send to those laboratories in the United States where a phage typing service is now in operation.

REFERENCES

(*1*) Wahl, R., and Lapeyre-Mensignac, P.: L'identification des staphylocoques par les bacteriophages. II. Essai de classification des staphylocoques par la methode des phages. Ann. Inst. Pasteur 78: 765–777 (1950).

(*2*) Bynoe, E. T., Elder, R. H., and Comtois, R. D.: Phage-typing and antibiotic-resistance of staphylococci isolated in a general hospital. Canad. J. Microbiol. 2: 346–358 (1956).

(*3*) Rountree, P. M., and Freeman, B. M.: Infections caused by a particular phage type of *Staphylococcus aureus*. Med. J. Australia 42: 157–161 (1955).

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