

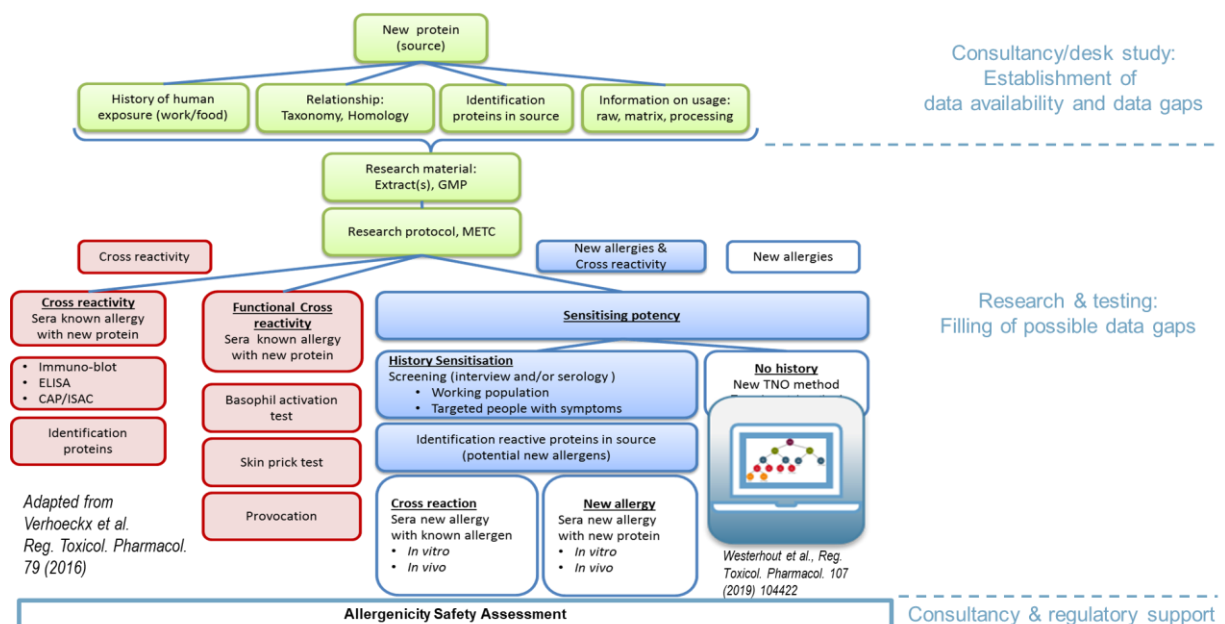
Allergenicity assessment of novel and modified food proteins

Every food producer knows the importance of allergen risk assessment and management in view of well-known allergens, such as those from peanut, egg and milk. However, all proteins intrinsically come with a risk of being allergenic. Therefore, safety assessment for protein-based food products needs to address potential allergenicity risks. This is particularly also important to all food manufacturers active in the field of novel or modified food proteins. Especially in view of the current Alternative Protein trend in food industry, driven by the global ecological challenges, allergenicity risk assessment is an important aspect of the product safety assessment strategy.



Based on our extensive scientific track record in the field of Food Allergen Risk assessment and Management, TNO offers tailor-made consultancy in protein allergenicity assessment. Our 3-step consultancy approach is based on a broadly applicable strategy to assess the allergenic hazard of novel and modified food proteins and is illustrated in the Figure below.

1. As a first step, through a consultancy/desk study, we make an inventory of all data available regarding the intended new food protein product and application (e.g. source of protein, evolutionary descent, food matrix properties) and existing data gaps. Based on this, an advisory report on how to fill possible data gaps is prepared.
2. Based on step 1, additional research and testing can be performed to fill possible data gaps.
3. Once all required data are available, we perform the actual allergenicity assessment and provide further consultancy and, if applicable, regulatory support towards market approval of your product and application.



Two key aspects of protein allergenicity assessment

In the assessment of allergenicity of novel and modified food proteins, two key aspects need to be addressed:

- 1) **the risk of cross-reactivity:** is there a risk that individuals who are already allergic to similar proteins experience an allergic reaction when they eat the novel food product?
- 2) **the risk of *de novo* sensitisation:** is there a risk that individuals become allergic when they are exposed to the novel or modified food product?

Cross-reactivity assessment

Currently, the default for assessing the cross-reactivity risk for novel protein products is based on determining amino acid sequence homology with one of the many known allergenic proteins and, if possible, specific IgE-binding tests. In case of raised concerns regarding cross-reactivity based on these, the tests can be supplemented with functional *in vitro* and/or *in vivo* studies. At TNO, we support you in this process based on our long-standing expertise and scientific network.



De novo sensitization: AllerMo in silico model to predict the allergenic potential of a protein

The question of *de novo* sensitization is more difficult to address. If there is a history of sensitization, e.g. in workers active in production facilities, serological studies to identify allergenic proteins may be performed. However, in the case there is no relevant history of exposure, there was until recently no method to establish a potential risk of *de novo* sensitization. However, based on recent breakthrough research, TNO is now offering the **AllerMo in silico model**. This machine learning tool enables the prediction of the allergenic potential of proteins based on its physicochemical and biochemical properties (Westerhout, et al. 2019). The validity of this in silico prediction tool was shown in a demonstrator case: AllerMo was able to identify previously unknown allergens from mealworms, a novel protein source for the feed and food market. Our prediction could be confirmed by specific IgE binding studies using blood from insect farmers. As AllerMo only requires the protein amino acid sequences of the food proteins as input, it can be easily incorporated into the existing allergenicity assessment approach. The results can be used in a weight of evidence-approach in novel food dossiers and/or can be applied as a step in your candidate selection processes in product development.

Interested in our services?

Our team is happy to discuss how we can support you to address your specific needs tailored to your product development pipeline. Please contact [Bas Kremer](#)

Key references:

- Kitty Verhoeckx, Henrike Broekman, André Knulst, Geert Houben. Allergenicity assessment strategy for novel food proteins and protein sources. *Regulatory Toxicology and Pharmacology*, Volume 79, August 2016, Pages 118-124 <https://doi.org/10.1016/j.yrtph.2016.03.016>
- Joost Westerhout, Tanja Krone, Almar Snippe, Lilia Babé, Scott McClain, Gregory S. Ladics, Geert F. Houben, Kitty C.M. Verhoeckx. Allergenicity prediction of novel and modified proteins: Not a mission impossible! Development of a Random Forest allergenicity prediction model. *Regulatory Toxicology and Pharmacology*, Volume 107, October 2019, 104422 <https://doi.org/10.1016/j.yrtph.2019.104422>