

The Future of Food Safety

An Exclusive Interview with Prof. Dr. Lars Fieseler, Head of Food Microbiology at ZHAW

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Franziska Gartenmann, Marketing Manager at NEMIS Technologies:

Hi Lars, great to be speaking to you. Since the focus of this interview is the future of food safety, let us start with the most important question. What do you think the future of food safety will look like in a couple of years?

I would assume that in the future, we will find just as much pathogenic around the food production line as we do today. **However, what will become increasingly important is the determination of the whole genome sequence of an isolated pathogen in order to trace it back to its origin.** Because what we need to understand after a pathogen has been found is where it came from and how it entered the product. There are two different possibilities. Firstly, the pathogen detected could be associated with the raw materials. Or secondly, it was present in the production environment and a cross-contamination occurred. Getting a positive test result as part of my environmental monitoring program does not indicate how the contamination occurred and how the specific pathogen entered the production facility. But this information is essential because what I want to derive from it are measure on how to prevent any kind of contamination of this particular strain occurring again. Therefore, I must not only detect pathogenic bacteria but also identify them. Beyond just knowing the species, I must know which strain it is and if it has already been isolated anywhere else in the world. Traditionally, technologies and methods are used to type a strain, but it has been found that many of them are simply not precise enough. Whole genome sequencing opens up a whole new era of possibility as the determination of the entire genome sequence is expressed in three to four million data points that allow a very accurate identification and subsequent comparison to other data entries. So, whole genome sequencing, in my eyes, is the most powerful technology to precisely identify a pathogen today. And it is also what is urgently needed to produce safer food today and in the future.

That sounds like this will increase the pressure on food producers significantly. Do you think this technology will remain predominantly in the hands of the government or is this something the entire industry will be using?

Of course, while making food safer it also significantly increasing the pressure on food producers. However, there is a lot that still needs to be clarified and regulated. At the moment, whenever there is an outbreak of a foodborne pathogen which is traced back to a certain item, it will be completely whole genome sequenced. That is where we are currently at. But now, the situation might change because if we start sequencing bacteria which have been detected in the production environment, we really need to clarify how to proceed. Today, it lies within the legal responsibility of the food manufacturer to produce safe products. No one is asking for precise cell counts of the production environment – yet. Of course, there are certain guidelines that have been determined, but there is little that is mandatory when it comes to environmental monitoring. I cannot answer whether it will become mandatory to whole genome sequence pathogens that are detected in the production environment. I know, it would enhance the quality of the entire production process and consequently, of the food itself. But there are a lot of questions to be answered. Who will pay for the analysis, the producer or the government? And more importantly, what happens to the data, especially in the case where pathogenic bacteria is actually detected? What will be the incentive for a food producer to share this information? Bacteria like *Listeria monocytogenes* will always be present in any case. *Listeria monocytogenes* is naturally associated with many raw materials because it is an environmental organism. It is not restricted to livestock and can be found almost anywhere. It is up to us to find and eliminate it to prevent it from causing harm. Therefore, environmental monitoring is a powerful tool to detect pathogens before the cross-contaminate the end product. Whole genome sequencing will take risk prevention and thus, management to the next level.

It sounds like the power of this new technology does not come from one data point but the interpretation of it within the context of a whole collection of data points. Is there such a centralized database yet?

The FDA in the US already established such a tool and made it available to the public. Anyone can log-in and have a look at the genomes that have been deposited there. It is also easy to simply submit a genome sequence and compare it to the existing data entries to find a potential match. The US is sequencing around 12'000 genomes each month and so this database will grow continuously. As for Europe, many genome sequences are available and have been published, but I am not aware of any one centralized database yet. Fact is that there is significant pressure building up on food manufacturers in terms of accountability. But this is reasonable, because there were countless outbreaks in the past where the strains that had caused them had been identified years

earlier. I am not quite sure how long it will take to establish whole genome sequencing in the food industry, also because it already is in a way. The technology exists and continues to be improved, resulting in a reduction of costs over time. It will not only depend on the pricing, but more importantly on the regulations and specifically the consequences that are applied when a pathogen is detected in the production environment. When it comes to end products, everything is already regulated, and the measures are clear. But I could imagine that quality and safety standards for the production environment are the next thing that will be standardized and legally enforced. But I really do not know what the final setting will be like.

If you were a food producer, how would you go about preparing yourself for this specific future of food safety?

All I can say, as a scientist, I know that this new methodology will have a tremendous impact on making food safer around the world. I think there are a lot of food producers that would like to make use of that technology to increase the safety and quality of the food they produce. But what isn't clear yet is how the information will be handled. Because like we established, the entry of *Listeria monocytogenes*, for example, into the production environment is normal because it is associated with raw materials. But as a non-familiar reader I might misunderstand the meaning of finding *Listeria monocytogenes*. And I could imagine that food producers do not want to be punished for making the extra efforts of putting an environmental monitoring program in place, detecting pathogens, sequencing and thus, identifying them. The way food safety works at the moment is that there are extremely hard consequences in place should an end product be contaminated. **The philosophy around environmental monitoring should be the exact opposite and food producers should be rewarded for finding pathogens before they can do harm.**



Prof. Dr. Lars Fieseler is lecturer and researcher ZHAW School of Life Sciences and Facility Management, serving as the head of food microbiology and running the center for food safety and quality management. He specializes in the detection of foodborne pathogens and bacteriophages and has published countless papers.