

When Nature steps up the *E. coli* 0157:H7 risk management

In 2005, consumers in the Southwest of France became sick after eating Chantegril brand frozen ground beef patties produced by Soviba.



Claude Guillaumot
Director of Hygiene and Quality,
Soviba (France)

Soviba, a French producer of ground beef patties, is committed to complete control of the risks related to *E. coli* 0157:H7. After making many changes to improve risk control following a food-poisoning incident in 2005, Soviba is coming back with its head held high. From now on, a unique rapid testing system in Europe provides the ultimate guarantee for the system, with no raw beef reaching stores before getting the go-ahead. All types of fresh ground beef or beef to be consumed raw, such as forcemeat, veal and beef olives, merguez sausages and carpaccio are concerned by this test. Explanations from Claude Guillaumot, Director of Hygiene and Quality at Soviba.

“Our objective: no raw beef on the shelves without first getting the go-ahead from testing”

Claude Guillaumot

For us and for the entire profession, it was a new problem that we had never faced. France had never seen this type of accident before. It recently reoccurred on two occasions on batches of fresh ground beef patties produced by our competitors. Up until then, it was thought that the pathogenic *E. coli* problem was restricted to the American continent where it is known as hamburger disease. We took immediate precautions after the Chantegril problem. As the *E. coli* is

naturally present in the intestine of a small number of cattle, the first decision we took was to exclude any meat from carcasses involved in an evisceration accident – or EA – from the ground beef circuit to eliminate any risk of potential contamination. Similarly, we reinforced hygiene conditions during skinning operations to prevent any contamination of carcasses due to contact with the animal hide. Additional dressing stations were created to remove parts that

Recombinant Phage Protein, a new Technology for food pathogen screening



Phages fixed on *E. coli* bacteria. Zoom: 500 nm

The earliest reference to bacteriophage dates back to the late 19th century. In 1896, a British chemist, E. H. Hankin observed that water from the Ganges and Jumna rivers in India could kill cholera bacteria.

1917, Félix d'Hérelle, French-Canadian microbiologist working at the Pasteur Institute in Paris, announced that he had discovered some mysterious entity capable of killing bacteria.

Phage have an extraordinary structure giving them the look of an alien insect. The largest part is a head in which their genetic material is stored. They have a protein tail consisting of fibres resembling legs which they use to attach themselves to their specific bacterial host.

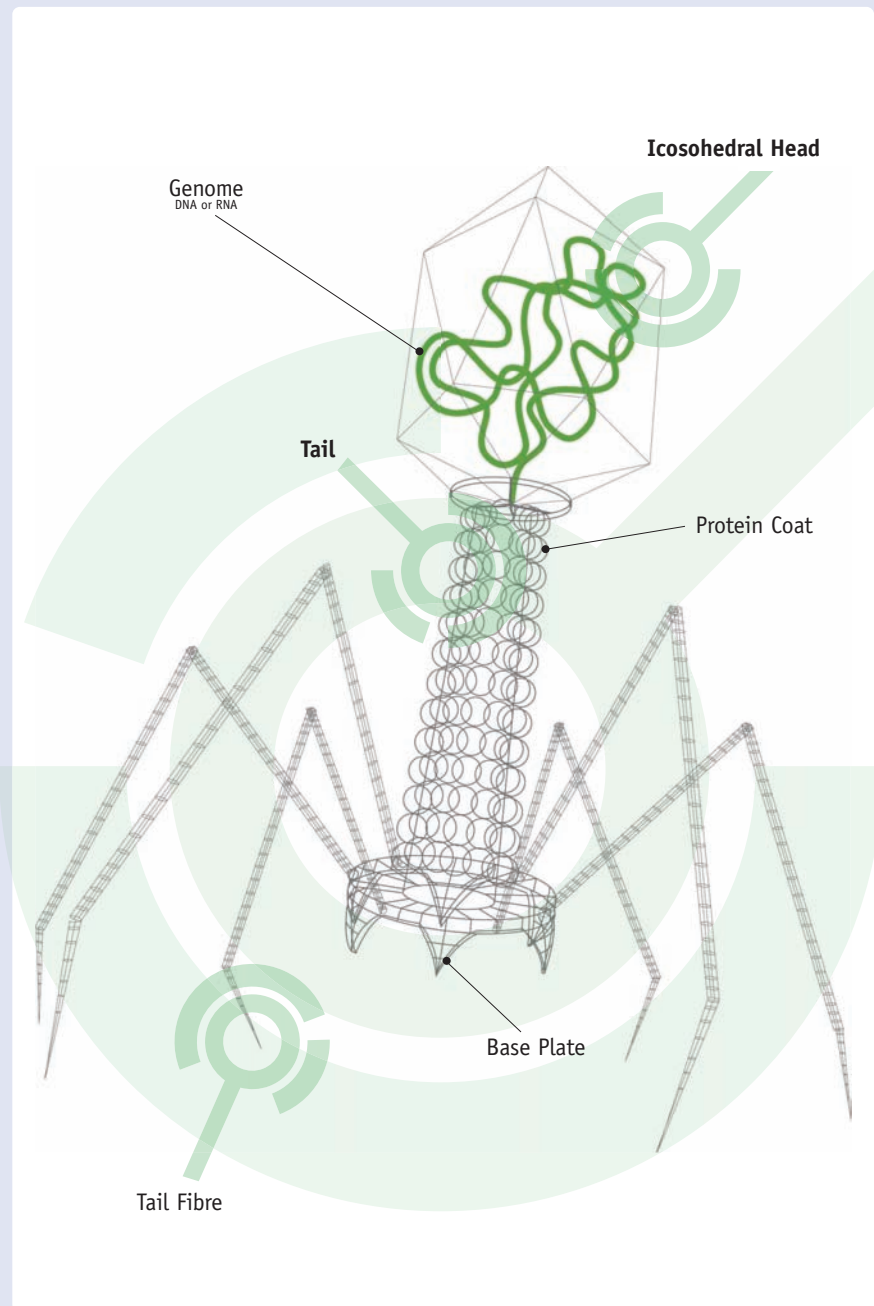
In the phage replication cycle, the first and extremely important step is the specific recognition and binding of these tail fibre proteins to their bacterial host.

Bacteriophages have co-evolved with their bacterial host and have developed highly efficient host-recognising mechanisms.

The phage tail fibre proteins used by the phage to identify its host represents billions of years of evolution.

The proper function of these proteins underlies the highest selective pressure as they are indispensable to assure the phages' survival.

For this reason tail fibre proteins were considered to be unique tools with unrivalled properties in the development of bacterial detection systems.



come into contact with hides or digestive contents.

Although current regulations do not require us to take such precautions, we have an objective to meet. It is up to us to select the suitable means via our HACCP analysis to obtain safe products. There is a regulatory framework, but it is not enough. In any case, the regulations stipulate that the company must perform its own risk analysis.

In order to increase product safety we set up systematic tests on frozen ground beef patties in 2006. We did so for two reasons: (1) frozen beef appears to pose the highest risk since it was involved in the 2005 accident, and (2) it takes the longest time to cook through. Often, it is put in the pan still frozen at -18°C. Analyses have enabled us to measure the progress achieved following the prevention project started in 2007. This plan, known as EC0 – for *E. coli* zero – was created by pooling all the existing knowledge on the problem. We brought together experts

“A monitoring study made it possible to determine where any failings were liable to occur and how to detect and correct them in order to set up a rapid information feedback system among operators”

from various fields for two days in June 2007. We then defined reference methods for each of the operations relating to sensitive stations in slaughterhouses with a view to harmonise risk control at all Terrena meat sites. We worked on selecting equipment used to ensure that the digestive tract of cattle was closed at both ends during the slaughtering process. Personnel at sensitive stations received specific training. Bacteriological purity, quality control and carcass wash sanitation methods were tried. A monitoring study made it possible to determine where any failings were liable to occur and how to detect and correct them in order to set up a rapid information feedback system among operators. In the two years since we began implementing these preventive measures,

From the identification of a specific phage through to a recombinant phage tail protein on VIDAS®

Phage tail fibre recombinant protein technology was developed by Profos AG, a European biotechnology company. bioMérieux has integrated this unique tool with its unrivalled properties of sensitivity and specificity into the continuous innovation pipeline of the VIDAS food pathogen detection platform.

Identifying the specific tail fibre proteins and their subsequent industrialisation to allow manufacture of the VIDAS reagents uses state of the art, patented technology.

The process is summarised in the following steps:

- Screening and identification of the specific phage for the pathogen of interest,
- Sequencing of the protein,
- Cloning,
- Production and purification of the recombinant protein,
- Labeling of the recombinant protein.

The labeled recombinant phage tail fibre protein can now be used as a specific and sensitive tool for capture and detection of the food pathogen of interest.

the number of positive results obtained on our frozen patties have been divided by six. Moreover, tests performed on cattle on entering the slaughterhouse demonstrate that the prevalence of the bacterium does not appear to have increased. The percentage of contaminated cattle remains between one and four per cent.

Last year we began looking for a rapid analytical method that could be used on products with a short shelf-life. At the time, the tests in use lasted several days and

could therefore be performed only on frozen foods. We took the time to conduct a large-scale evaluation of various methods, one of which now enables us to reduce the result turn around time considerably. Recent events have proven us right in adopting this approach. This revolutionary method was developed by bioMérieux and we have played an active role in its development. In our opinion, it is necessary to monitor the effectiveness of all the preventive measures taken right from the

A totally safe technology, eliminating the risk of using live phage

It is common in food industries to use technological flora in the production process for diverse applications such as fermentation.

Live phage are complex structures which contain as well as the bacterial recognition element, lytic proteins for the eventual destruction of the host cell.

During the phage replication cycle, mutants may occur which no longer recognise the bacterial host but allow the lyses of other bacterial species.

The use of live bacteriophage in the proximity of the production plant or valuable culture collections presents an unacceptable risk for these industries.

The technology of recombinant phage tail fibres used in the VIDAS assay eliminates these risks and allows the use of the phage's unique binding properties with total safety.

VIDAS UP *E. coli* O157:H7 : Step up your risk management

Thanks to the use of recombinant phage protein, VIDAS UP *E. coli* O157:H7 offers unrivalled sensitivity and specificity.

The ultra specificity allows an early and reliable decision after a positive result and, therefore, reduces potential economical loss.

An optimised protocol has been designed to reduce reagent cost (single enrichment in buffered peptone water, optimised sample to broth ratio), to limit labour cost and, therefore, increase the overall productivity of the lab.

The ultra sensitivity enables an improved sampling plan and better management of the *E. coli* O157:H7 risk. Very low contamination levels

can be detected in sample sizes from 25 up 375g.

Due to the ability of phage to find their host in highly contaminated environments, VIDAS UP *E. coli* O157:H7 can be used not only for food matrices but also for breeding environmental samples such as faeces, animal feed...

The unprecedented sensitivity results in the ability to release products in less than seven hours.

VIDAS UP *E. coli* O157:H7, convergence between the performance of the phage recombinant protein technology and VIDAS ease of use.

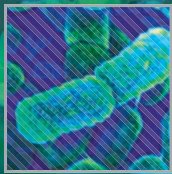
animal raising stage. It is an ultimate guarantee of safety and in no way relieves us from the duty of ensuring hygiene at all stages from the farm to the plate.

We will continue to remain vigilant. Our short-term objective is that no ground beef patties or ground beef preparation or beef intended to be consumed raw reaches the store before getting the go-ahead from the test. As a result, we had to reorganise our way of functioning. We have set up a laboratory module at Bougé-Chambalud to

test batches on-site. The Lion d'Angers lab will analyse batches produced at our Angers site. In concrete terms, batches produced during the day will be analysed overnight. The results will be known early in the morning and no batch of ground beef patties will reach the shelves before getting the go-ahead. We can allow this additional time as we have recently updated our packaging method for fresh ground beef patties to a controlled atmosphere sealed tray enabling us to gain an extra two days

of shelf-life. On this way we continue to guarantee a shelf-life of six days after receipt in our customers' warehouses.

Upstream, we also need to look at how we can fight the bacterium in farms. Our fundamental research will continue to monitor the state of the art in the field and for all pathogenic bacteria. Other *E. coli* variants may emerge and we need to be prepared for this possibility. Our aim is to be the reference ground beef patty producer in France. This is a new start for Soviba.



STEP UP YOUR *E. COLI* O157:H7 RISK MANAGEMENT

VIDASUP™

Recombinant Phage Protein
***E. coli* O157:H7**

This amazing technology is only available on bioMérieux evolutive automated platforms for pathogen screening: VIDAS® and mini VIDAS®



www.biomerieux-industry.com/vidasup

