

Microbial Modelling and Risk Analysis PDG Meeting

Attendees: Balasubrahmanyam (Bala) Kottapalli (Chair), Panos Skandamis (Vice Chair), Seun Agbaje, Alberto Aguayo-Acosta, Deann Akins-Lewenthal, Mohammad Alam, Leen Baert, S. (Bala) Balamurugan, Michael Batz, Avery Becker, Amber Beckett, Aaron Beczkiewicz, Alexandra Belias, Yige Bima, Luc Bourbonniere, Fred Breidt, Brianna Britton, Sharon Brunelle, Daniela Buosi, Anne Carr, Yuhuan Chen, Vijay Chhetri, Ruplal Choudhary, Anika Chowdhury, Shahidullah Chowdhury, Angel Conde, Alison Cousins, Maeve Cushen, Hossein Daryaei, Atin Datta, Kris De Smet, Heidy Den Besten, Marie-Hélène Dufresne, Lise Duran, Joe Eifert, Mariem Ellouze, Glen Feller, Eduardo Franco Frias, Francisco Garces Vega, Heather Garcia, Donna Garren, Ariel Garsow, Tim Gillam, Angelica Godinez Oviedo, Rolando Gonzalez, Leena Griffith, Stephen Grove, Jiewen Guan, Ahmed Hammad, Xiaoxu Han, Sophia Harrand, Arie Havelaar, Erin Headley, Montserrat Hernández Iturriaga, Ian Hildebrandt, Lijun Hu, Lihan Huang, Xiaoping Huang, Barbara Ingham, Bulbul Jain, Vijay Juneja, Jiin Jung, Md Niamul Kabir, Jessica Kassuelke, Mark Kazmierczak, Albert Koelmans, Barbara Kowalczyk, Kento Koyama, Adam Kramer, Brian Kraus, Michele Kubista, Vickie Lewandowski, Chao Liao, Siman Liu, Xiyang Liu, Zhuosheng Liu, Bradley Marks, Sherri McGarry, Maia McNair, Jose Merino Mascorro, Barry Michaels, Hansel Mina, Abhinav Mishra, Sheri Morgan, Benjamin Morrow, Roza Nguyen, Hung Nguyen-Viet, Joyce Njoroge, Prachi Pahariya, Greg Paoli, Mickey Parish, Jinhwa Park, Anne-Marie Perchec - Merien, Fernando Perez-Rodriguez, Ruth Petran, Hannah Pilch, Brian Poon, Bill Potter, Abani Pradhan, Felix Ramos Guerrero, Bhargavi Rane, Surabhi Rani, Tanya Roberts, Joyjit Saha, Joelle Salazar, Sofia Santillana-Farakos, Donald Schaffner, Kristin Schill, Xianming Shi, Subash Shrestha, Ryan Simmons, Nitya Singh, Shreya Singh Hamal, Ben Somerton, Charles Staff, Matthew Stasiewicz, Quincy Suehr, Rico Suhaim, Juming Tang, Abdullatif Tay, Clare Thorp, Xuwen Wieneke, Dory Worcman Barninka, Sophie Wu, Chee Zheng, Kang Zhou, and Marcel Zwietering.

Number of Attendees: 127.

Meeting Called to Order at: 3:15 p.m., Sunday July 21, 2019.

Minutes Recording Secretary: Panos N. Skandamis.

Welcome and Introduction:

Chair Bala Kottapalli welcomed attendees and reviewed the meeting agenda partially.

Greetings/Announcements from IAFF Executive Board:

The following committee and PDG announcements were made via email by Didi Loynachan:

1. The IAFF Executive Board welcomes you to Louisville and IAFF 2019. We hope you enjoy the conference. Let us know if you need assistance or you can stop at the IAFF registration desk.

2. Webinars no longer need sponsorship due to the IAFF Foundation supporting the expense. We encourage PDGs to make use of webinars for symposia that were not able to be on the Annual Meeting program. Membership is required to view the recorded webinars.
3. Please make use of IAFF Connect for your PDG or Committee communications. You may also pose questions for colleagues to answer, post documents to share and discuss submissions for next year's Annual Meeting.
4. Use your Committee or PDG Liaison to assist you with questions for the Board or items for the staff.

Adoption of 2018 PDG Minutes:

Minutes from the 2018 meeting were tabled for comments or edits. There were no edits. Motion to adopt the minutes by Bala Kottapalli, seconded by Yuhuan Chen. Minutes adopted.

Election of Vice Chair:

Proposal was made for rotation of Vice Chairs (VC) between government, industry, academia in the States and the rest of the world. For the upcoming year (2019–2020), the priority for the next VC would be the regulatory authority and then from the industry, both from the States.

Matters Arising from 2018 PDG Meeting:

No matters were discussed.

Updates from SRA, MRA Specialty Group and ICPMF Committee:

Dr. Abani Pradhan provided the vision statement for SRA. He indicated that SRA is a multidisciplinary, interdisciplinary, scholarly, international society that provides an open forum for all those who are interested in risk analysis. SRA has several specialty groups one which is Microbial Risk Analysis Specialty Group (MRASG). The MRASG focuses on public health risks associated with a variety of biological hazards. Different activities of MRASG include: (1) Sponsor/organize symposia, technical sessions, posters at SRA annual meeting (2) Organize webinars (3) Encourage students – Specialty Group student merit award competition and (4) Facilitate communications and networking (e.g., LinkedIn subgroup). The upcoming 2019 SRA Annual Meeting will be held December 8–12, 2019 in Arlington, Virginia. For more information relating to SRA, please contact Amir Mokhtari (Amir.Mokhtari@fda.hhs.gov).

Dr. Mariem Ellouze gave an overview of ICPMF activities. The mission of ICPMF is to catalyze the development of predictive modelling in foods, primarily through advancing the success and sustainability of the bi-annual ICPMF conferences. ICPMF organized a symposium and a software fair in 2017 in Tampa with a great success. Another Symposium and Software Fair is taking place during the current annual meeting (Tuesday 7/23/19 from 1:30 p.m. to 5:15 p.m. in Louisville, KY. Furthermore, a series of other relevant activities was reported, including: (a) two software Fair sessions at the last FoodMicro meeting in September 2018 (9 software, 50 attendees), in Berlin and at the Dubai International Food Safety Conference in October 2018

(5 software tools, 40 attendees), (b) a series of predictive modelling and Risk assessment workshops with the Danish authorities (06/13/19), or in Spain (scheduled for November, 12–14, 2019 in Spain), an ICPMH sponsored workshop in India (planned for the 2nd quarter of 2020) and a South Africa workshop, scheduled for the 3rd quarter of 2020. The committee has created newly a webinar group that can liaise very well with our PDG and already 5 webinars are discussed or planned for 2019 and 2020. The next conference ICPMF will be in Braganza, Portugal 17–30 September 2019. More information about ICPMF can be obtained by contacting contact@icpmf.org.

Guest speaker:

Shigenobu Koseki, Ph.D. (Associate Professor, Agricultural and Food Process Engineering, Hokkaido University), Title: *Stochastic Approach for Prediction of Bacterial Inactivation*.

Highlights of the presentation:

Title: Stochastic approach for prediction of bacterial inactivation.

(a) Introduction:

- D value log-linear inactivation, but non-linearities may occur, due to variability in inactivation times.
- All phenomena can be described via stochastic process, via probability distribution. Bacterial inactivation can be described as a stochastic process.
- Variability considered includes that in:
 - a. The initial cells.
 - b. Inactivation time.
- Number of initial cells follows Poisson and is an independent process. By describing variability in inactivation time you may translate that in variation in survivors at each time interval.
- Examples of Weibull-based inactivation curves. Linear, upward concavity ($P < 1$), downward concavity ($P > 1$).

(b) Stochastic simulation of inactivation:

- Data from Aspidou and Koutsoumanis 2015. Inactivation time converted to CPD of bacterial death (No-Nt)/No, resulting in PDF of time to inactivation. Publication by Koyama et al. 2019, *J. Theor. Biology* 469, 172–179.
- He showed survival curves with shoulder or not having incorporated the variability of time to inactivation at low population levels even of the variability in inactivation is low at high populations (i.e., from 6 to 3 log CFU/g).
- He simulated stochastic inactivation lines for high and low initial population compared to the data from Aspidou and Koutsoumanis 2015.
- Then a demo of the R-based software (and Python) was shown for the stochastic simulation of inactivation for different Weibull shape parameter values was demonstrated both with the script and the figures.

(c) Simulating inactivation by assuming random distribution of survivors, in an independent process:

- Inactivation is approached via mathematical calculation and compared to stochastic simulation. Paper by Abe et al. 2019. *Food Microbial.* 82, 436–444. Simulations were compared with laboratory data of *Salmonella* inactivation at pH 2.5 (data from Aspidou and Koutsoumanis 2015).

Take away messages:

- To calculate the probability of surviving population numbers by conventional kinetic Weibull fitting parameters. Enable the calculation of survival cell numbers in stochastic way. Dr. Koseki showed curves of rate of survival cell count vs CFU. Again the script and graphical output of simulations [e.g., survival probability vs heating time (s)] was shown for varying values of shape Weibull parameters for inactivation curves.
- To convert kinetic parameters from conventional data sources (e.g., Combase) into stochastic simulations of inactivation (also encompassing the single cell inactivation time) – saving experimental time and research money.
- Calculate uncertainty and variability in fitting curves: at high populations, the uncertainty is stronger as opposed to low populations, where variability is stronger than uncertainty.
- He prompted audience to attend technical presentation.

He acknowledged his students and colleagues Hiroki and Kenzo.

Some questions to the speaker and his answers are appended below:

1. Can this be applied also under dynamic conditions?
Answer: YES see technical presentation during IAFFP meeting.
2. If COMBASE data are not available then what?
Answer: You fit the deterministic model and you add the variability afterwards.

MMRA PDG Student Award

Bala explained the process of expert panel composition and selection of abstracts. He also called up the expert judges to be recognized by the audience. Briefly the process is as follows:

- The Expert Panel consisted of 7 experts, recognized scientists from Academia, Industry and the Authorities, also members of the PDG.
- Abstract Selection Process:
 - Round 1: Three groups of panelists reviewed 30 abstracts and each group. Recommended top 2 abstracts.
 - Round 2: Top 6 abstracts were reviewed by all panelists.
- Criteria for selection (Round 1):
 - Abstract – Clarity, comprehensiveness and conciseness.

- Scientific Quality – Adequacy of experimental design (methodology, replication, controls), extent to which objectives were met, difficulty and thoroughness of research, validity of conclusions based upon data, technical merit and contribution to science.
- Criteria for selection (Round 2):
 - Abstract clarity and scientific quality is average level.
 - Abstract clarity and scientific quality is above average level.
 - Abstract clarity and scientific quality surpasses average level and merits an award.
- Winner was notified.
- Winner to receive certificate.

Bala also acknowledged the following members for their help and support in determining the MMRA PDG Student award:

- Dr. Marcel Zwietering, Wageningen University & Research.
- Dr. Yuhuan Chen, FDA-CFSAN.
- Dr. Mariem Ellouze, Nestle.
- Dr. Sofia Santillana Farakos, FDA-CFSAN.
- Dr. Fernando Perez-Rodriguez, University of Cordoba.
- Dr. Panagiotis Skandamis, Agricultural University of Athens.
- Dr. Bala Kottapalli, Conagra Brands.
- IAFP Board.
 - Tamara Ford.

Finally, Bala presented the award and gave the floor to the recipient Shraddha Karanth, who gave a 5 min. presentation.

Highlights of awarded student presentation:

- 156 *Salmonella* GenomeTrakr isolates.
- *De novo* assembly – SPAdes v.3.13.0.
- Protein-coding gene prediction – Prodigal.
- Phenotypic characterization – virulence, stress response.
- Clustering for virulence profile determination.
- Cluster prevalence estimation – Poisson regression model.

Main results:

Differentially expressed protein-coding virulence genes from the variable region, primarily belonging to SPI-6, 7, 10-12, and 16-19.

Concluding remarks:

- Considerable inter- and intra-serovar heterogeneity observed in virulence and stress-response profiles of *Salmonella* allowed for clustering based on presence/absence of specific virulence and stress response genes.
- Application into forecasting models indicated cluster-specific temporal trends and seasonality.

IAFP 2019 accepted proposals for roundtables, special event and symposia (Sponsored by MMRA PDG).

10 out of 13 proposals for symposia, roundtables or workshop were accepted and listed as follows:

Topic title:

- *Campylobacter, Health Impact, Performance Objectives and Effectiveness of Sampling Plans (Symposium, Primary Contact: Marcel Zwietering).*
- *Back to the Future: What Do Decision Makers Want to Know or Need to Know about Managing Chemical Risks in Foods? (Symposium, Primary Contact: Yuhuan Chen).*
- *Challenges of Campylobacter Detection and Control (Symposium, Primary Contact: Nabila Haddad/Heidy Den Besten).*
- *Future Pains: Assessing the Long-term Consequences of Foodborne Exposure to Microbial and Chemical Hazards (Symposium, Primary Contact: Barbara Kowalczyk).*
- *Water Re-use in Food Processing Industry. It's Inevitable! (Symposium, Primary Contact: Elisabetta Lambertini).*
- *Application of Principles of Failure Mode Effects Analysis (FMEA) for Effective Verification and Implementation of Food Safety Plans (Symposium, Primary Contact: Aaron Uesugi).*
- *Software Fair (Symposium followed by Special Event, Primary Contact: Mariem Ellouze)*
- *Pushing the Ball Forward for Agricultural Water (Workshop, primary Contact: Dan Stoeckel).*
- *Attributing Illnesses to Food Sources in the Face of Uncertainty (Symposium, Primary Contact: Michael Bazaco).*
- *A New Paradigm: Cutting Pathogens off at the Pass by Understanding Their Evolution Dynamics (Symposium, Primary Contact: Pushpinder Litt).*

Roundtables, Symposia, Workshops and Webinars – Ideas for 2020:

Proposal submission due on October the 1st, 2019.

- Re-cap symposia and workshops in 2018 proposed by members/sponsored by MMRA PDG.
 - People do mention our sponsorships without contacting. For symposia proposal sponsorships, please contact Bala and Panos. For receiving PDG support, please be timely with your request, the latest 48 hours before closing. Some symposia with our PDG marked as primary sponsored during submission do not acknowledge the PDG in the final program. Please indicate MMRA PDG sponsorship in the submission process (if received support from MMRA PDG).
- Discussion on ideas for 2019: considering cutting-edge information not previously presented; international perspectives on various issues (Formats: roundtables, technical symposia, pre-meeting interactive workshops).

- Computational modelling (industry to be updated).
- Marcel: All aspects that need to be included (identify flaws, proper assumptions, etc.) when performing a QMRA or laboratory experiment, or paraphrasing literature, or assumptions in statistical testing (webinar, roundtable, symposia).
- Yuhuan: Machine learning, automation, how the new trends/thinking may help us do QMRA, or show potential limitations – exploring in this area.
- Heidy: Variability estimation, approaches to calculate variability make use of variability in decision making and regulatory authorities.
- Tania Roberts: Interested in data issue from industry, how do we create a more robust data system to use data (sharing, confidentiality) – how do we handle.
- Yuhuan: Roundtable with 6 panel members on software tools for risk-based thinking, risk-reduction mindset, encompassing practical use of these tools.
- Bala encouraged proposers of symposia that were rejected in 2019 to revise and re-submit their proposals for 2020.
- Member from Vietnam: QMRA between developed and developing countries – possible webinar or online platform to discuss knowledge transfer on QMRA between the above.

Proposal leads can contact other PDGs, and send in before October 1st (and to the PDG before end of September if sponsoring is desired). The Chair/Vice Chair can serve as a liaison(s) to other PDGs to strengthen the symposium proposals and avoid overlapping – e.g., reach out chemical and allergen PDG.

Webinars and other communications:

- Already two webinars were held in 2019.
 - a. How to Integrate – OMICS in Risk Assessment (March 2019).
 - b. Applying Behavioral Economics to Model the Threads of Food Fraud (April 2019).
- Potential webinar topics 2019–2020/Volunteers. The list of events that have taken place so far was shared with the PDG to facilitate discussion between members and motivate ideas.

Any Other Business:

The Chair and Vice Chair of the PDG ask the members to express their interest to serve as judges (or nominate other members) for evaluating student abstracts that will receive certificate of presentation in the PDG committee.

Recommendations to the Executive Board:

1. Maintain the student recognition award.
2. Stress it to during the Chair/Vice Chair meeting.

Next Meeting Date: August 2–5, 2020, Cleveland, Ohio.

Meeting Adjourned at: 5:05 p.m.

Chairperson: Bala Kottapalli.