NOMADS UAB Receives Its First GRAS Regulatory Clearance For Plant-Made Endolysins for Control of *Clostridium perfringens*

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NOMADS UAB, Lithuania, a wholly owned subsidiary of NOMAD Bioscience GmbH, Germany, received a formal 'no questions' letter from the US Food and Drug Administration (FDA) in response to NOMAD's GRAS notice GRN 802 describing use of phage Endolysins produced in plant species for control of major foodborne pathogenic strains of *Clostridium perfringens*. Endolysins are natural non-antibiotic antibacterial products developed by NOMADS and NOMAD. The FDA's response represents the first regulatory concurrence from the Agency to NOMADS' notice and the fifth positive Agency response to the two companies' applications.

The anaerobic spore-forming bacterium *Clostridium perfringens* is a source of one of the most common food-borne illnesses in the United States and Europe. The costs associated with this disease are high; therefore, effective and safe antimicrobials are needed to control food contamination by *C. perfringens*. NOMADS data demonstrate that viable solution to this problem could be bacteriophage Endolysins used as food substances or food processing aids, and such antimicrobials could be produced in green plants.

The described process is the first GRAS clearance of *Clostridium* bacteriophage-derived Endolysins. NOMADS demonstrate successful expression of six Endolysins belonging to two different families. The plant-expressed Endolysins are active against a panel of *C. perfringens* food strains under salinity and acidity conditions mimicking the food environment. NOMADS demonstrate that in simulation studies, plant-expressed Endolysins prevent multiplication of *C. perfringens* on cooked meat matrices and provide a far better control of the pathogens than nisin, the only currently available protein-based food antimicrobial substance. NOMADS' product candidates described in the notice are simple mixtures of two or more Endolysins produced in plants and applied at very low concentrations; the products are highly and broadly active against all major pathogenic *Clostridium* pathovars causing food poisoning. The underlying research has also recently been published in a research paper in the Nature Scientific Reports (Kazanavičiūtė et al. (2018) Sci. Reports 8, article number 10589; http://www.nature.com/articles/s41598-018-28838-4).

In addition to Endolysins intended for control of *Clostridium perfringens*, other plant-produced bacterial and bacteriophage antimicrobial proteins (bacteriocins) are being developed by NOMADS and its parent company NOMAD as inexpensive food substances and food processing aids for the broad control of bacterial pathogens (*Escherichia coli, Salmonella enterica,* etc.) in food products. NOMADS and NOMAD are also actively developing Bacteriocins as medical alternatives to antibiotics, with its pre-clinical research focused on novel antibacterial proteins for control of major multi-drug resistant Gram-negative pathogens including *Escherichia, Salmonella, Pseudomonas and Klebsiella*.

About NOMADS UAB, Vilnius, Lithuania. NOMADS UAB is a biotechnology company developing new non-antibiotic antibacterials, including bacteriocins and endolysins, to be used as pharmaceuticals, food additives and medical devices.

About NOMAD Bioscience GmbH, Germany. NOMAD Bioscience GmbH is a plant biotechnology company developing a broad range of biotechnology products manufactured in plants. Corporate offices are headquartered in Munich, Germany and the Company's Research Division is located in Halle, Germany. NOMAD Bioscience GmbH has two subsidiary companies: NAMBAWAN Biotech GmbH (Halle, Germany) and NOMADS UAB (Vilnius, Lithuania).