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GLOW REVEALS DANGEROUS BACTERIA: CHEMILUMINESCENCE PROBES FOR THE RAPID AND SENSITIVE DETECTION OF SALMONELLA AND LISTERIA

JULY 2, 2019 - Salmonella and listeria are among the most widely distributed and deadliest causes of foodborne infections. Their rapid and reliable detection on food and industrial food processing equipment is very important. In the journal *Angewandte Chemie*, scientists have introduced a new, ultrasensitive, chemiluminescence-based method for the direct detection of Salmonella and *Listeria monocytogenes*. Because of the simplicity and sensitivity, this test is significantly faster than conventional methods and can be carried out in the field.

Glow Reveals Dangerous Bacteria: Chemiluminescence probes for the rapid and sensitive detection of salmonella and listeria

It is estimated that about a million people per year are infected with salmonella infections in the USA alone. Of these, 380 die. Infections with listeria can also often be fatal. Current testing methods usually require the growth of bacterial cultures in a containment laboratory. A conclusive result based on standard diagnostic techniques generally takes two to six days.

Researchers working with Urs Spitz and Doron Shabat at the University of Tel Aviv, Nemis Technologies AG (Zurich, Switzerland), Zurich University of Applied Sciences, and Biosynth AG (Staad, Switzerland) have now introduced a new and efficient method for the ultrasensitive and significantly faster detection of Salmonella and Listeria. The method is based on chemiluminescence—the emission of light resulting from a chemical process. The simplicity of the tests allows for both enrichment of the bacteria and their detection in a test tube, with no further sample preparation, so no containment laboratory is required. The chemiluminescence probes have proven to be about 600 times more sensitive than conventional fluorescence probes.

The success of this technique is due to two specially developed probe molecules made by combining a luminescent substance (a phenoxy-dioxetane) with a “trigger”. In this form the probe does not light up. The trigger is tailored to the bacteria to be detected: it is recognized by a specific enzyme produced by the pathogen—a special esterase in the case of Salmonella and a special phospholipase C for Listeria—that splits it from the luminescent part. This initiates a chemical reaction that causes the luminescent molecule to split off more pieces. The energy released by the reaction is emitted in the form of a very intense green glow. Tests with various bacteria demonstrated that the probe tailored to Listeria test only reacts to *Listeria monocytogenes*, not to other, non-pathogenic, strains of listeria. The intensity of the glow can

be used to quantify the concentration of bacteria. The tests are so sensitive that, for example, a count of ten salmonella can be detected within six hours of enrichment. Even dried bacteria can be swabbed from surfaces and detected.

The researchers are confident that their new method can be used more broadly to develop specific chemiluminescence probes for other bacteria.

*Full citation: "Ultrasensitive Detection of Salmonella and Listeria monocytogenes by Small-Molecule Chemiluminescence Probes." Roth-Konforti M, Green O, Hupfeld M, Fieseler L, Heinrich N, Ihssen J, Vorberg R, Wick L, Spitz U, Shabat D. *Angewandte Chemie International Edition*; Published Online: June 2, 2019 (DOI: 10.1002/anie.201904719).*

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IMPRINTED SPHERES FIGHT BREAST CANCER: INHIBITION OF HER2 ON TUMOR CELLS BY MOLECULARLY IMPRINTED NANOPARTICLES

JULY 3, 2019 - A particularly aggressive, metastasizing form of cancer, HER2-positive breast cancer, may be treated with nanoscopic particles "imprinted" with specific binding sites for the receptor molecule HER2. As reported by Chinese researchers in the journal *Angewandte Chemie*, the selective binding of the nanoparticles to HER2 significantly inhibits multiplication of the tumor cells.

Imprinted Spheres Fight Breast Cancer: Inhibition of HER2 on tumor cells by molecularly imprinted nanoparticles

Breast cancer is the most common form of cancer in women and one of the leading causes of death. About 20 to 30 % of breast cancer cases involve the very poorly treatable HER2-positive variety. HER2 stands for Human Epidermal Growth Factor Receptor 2, a protein that recognizes and binds to a specific growth factor. HER2 spans across the cell membrane: one part protrudes into the interior of the cell; the other is on the cell surface. As soon as a growth factor docks, the extracellular parts of HER2 bind into a heterodimer with a second, closely related HER, such as HER1 or HER3. This triggers a multistep signal cascade within the cell, which is critically involved in processes like cell division, metastasis, and the formation of blood vessels that supply the tumor. HER2-positive tumor cells contain significantly higher concentrations of HER2. One current therapy for early-stage HER2-positive tumors is based on binding an antibody to HER2 to block the dimerization. Researchers led by Zhen Liu at Nanjing University (China) have now developed "molecularly imprinted" biocompatible polymer nanoparticles that recognize HER2 just as specifically as an antibody in order to prevent the dimerization.

Nanoparticles can be molecularly imprinted in that – to simplify – a polymerizable mixture is polymerized into nanospheres in the presence of the (bio)molecules they are supposed to recognize later. The (bio) molecules act as a kind of stamp, leaving nanoscopic "imprints" in the spheres. These then perfectly fit