

# Protein Allergens, Toxins, and Bioinformatics (PATB) Committee and the COMPARE Database



## Our Mission

The committee's mission is to advance the scientific understanding of the relevant parameters defining allergenic proteins and protein toxins in foods and feeds by: (i) encouraging the development of reliable and accurate methodologies for characterizing the allergenic potential and "toxicity" potential of novel proteins, and (ii) leveraging the power of bioinformatics approaches in accomplishing these efforts.

## Chairs

### Public Chair

Prof. Ronald van Ree  
(Amsterdam University  
Medical Centers)

### Private Chair

Dr. Andre Silvanovich  
(Bayer CropScience)

## HESI Staff

Dr. Lucilia Mouriès (PATB &  
COMPARE DB,  
[lmouries@hesiglobal.org](mailto:lmouries@hesiglobal.org))  
Ms. Liisa Koski (COMPARE DB,  
[lkoski@hesiglobal.org](mailto:lkoski@hesiglobal.org))

## Webpage

[https://hesiglobal.org/  
protein-allergens-toxins-and-  
bioinformatics-committee-patb/](https://hesiglobal.org/protein-allergens-toxins-and-bioinformatics-committee-patb/)

## 2022 Committee Highlights



### Participating Organizations

2 government/regulatory agencies, 6 academic/research institutes,  
6 industry, 1 other



### Publications

2 publications, 1 accepted, 1 in progress



### Scientific Meetings and Trainings

2 meetings

- PATB Committee Annual Meeting (virtual; 15 attendees)
- COMPARE DB Annual Meeting (virtual; 16 attendees)



### Web Tools, Assays and Resources

1 database, 1 web resource

- [COMPARE Allergen Database](#)
- [COMPASS Bioinformatics Tool](#)



### Outreach

1 poster, 1 meeting participation

#### EFSA ONE – Health, Environment & Society – Conference

- Poster: The COMPARE database: A Comprehensive Public Resource for Allergen Identification and Protein Allergenicity Assessment.

#### 29th Plenary Meeting of the OECD Working Party on Safety of Novel Foods and Feeds

- Meeting participant.



### Geographic Representation

Belgium, Denmark, China, France, Germany, Netherlands,  
Paraguay, Portugal, United States

## Working Groups

- **Digestibility WG: Food Matrix Project.** PROJECT COMPLETED. This research project aimed to study the impact of food matrices on the digestibility of proteins and complements previous work on digestibility *in vitro* models (Akkerdaas et al. 2018), by testing whether protocols that take matrices into account would provide a better discrimination of allergens and non-allergens than protocols focusing on purified proteins in solution. This was a three-year project where PATB invested committee funds to support this joint research with Amsterdam University Medical Centers.
- **Allergen Rebuild Project.** This project aims to evaluate the impact of amino acid replacement, at a single dominant epitope level, on IgE binding to the epitope, as part of a full-length major protein allergen. Complementary structural studies have been conducted on the molecules, in collaboration with the University of Innsbruck, Austria (NMR, CD-spectroscopy, Fourier-transform infrared spectroscopy, microscale thermophoresis, and computer modelling) and the results have been analyzed. Publication development will start in the coming months. It is anticipated that this study will enhance understanding of the biology of allergen IgE binding. This was a five-year project where PATB invested committee funds to support this joint research with Amsterdam University Medical Centers.



**Protein Toxins Task Force.** In 2020, the task force hosted a workshop to review recent advances in protein toxins biology, the use of computational biology for protein toxins identification and characterization with *in silico* approaches, and to discuss the applicability of existing tools and resources for safety assessment of novel food biotechnology products. In 2021 the task force drafted a report of this workshop (published in Feb. 2022). In 2022, the task force started designing plans to take action on the needs identified at the workshop (i.e., the development of a harmonized framework or approach to using bioinformatic tools and interrogating available public databases to aid in the interpretation of sequence similarities for the assessment of potential protein toxicity). An international ad-hoc expert group has been convened to take on this task; the kickoff meeting was held on 11/09/2022.

- **Immunogenicity.** This project aims to examine application of an *in vitro* protocol for identifying specific T cells and antibodies from non-allergic individuals and allergic patients to pairs of proteins from the same protein family but with different allergenicity. After some delays in the anticipated start date due to the COVID-19 pandemic, the project has resumed at the leading institution, Copenhagen University Hospital at Gentofte (Copenhagen, Denmark). Results are anticipated at the end of 2022/early 2023.
- **COMPARE Database.** The [COMPARE Database](#) is a transparent resource, publicly accessible, for the identification of protein sequences that are known allergens. The sixth iteration of the database, COMPARE 2022, was released on 26 January 2022. This year, as part of COMPARE's commitment to continuous improvement, we have included the feature to search the "Parent Accession" field of an allergen sequence on the main page and have added >500 official "WHO IUIS Names" to previous COMPARE entries. COMPARE presently contains 2,463 allergenic protein sequences. The database hosts bioinformatics analytical capability through its [COMPASS tool](#) to provide website-based, real-time use of the COMPARE database to stakeholders to run bioinformatics comparative sequence analysis for the assessment of potential protein allergenicity for a protein of interest. As part of the program outreach efforts this year, a poster was presented at the "EFSA One" 2022 Conference and a new article has been submitted to a Chinese scientific journal, introducing the database and its application, in Chinese language.



**Celiac Disease.** New project in scoping. The committee is aiming to evaluate the clinical relevance of non-gluten peptides that share similarity with the disease-causing gluten peptides, in triggering Celiac disease. The interest in this research area stems from recent reports of *in vitro* studies linking bacterial peptide mimics present in the human gut to Celiac disease. The committee has reached out to clinical experts in Celiac disease and is exploring the feasibility of a project.

## Areas of Focus for 2023

- Manuscript development for the “Allergen Rebuild Study.”
- Conclusion of the Immunogenicity project. Results analysis will aim to determine if, in a same individual, allergens have an inherent different type of immunogenicity compared to non-allergens from the same protein family. Furthermore, results from this study could help answer questions such as: Do allergic patients mount a more “allergic” immune response, even to proteins to which they have no allergy or IgE? Are “strong” allergens (i.e., Ara h 2) also stronger immunogens? Is the serological response related to the T-cell response, and does it reflect immunogenicity and/or allergenicity?
- Scoping new project on triggers of Celiac disease: the committee will continue interacting with Celiac disease experts to explore the feasibility and implementation of a potential project. Scientists with relevant expertise interested in this topic are encouraged to join the effort!
- Annual update of the COMPARE Database will continue. The 7th version of COMPARE will be released in January 2023.
- The PATB and COMPARE database programs are actively recruiting new participants who share our goal of improving the science behind safety assessment of novel food/feed to improve human health. If you would like to get involved and support these activities, contact PATB’s Senior Scientific Program manager, Dr. Lucilia Mouries ([lmouries@hesiglobal.org](mailto:lmouries@hesiglobal.org)), or COMPARE’s Scientific Program manager, Ms. Liisa Koski ([lkoski@hesiglobal.org](mailto:lkoski@hesiglobal.org)) for information.

## Strategic Impact Areas

### Catalysis of New Science

The PATB focus on new research generates a variety of novel data to better understand the mechanisms of allergenicity and the impact of food matrices on allergenicity of food proteins. This year, the committee started scoping a new topical area related to Celiac disease, to investigate the relevance and impact of a non-gluten protein containing a known celiac epitope (peptide mimics) in triggering the disease.



### Enhancement of the Societal Knowledge Base on Human Biological Processes of Relevance for Protecting Human Health

The PATB develops science to better understand the mechanisms of allergenicity and allergens sensitization, a condition that affects 2–5 percent of the US population and other developed nations. The COMPARE Allergen Database is a free public resource than can be used by anyone with interest in allergens. The database companion tool, COMPASS, supports the needs for *in silico* allergenicity assessment.



### Increasing the Audiences for Collaborative Safety Science

After a successful workshop in late 2021, the HESI PATB Committee looks forward to continued engagement and interaction with the global scientific community as part of the framework development efforts. The committee also aims to establish new connections in the field of Celiac disease, as well as continuing outreach globally to disseminate outputs of the committee and disseminating the use and applications of the COMPARE database.



## 2022 Awards, Grants, and Recognition

Since 2019, HESI is an official observer in OECD meetings of the Working Party on Safety of Novel Foods and Feeds (WP-SNFF). Observer status allows HESI to participate in WP-SNFF meetings that are relevant to the work of the HESI PATB Committee and COMPARE Allergen Database. We are grateful to the OECD WP-SNFF for welcoming HESI as an official observer and allowing us to contribute scientific expertise, information sharing, and knowledge exchange about available resources supporting the safety assessment of novel foods and feeds.



## Publications

### Published

Akkerdaas et al. 2022. Impact of Food Matrices on Digestibility of Allergens and Poorly Allergenic Homologs. *Frontiers in Allergy*. <https://doi.org/10.3389/falgy.2022.909410>

Bauman et al. 2022. “From Protein Toxins to Applied Toxicological Testing” Virtual Workshop Identifies the Need for a Bioinformatic Framework to Assess Novel Food Protein Safety. *Regulatory Toxicology and Pharmacology*. <https://doi.org/10.1016/j.yrtph.2022.105146>

### Accepted

Zhao Lan and Gao Zhong-Shan. Introduction and application of the COMPARE allergen database. *Journal of Food Safety and Quality* [article in Chinese].

### In Progress

van Ree et al. Allergen Rebuild.



## Participating Organizations

### Government/Regulatory Agencies

US Environmental Protection Agency (EPA)

US Food and Drug Administration (FDA)

### Academic/Research Institutes

Copenhagen University Hospital at Gentofte

Amsterdam University Medical Centers

Joint Institute of Food Safety and Applied Nutrition (University of Maryland/FDA)

Universidad Nacional de Asuncion, Paraguay

University of Porto, Portugal

ZJU University, China

### Industry

BASF Corporation

Bayer CropScience

Corteva Agriscience

KWS

Limagrain

Syngenta

### Other

Children’s Hospital of Philadelphia