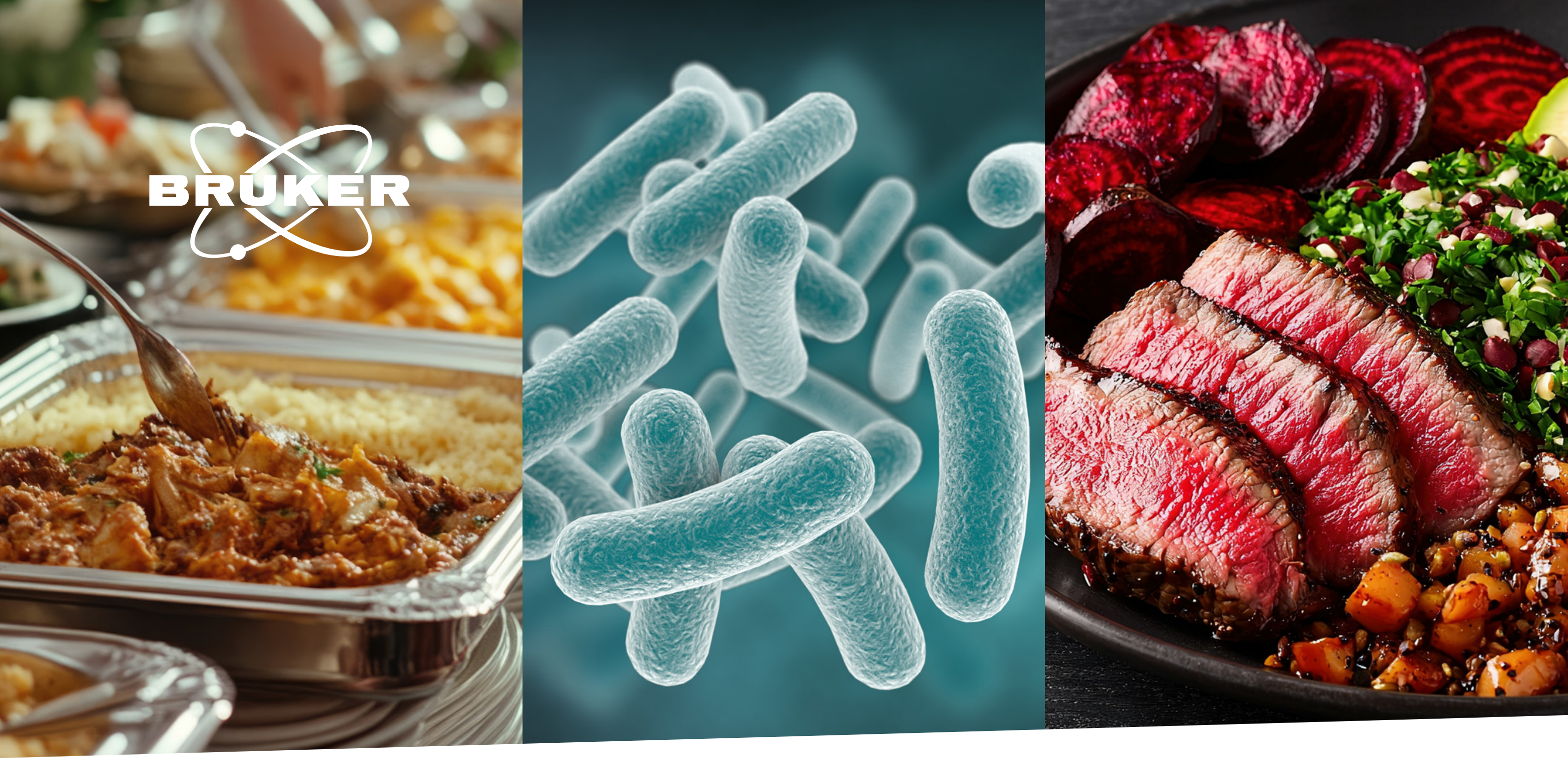

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Clostridium perfringens in food microbiology laboratories

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Clostridium perfringens is a bacterium commonly found in soil, as well as in the intestines of humans and animals, and in various foods. It ranks among the leading causes of foodborne illness globally. This microorganism forms spores that can withstand cooking temperatures and later multiply in food that is not properly stored, potentially causing food poisoning. Effective monitoring of *C. perfringens* is essential for ensuring food safety. By following established safety guidelines and employing reliable testing methods, the risk of foodborne illness can be significantly minimized. Bruker's MALDI Biotyper® and IR Biotyper® are easy, fast and cost-effective testing solutions empowering food safety.

Clostridium perfringens was first identified in the 1940s as a causative agent of foodborne illness and has remained a significant concern for food safety ever since. Although it garners less public attention than more prominent pathogens like *Salmonella*, *E. coli*, or *L. monocytogenes*, its impact on public health is substantial. In the United States alone, it is estimated that nearly one million cases of food poisoning each year are attributable to *C. perfringens*.

The bacterium's pathogenicity is closely tied to the quantity ingested. When food contains more than the critical threshold of 10^5–10^6 CFU/g, the vegetative cells of the bacterium can reach the intestine and begin to form spores in response to the acidic gastric environment. During sporulation, the enterotoxin (CPE) is released, damaging intestinal epithelial cells and triggering gastrointestinal symptoms such as diarrhea and abdominal cramps, typically within 6 to 24 hours.[1]

While most cases are mild and self-limiting, the illness can be more severe in elderly or immunocompromised individuals.

Conditions that support the growth of *C. perfringens* are unfortunately common. As an anaerobic organism, it proliferates rapidly in cooked foods that are improperly stored - especially in large volumes. Slow cooling and holding food at room temperature create ideal conditions for spore germination and bacterial multiplication. Consequently, outbreaks frequently occur in institutional settings such as hospitals, school cafeterias, prisons, nursing homes, and large-scale catering events, where maintaining strict temperature control can be challenging.[2]

Nutritionally demanding, *C. perfringens* requires over a dozen amino acids and vitamins to grow, thriving particularly in protein-rich foods like meat and poultry - common culprits in outbreaks. Roast beef is a frequent source due to improper handling and insufficient cooling. Other high-risk foods include sauces, gravies, and stews. A notable outbreak in the United Kingdom was traced to leeks in cheese sauce.[3] The investigation revealed serious food safety lapses, including inadequate temperature control during cooking and hot-holding, cross-contamination between raw and cooked foods, and the reuse of leftover sauce. Stool samples from affected individuals tested positive for *C. perfringens*, with one case confirming the presence of the enterotoxin gene.

To prevent illness, the CDC recommends rapid cooling of cooked foods, avoiding prolonged storage at room temperature, thawing frozen dishes in the refrigerator, reheating foods to an internal temperature of at least 74°C (165°F), and properly managing food recalls.[4] These practices are essential not only in commercial foodservice operations but also at home.

At the industrial level, monitoring and detection are guided by the ISO 15213-2:2023 standard, which outlines validated methods for enumerating *C. perfringens* in food and environmental samples.[5] Advanced analytical tools further enhance detection and traceability. The MALDI Biotyper, based on MALDI-TOF MS, enables rapid and accurate identification of *Clostridium* species using several reference libraries covering more than 4,700 microbial species in total. Meanwhile, the IR Biotyper, utilizing FT-IR spectroscopy, supports strain typing for epidemiological analysis and traceability. With the addition of the IR Tracker™ software feature, root cause analysis has become faster and more accessible.

Ultimately, effective temperature control and the use of modern analytical technologies are critical to preventing and containing this often overlooked but impactful pathogen.

References
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