

Protein Allergens, Toxins, and Bioinformatics (PATB) 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 (lmouries@hesiglobal.org)

Ms. Liisa Koski, MS (COMPARE Allergen Database, lkoski@hesiglobal.org)

Webpage

<https://hesiglobal.org/protein-allergens-toxins-and-bioinformatics-committee-patb/>

2021 Committee Highlights



Participating Organizations

2 government/regulatory agencies, **6** academic/research institutes, **6** industry, and **1** clinical



Publications

1 published and **2** in progress



Scientific Meetings and Trainings

2 meetings

- COMPARE Database Annual Meeting (March 2021, virtual; 18 attendees)
- PATB Committee Annual Meeting (May 2021, virtual; 25 attendees)



Web Tools and Assays

1 database and **1** web resource

- COMPARE Allergen Database (comparedatabase.org)
- COMPASS Tool (comparefasta.foodrisk.org)



Outreach

1 oral presentation

- 28th Plenary Meeting of OECD Working Party on Safety of Novel Foods and Feeds (March 2021, virtual): HESI was one of seven delegations selected to present highlights of their activities at the meeting. Dr. Lucilia Mouriès (HESI) presented an overview of the PATB Committee with emphasis on the committee's workshop "[From Protein Toxins to Applied Toxicological Testing](#)" held in Fall 2020 as well as the [COMPARE Allergen Database](#).



Collaborations

1 external

- SOT Food Safety Specialty Section (FSSS): writing the Protein Toxins Workshop report with SOT FSSS representatives



Geographic Representation

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

Working Groups

- **Digestibility Working Group: Food Matrix Project.** This research project aims to study the impact of food matrices on the digestibility of proteins and complements the work completed on digestibility *in vitro* models 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. The experimental work has been concluded and the data has been analyzed. A publication is in preparation. This was a three-year project where the 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 using an intact, full-length major protein allergen. Complementary structural studies have been conducted on the molecules, in collaboration with the University of Innsbruck, Austria, and the results have been analyzed this year. 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 the PATB invested committee funds to support this joint research with Amsterdam University Medical Centers.
- **Protein Toxins Task Force.** The goals of the task force are to (1) investigate approaches for identifying protein toxins and (2) suggest best practices to identify new protein toxins. In 2020, the Task Force hosted a workshop to review recent advances in protein toxins biology and the use of computational biology for protein toxins identification and characterization with *in silico* approaches, as well as 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 and started designing plans to take action on the needs identified at the workshop (i.e., the development of a harmonized framework for using bioinformatic tools, interrogating available public databases, and aid in the interpretation of sequence similarities for the assessment of potential protein toxicity).
- **Immunogenicity.** This project aims to examine the application of an *in vitro* protocol for identifying specific T cells and antibodies from non-allergic 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 officially received the green light from the leading institution, Copenhagen University Hospital at Gentofte (Copenhagen, Denmark) and began work in mid-2021.
- **COMPARE Allergen Database.** The [COMPARE Allergen Database](#) is a transparent resource for the identification of protein sequences that are known allergens. The fifth iteration of the database, COMPARE 2021, was released in January 2021 and includes two new metadata categories. COMPARE presently contains 2,348 allergenic protein sequences, is updated annually, and is led by a collaborative steering team of public and private scientific organizations across the United States, Europe, and China. The database hosts bioinformatics analytical capability through its [COMPASS Tool](#) to provide publicly accessible resources to stakeholders for the assessment of potential protein allergenicity.

Areas of Focus for 2022

- The Food Matrix Study and Rebuild Study have concluded. In 2022, the Digestibility Working Group will continue the publications development resulting from these two large, multi-year projects.
- The Protein Toxins Task Force will put in place plans to address needs identified at their 2020 workshop (i.e., the development of a harmonized framework for using bioinformatic tools, interrogating available public databases, and aid in the interpretation of sequence similarities for the assessment of potential protein toxicity).
- The Immunogenicity project will progress into 2022 and is anticipated to be concluded by year end.
- The annual update of the COMPARE Allergen Database will continue. The sixth version of COMPARE will be released in January 2022.

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 the allergenicity of food proteins.



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% of the US population and other developed nations. The COMPARE Allergen Database is a free public resource that can be used by anyone with interest in allergens. The database's 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 committee looks forward to continuing engaging and interacting with the global scientific community as part of the framework development efforts and new opportunities for education and training.



2021 Awards, Grants, and Recognition

- Since 2019, HESI is an official observer organization of the OECD 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 PATB Committee and COMPARE Allergen Database.
- The Japanese National Institute of Health Sciences (NIHS) has developed a comprehensive repository of tools, resources, and guidelines called "[GMO-db](#)" related to biotechnology products. The resource cites the COMPARE Allergen Database among "databases capable of implementing the FAO/WHO allergenicity prediction method."

Publications

Published

van Ree R, Ballerda DS, Berin MC, Beuf L, Chang A, Gadermaier G, Guevera PA, Hoffman-Sommergruber K, Islamovic E, Koski L, Kough J, Ladics GS, McClain S, McKillop KA, Mitchell-Ryan S, Narrod CA, Pereira Mouriès L, Pettit S, Poulsen LK, Silvanovich A, Song P, Teuber SS, Bowman C (2021). The COMPARE Database: A Public Resource for Allergen Identification, Adapted for Continuous Improvement. *Frontiers in Allergy*, 2: 39. doi: [10.3389/falgy.2021.700533](https://doi.org/10.3389/falgy.2021.700533).

In Progress

van Ree et al. Impact of food matrices on digestibility of allergens and poorly allergenic homologues. In preparation.

Bauman et al. From protein toxins to applied toxicological testing: virtual workshop identifies the need for a bioinformatic framework to assess novel food protein safety. In preparation.

Participating Organizations

Government/Regulatory Agencies

US Environmental Protection Agency
US Food and Drug Administration

Academic/Research Institutes

Amsterdam University Medical Centers
Copenhagen University Hospital at Gentofte
Universidad Nacional de Asunción, Paraguay
University of Maryland, Joint Institute of Food Safety and Applied Nutrition
University of Porto, Portugal
Zhejiang University, China

Industry

BASF
Bayer
Corteva Agriscience
KWS
Limagrain
Syngenta

Clinical

Children's Hospital of Philadelphia