The ability to track and authenticate food products is important for all stakeholders of the food chain, not only economically, regarding substitution of ingredients partly or completely by those with a lower economic value, but also for reasons of food safety and protection of consumer interests and public health, due to growing number of allergies and food intolerance cases. Intercontinental long-distance food transport, the complexity of products, and the ease and widespread use of functional additives create temptation and risk of intentional malpractice in the labeling of foodstuffs. The proposed research aims to acquire new knowledge about the possibilities of application of modern and innovative analytical techniques for the detection of unique markers specific for food ingredients of animal origin.

The purpose of this project is to identify key peptidomic and genetic markers (i.e. short fragments of proteins and DNA) unique to food components of animal origin resistant to technological processes and to develop methods for reliable detection and quantitation of these particular food components in highly processed food products. The project will be conducted in collaboration with scientists from the Republic of South Africa. The subjects of research are animal species and processed food products that have been rarely explored in scientific research so far, and available on the Polish and South African markets, namely roe deer, red deer, wild boar, bushpig, and warthog, as well as collagen and gelatin extracted from cattle, pigs, chicken, and fish.

Three analytical methods will be developed, compared, and evaluated. Detection of specific peptide markers by high-resolution liquid chromatography-mass spectrometry (LC-MS) and detection of genetic markers by real-time polymerase chain reaction (qPCR) will be conducted by the Polish team and next-generation sequencing (NGS) will be conducted by South African team. Technological processes, including the most invasive ones, like cooking and food sterilization, cause degradation of both proteins and DNA. As a result, the processing affects the qualitative and quantitative analyzes of a given ingredient in a food product. The proposed research aims to select and identify short peptide and nucleic acid fragments that are not degraded by the technological processes used during food manufacture and to apply them in the study of the aspects of food authenticity.

With an increase in the level of food processing, the ability to successfully detect the marker molecules decreases. An additional consideration is that the target may only be present at low levels in the final product, for example, collagen or gelatine used as additives in food products. Therefore, the proposed project aims to determine the practical limits of protein and peptide detection by mass spectrometry (LC-MS) and detection of genetic markers by PCR and next-generation sequencing (NGS) in various processed food matrices, to determine the technical limitations of these methods. It is assumed that at some level of food processing, even using sensitive techniques, the detection of meat species or additives may be difficult or not applicable in practice and it would be interesting to try to determine what the pragmatic limits of analytical detection are.

The proposed research will contribute to the development of quantitative analysis in food science, and thus to the improvement of food quality. Consumers around the world demand high-quality food and avoid eating certain types/species of meat for health, religious, or lifestyle reasons. The continuous increase in the production of processed food and, at the same time, a high degree of its processing, make detection of animal ingredients in these products still a challenge. Proposed research to determine practical limits of peptide and genetics marker detection and quantitation in various complex and processed food matrices using modern analytical tools is the answer to the needs of quantifying ingredients in food.