EDITORIAL

Microbiology puts food on the table

Microbiological processes have important roles in nearly all stages of food production. Therefore, microbiologists will be key players in making the improvements to food production that are required to feed the growing world population.

During the upcoming holidays, many events will involve traditional foods, such as turkey at Thanksgiving and Christmas. That microorganisms can spoil any of these foods, and thereby the entire party, is well known, but perhaps less obvious is the fact that microbiological processes are involved in the production of nearly all types of food. The global population is now more than 7 billion and is expected to pass 9 billion before 2050. Producing the maximum amount of food from the available land in a sustainable manner will therefore become increasingly important. As made clear by the recent *Position statement on food security and safety* from the Society for General Microbiology, the Society for Applied Microbiology, the British Mycological Society and the British Society for Plant Pathology, microbiologists can have a pivotal role in this important field. The position statement outlines nine research themes through which microbiologists can participate in food safety and security, including the investigation of microorganisms that cause food poisoning or kill crops and livestock, as well as research into the ways in which microorganisms can improve food production.

When thinking of microorganisms and food safety, food poisoning immediately comes to mind. As exemplified by the recent outbreaks of *Escherichia coli* infection in Germany and *Listeria monocytogenes* infection in the United States, microbial food contamination remains a major problem. There are roughly 47.8 million cases of food poisoning in the United States annually, leading to more than 125,000 hospitalizations and 3,000 deaths, and in the United Kingdom there are about 1 million cases of food poisoning, 20,000 hospitalizations and 500 deaths. Improved detection methods and processing practices, in addition to awareness campaigns that inform the public of the potential dangers in food, should help reduce the burden of these infections.

Safeguarding future food safety and security also means ensuring that the world grows sufficient produce to feed the expanding population. Microbiologists can play an important part in this in two ways: by reducing the losses of crops and farm animals, and by increasing crop yields and animal health (thereby increasing the yield per animal). The best known example of crop loss owing to microorganisms is the Irish potato famine, during which an outbreak of potato blight caused by *Phytophthora infestans* led to an estimated 1 million deaths. Even today, annual worldwide losses owing to *P. infestans* infection exceed US$5 billion. Furthermore, *Puccinia graminis* str. UG99, an aggressive strain of the organism that causes stem rust, is rapidly spreading throughout Africa and Asia, and 90% of the world's wheat crop has no natural defence against this pathogen. Similarly, animal diseases such as foot-and-mouth disease, bovine tuberculosis and blue tongue pose a major threat to the world's food supply. Even after harvest, microbial spoilage causes further reductions; more than 25% of food is lost in this manner, and it has been estimated that each 1% reduction represents enough food for 25 million people. More research into the organisms involved is desperately needed to develop new treatments, vaccines and culture or growth regimens that can halt their transmission. Such investigations should not focus on only the headline-grabbing outbreaks of imported infections but should also include endemic diseases. The recent eradication of rinderpest, outbreaks of which have killed millions of cattle and caused devastating famines, has shown the benefits of targeting diseases of livestock.

Less obvious, but just as important, are the ways in which microbiologists can improve food yields. A better understanding of the interactions of fungi and bacteria with plants, in the form of mycorrhizae and rhizobia, may allow the manipulation of these interactions to increase plant growth. Soil conditions can also affect the growth of crops, making nutrient cycling by microorganisms in soil an important facet of the role of microbiology in food production. Similarly, the gut microbiota of animals can affect body weight and general health. An understanding of the microbiota associated with farm animals may therefore lead to treatments or probiotic formulations that can increase animal growth and well-being.

Together, the nine research themes described in the position statement provide an overview of the essential role that microbiological processes have in food production. Although most of our readers are probably not faced with an imminent food shortage, in many parts of the world food production needs to continue to increase to feed the growing number of mouths. With focused research programmes and the necessary appreciation from national and international funding bodies, microbiologists can make important contributions to this goal. Bon appétit!

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