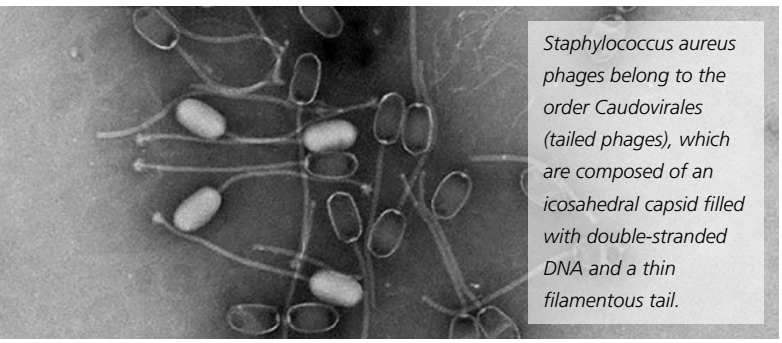
Public Health England

Sarah Alexander
The National Collection of Type Cultures (NCTC), Public Health England (PHE), UK

The importance of immortalising the bacteriophage

Bacteriophages, or phages, are viruses that infect bacteria and in recent years phages have been attracting increasing levels of attention from both scientists and the mainstream media alike due to their potential role in the treatment of bacterial infections (phage therapy). The first bacteriophages were described over 100 years ago concurrently by two scientists, Twort (1915) and d'Hérelle (1917). It was at this time that the name bacteriophage was formed, which literally means 'bacteria-eater'. Ever since, phages have played an instrumental role in our knowledge of molecular biology: T2 was the model organism used in the Hershey–Chase experiments that proved DNA was the key genetic material; and T4 was central in Crick's experiments that led to the discovery of the genetic code. The first organism to ever have its genome fully sequenced was the phage φX174. Phages have also played a unique role in genetic engineering, where technology such as phage display has provided scientists with the first tools to produce novel proteins within the laboratory setting. Phages also proved to be valuable epidemiological tools, with phage typing schemes being described and applied to the outbreak investigation of many major pathogens including *Salmonella* and *Staphylococcus* species.



Staphylococcus aureus phages belong to the order Caudovirales (tailed phages), which are composed of an icosahedral capsid filled with double-stranded DNA and a thin filamentous tail.

The significance of phages within the environment cannot be underestimated. It is well established that bacteriophages are ubiquitous in nature, where they have been isolated from almost every known ecological niche. Bacteriophages are also regarded as the most abundant life form on earth, with marine phages being known to play a key role in nutrient cycling (particularly of nitrogen and carbon) from the oceans. However, it is the therapeutic use of phages, when lytic phages are applied to treat bacterial infections, which is currently attracting the most attention. Phage therapy is not a new phenomenon; it was first described over 100 years ago, when its applications were used widely, particularly in Eastern Europe. The rise of antimicrobial resistance combined with several high-profile cases of successful phage therapy, when all other treatment options had been exhausted, has once again re-engaged interest in this approach.

As the application of phages for potential solutions to bacterial problems grows, having a repository from which scientists can both source and deposit bacteriophages is essential. The National Collection of Type Cultures (NCTC) is the world's oldest bacterial strain collection and has recently established a bacteriophage repository, which aims to provide a trustworthy source of authenticated phages. NCTC will also preserve all the deposited bacteriophages indefinitely and therefore ensures such precious biological materials are available for future scientific exploitation. The transient nature of both research groups and funding streams means that irreplaceable personal phage collections are frequently located in academic freezers and can become irretrievable in a short space of time. Indeed, nothing illustrates this message more clearly than the case of *Acinetobacter* bacteriophages. Since 1966, over 100 *Acinetobacter* bacteriophages have been described in the scientific literature; however, many are no longer accessible as they were not deposited within a culture collection and therefore the biological material has sadly been lost to science. The NCTC bacteriophage collection will be dynamic, representing a repository into which microbiologists can deposit phages, which in turn will support accessibility and reproducibility in science.

FURTHER READING

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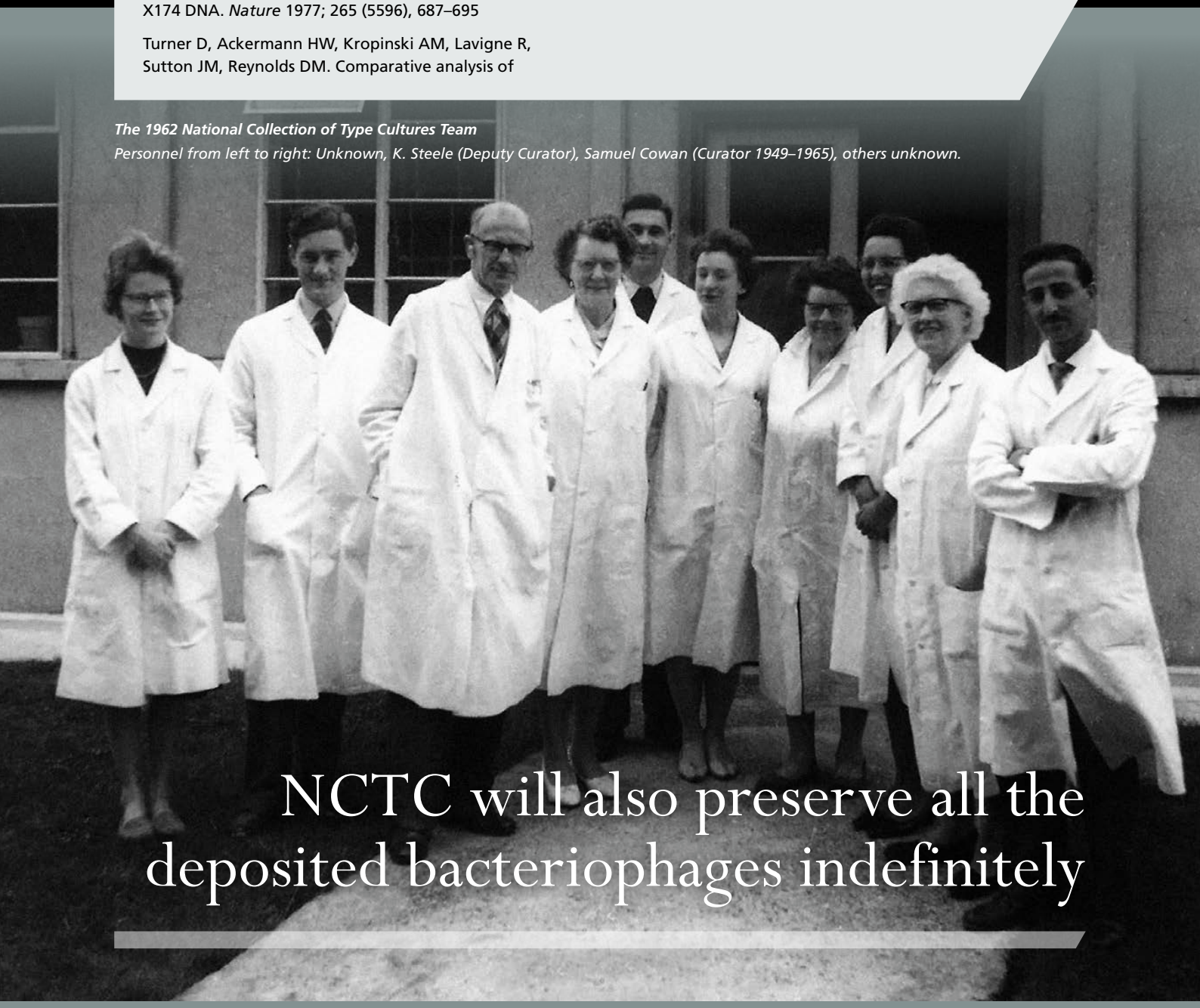
The 1962 National Collection of Type Cultures Team

Personnel from left to right: Unknown, K. Steele (Deputy Curator), Samuel Cowan (Curator 1949–1965), others unknown.



NCTC will also preserve all the deposited bacteriophages indefinitely