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Application of predictive modelling techniques in industry: from food design up to risk assessment

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**5th INTERNATIONAL
CONFERENCE
PREDICTIVE MODELLING
IN FOODS
IC PMF 2007**

Fundamentals, State of the Art and New Horizons

September 16-19, 2007

ATHENS – GREECE

**TRAINING CENTRE OF THE
NATIONAL BANK OF GREECE- GLYFADA**



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of Athens (AUA)



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PROGRAMME OVERVIEW

Sunday, September 16th	
14:00	Registration (Reception Area)
15:00	Session 1 (Room Aristotle)
17:10	Poster Session A (Lobby)
18:10	<i>Welcome Cocktail (Atrium)</i>

Monday, September 17th	
09:00	Session 2 (Room Aristotle)
10:20	<i>Coffee Break (Atrium)</i>
11:00	Session 3 (Room Aristotle) Session 4 (Room Plato)
12:40	<i>Lunch Break (Atrium)</i>
14:00	Session 5 (Room Aristotle)
15:20	<i>Coffee Break (Atrium)</i>
16:00	Session 6 (Room Aristotle) Session 7 (Room Plato)
17:40	Poster Session A (Lobby)
20:30	<i>Gala Dinner at Poseidon Temple, Sounio</i>

Tuesday, September 18th	
09:00	Session 8 (Room Aristotle)
10:20	<i>Coffee Break (Atrium)</i>
11:00	Session 9 (Room Aristotle) Session 10 (Room Plato)
13:00	<i>Lunch Break (Atrium)</i>
14:00	Session 11 (Room Aristotle)
15:20	<i>Coffee Break (Atrium)</i>
16:00	Session 12 (Room Aristotle) Session 13 (Room Plato)
17:20	Poster Session B (Lobby) Predictive modelling software demonstrations (Room Hestia)
20:30	<i>Conference Dinner</i>

Wednesday, September 19th	
09:00	Session 14 (Room Aristotle)
10:20	<i>Coffee Break (Catering Area)</i>
11:00	Session 15 (Room Aristotle) Session 16 (Room Plato)
13:00	<i>Lunch Break (Catering Area)</i>
14:00	Session 17 (Room Aristotle)
15:40	Poster Session B (Lobby)
17:00	<i>Closing Event (Atrium)</i>

PROGRAMME

Sunday, September 16th

14:00-19:00

14:00 **Registration**

Session 1: A Bird's Eye View on Predictive Modelling in Foods

Room Aristotle

Chairs: G.-J.E Nychas – J. Van Impe – P. Taoukis

15:00 Welcome Addresses

15:10 Predictive Modeling of the Past: a Personal Account (S1 -1)

C. Genigeorgis

15:30 **Key note lecture:** The Future of Predictive Microbiology: Innovative Applications and Great Expectations (S1 -2)

T.A. McMeekin, J. Bowman, S. Dobson, L. Mellefont, T. Ross and M. Tamplin

16:10 A Global Approach to Predict *Listeria innocua* Growth at the Surface of Foods as a Function of the Media and Process Characteristics (S1 -4)

I. Lebert, S. Portanguen, C. G. Dussap and **A. Lebert**

16:30 Quantification of Hurdles: Predicting the Combination of Effects on the Growth-No Growth Boundary (S1 -5)

R.J.W. Lambert and E. Bidlas

16:50 Temperature is the Main Factor Governing the Rate of Non-Thermal Inactivation of Vegetative Bacteria (S1-6)

T. Ross, D. Zhang and O. McQuestin

17:10 **Poster Session A:** Predictive Modelling Methodologies and New Modelling Techniques/Approaches

18:10 *Welcome Cocktail*

Session 2: Applications in Quantitative Microbiological Risk Assessment (I)

Room Aristotle

Chairs: T. McMeekin – K. Koutsoumanis – A. Geeraerd

- 09:00 **Key note lecture:** Risk Analysis-Current Thinking and Applications (S2-1)
L. Gorris
- 09:40 Quantitative Risk Assessment for *Escherichia coli* O157:H7 in Frozen Ground Beef Patties Consumed by Young Children in French Households (S2-2)
M.L. Delignette-Muller, M. Comu, N. Bemrah and C. Vernozy-Rozand
- 10:00 Application of Predictive Modelling Techniques in Industry: from Food Design up to Risk Assessment (S2-3)
J.M. Membre and R.J.W. Lambert
- 10:20 *Coffee Break*

Session 3 (Parallel): Predictive Modelling Methodologies for (Non)thermal Microbial Inactivation

Room Aristotle

Chairs: V. Juneja – F. Devlieghere – P. Skandamis

- 11:00 Simulation Intricacies Associated with a Weibull-type Model, Developed Based on Microbial Inactivation Experiments under Static Conditions, when Applied under Dynamic Conditions (S3-1)
M. Janssen, A. Verhulst, V. Valdramidis, F. Devlieghere, J.F. Van Impe and **A.H. Geeraerd**
- 11:20 Modular Approach for Modelling the Non-Thermal Inactivation of *Listeria monocytogenes* and *Salmonella typhimurium* (S3-2)
L. Coroller, I. Leguerinel, E. Mettler, D. Thuault and P. Mafart
- 11:40 Modelling the Inactivation of a Bacterial Spore Population Composed of Heat Sensitive and Heat Resistant Spores (S3-3)
I. Leguerinel, A. Palop, L. Coroller, S. Condon and P. Mafart
- 12:00 Identification of Non-Linear Microbial Inactivation Kinetics under Dynamic Conditions (S3-4)
V.P. Valdramidis, A.H. Geeraerd, K. Bernaerts and J.F. Van Impe
- 12:20 Development of the Quasi-Chemical Model for the Inactivation of Pathogens and Bacterial Spores by High Pressure and Chemical Sterilizing Agents (S3-5)
F.E. Feherly, C.J. Doona and E.W. Ross

Session 4 (Parallel): Predictive Modelling Methodologies for Abiotic Stresses during Microbial Growth

Room Plato

Chairs: M. Jakobsen – P. Mafart – C. Biliaderis

- 11:00 Modelling the Vapour-Phase Antimicrobial Activity of Essential Oils against a Wide Array of Foodborne Microorganisms (S4-1)
L. Gutierrez, P. Lopez, C. Sanchez, R. Batlle and C. Nerin
- 11:20 Prediction of pH and Water Activity of Complex Bacterial Growth Media Containing Electrolytes Using UNIFAC Model (S4-2)
I. Lebert, C.G. Dussap, S. Portanguen, T. Rougier, J.D. Daudin and **A. Lebert**
- 11:40 Direct Imaging Based Quantification of the Growth Dynamics of Salt-Stressed *Bacillus cereus* (S4-3)
H.M.W. den Besten, C.J. Ingham, R. Moezelaar, M.H. Zwietering and T. Abec
- 12:00 Towards a Unified Approach for Modelling the Effect of Different Levels of Osmotic Stress on the Survival of *Listeria monocytogenes* (S4-4)
P. Skandamis, A. Gounadaki, V. Valdramidis and G.-J.E. Nychas
- 12:20 Combined Effects of Thermal Treatment, pH and Glnamaldehyde on the Viability of *Alicyclobacillus acidoterrestris* spores (S4-5)
A. Bevilacqua, M.R. Corbo and M. Sinigaglia
- 12:40 *Lunch Break*

Session 5: New Horizons in Shelf-Life Modelling and Monitoring

Room Aristotle

Chairs: T. Labuza – M. Zwietering – J.P. Sutherland – D. Thuault

- 14:00 Application and Validation of the TTI Based Chill Chain Management System SMAS on Shelf Life Optimization of Vacuum Packed Fresh Tuna Slices (S5-1)
T. Tsironi, **E. Gogou** and P. Taoukis
- 14:20 Modelling pH Evolution and Lactic Acid Production in a LAB. Application to Set a Biological TTI (S5-2)
M. Ellouze, C. Bonaiti, L. Coroller, O. Couvert, D. Thuault and R. Vaillant
- 14:40 Modelling of Growth and Histamine Formation by *Morganella psychrotolerans* (S5-3)
J. Emborg and P. Dalgaard
- 15:00 Development of a Microbial Time Temperature Indicator (TTI) for Monitoring Microbiological Quality of Foods (S5-4)
H. Vaikousi, C.G. Biliaderis and K. Koutsoumanis
- 15:20 *Coffee Break*

Session 6 (Parallel): Predictive Modelling Methodologies in/on Structured Food/Model Systems

Room Aristotle

Chairs: T. Brocklehurst – D. Schaffner – T. Ross

- 16:00 Modelling the Outgrowth of *Clostridium perfringens* during the Cooling of Bulk Meat (S6-1)
Y. Le Marc, J. Plowman, C.F. Aldus, M. Munoz-Cuevas, J. Baranyi and M.W. Peck
- 16:20 Effect of pH, Water Activity and Gel Micro-Structure, Including Oxygen Profiles and Rheological Characterisation, on the Growth Kinetics of *Salmonella* Typhimurium (S6-2)
T.E. Theys, A.H. Geeraerd, F. Devlieghere, A. Verhulst, K. Poot, P. Moldenaers, DR. Wilson, T.F. Brocklehurst and J.F. Van Impe
- 16:40 *Listeria monocytogenes* Growth in Structured Food: Effect of Population Density (S6-3)
N. Gnanou-Besse, L. Barre, A. Cauquil and M. Simon-Cornu
- 17:00 Effect of Food Structure (Type of Growth), Composition and Microbial Interaction on the Growth Kinetics of *L. monocytogenes* (S6-4)
D. Dourou, A. Stamatou, **K. Koutsoumanis** and G.-J.E. Nychas
- 17:20 Modeling *Bacillus cereus* Adherence to Stainless Steel Surface as Function of Temperature, pH and Time (S6-5)
W.E.L. Pena, **N.J. de Andrade** and N.F.F. Soares

Session 7 (Parallel): Applications of Predictive Modelling to Dairy Products & Processing

Room Plato

Chairs: M. Tamplin – J. Van Impe – R.J.W. Lambert

- 16:00 A New Web-Based Modeling Tool (Websim-MILQ) Aimed at Optimization of Heating Processes in the Dairy Industry (S7-1)
M.A.I. Schutyser, J. Straatsma, P. Horak P. Keijzer, M.M.M. Vissers, M. Verschuere and P. de Jong
- 16:20 Application of Mathematical Modelling in Microbiological Spoilage Analysis and Shelf-Life Determination of Pasteurized Cream (S7-2)
A. Fasoulaki, E.Z. Panagou and G.-J.E Nychas
- 16:40 A Predictive Model for *Listeria monocytogenes* in Dairy Products (S7-3)
A. Lobacz and J. Baranyi
- 17:00 Modelling the Competitive Growth between *Listeria monocytogenes* and Biofilm Microflora of Smear Cheese Wood Shelves (S7-4)
L. Guillier, V. Stahl, B. Hezard, E. Notz and R. Briandet
- 17:20 Katiki - A traditional Greek Soft Cheese: Modeling Survival of *Listeria monocytogenes* during Storage from 5 to 20 °C (S7-5)
V. Stergiou, A. Lazaridou, M. Mataragas, and G.-J.E. Nychas
- 17:40 **Poster Session A:** Predictive Modelling Methodologies and New Modelling Techniques/Approaches
- 20:30 *Gala Dinner at Poseidon Temple, Sounio*

Session 8: Predictive Modelling Methodologies at Individual Cell Level (I)

Room Aristotle

Chairs: S. Brul – R. Whiting – S. Koseki

- 09:00 **Key note lecture:** Microbial Adaptation: Continuously Discrete or Discretely Continuous? (S8-1)
J. Baranyi
- 09:40 Modelling the Individual Cell Lag Time Distributions of *Listeria monocytogenes* as a Function of the Physiological State and the Growth Conditions (S8-2)
J.C. Augustin and **L. Guillier**
- 10:00 A Study on the Variability in the Growth Limits of Individual Cells and its Effect on the Behaviour of Microbial Populations (S8-3)
K. Koutsoumanis
- 10:20 *Coffee Break*

Session 9 (Parallel): Applications in Quantitative Microbiological Risk Assessment (II)

Room Aristotle

Chairs: L. Gorris – M. Delignette-Muller – M. Tamplin

- 11:00 Microbial Quantitative Exposure Assessment of *Listeria monocytogenes* in Minimal Processed Fresh Salads Using Hierarchical Bayesian Modelling and Second-Order Monte Carlo Simulation (S9-1)
A. Crepet, V. Stahl and F. Carlin
- 11:20 Behaviour of *Clostridium perfringens* in the Gastro-Intestinal Tract in Relation to Food Borne Disease (S9-2)
L.M. Wijnands and A. Pielaat
- 11:40 Implications of FSO Scenarios for the Broiler Chicken Supply Chain (S9-3)
E.D. van Asselt, S. Tromp, H. Rijgersberg and H.J. van der Fels-Klerx
- 12:00 Risk Associated with *Salmonella* on the Shell of Hens' Eggs (S9-4)
P. Botey-Salo, A. Anyogu, A.H. Varnam and J.P. Sutherland
- 12:20 An Integrated Risk Assessment of Patulin in Apple Juices throughout the Food Chain (S9-5)
K. Baert, B. De Meulenaer, A. Amiri, J. Debevere and F. Devlieghere
- 12:40 Semantic Annotation of Web Data Applied to Risk in Food (S9-6)
G. Hignette, P. Buche, O. Couvert, J. Dibia-Barthelemy, D. Doussot, O. Haemmerle, E. Mettler and L. Soler

Session 10 (Parallel): Presentations of Predictive Modelling Software

Room Plato

Chairs: J. Baranyi – P. Dalgaard – V. Juneja

- 11:00 Use of USDA-Pathogen Modeling Program and the Predictive Microbiology Information Portal (S10-1)
V. Juneja
- 11:30 ComBase: An Integrated Database and Predictor of Microbial Responses to Food Environments (S10-2)
J. Baranyi
- 11:50 Seafood Spoilage and Safety Predictor (SSSP)-New Safety Models for Popular Software (S10-3)
P. Dalgaard, O. Mejlholm, J. Emborg and B.J. Cowan
- 12:10 SymPrevius: System for Prediction of Processes and Environments Impacts on Microorganisms in Food (S10-4)
O. Couvert and F. Postollec
- 12:30 Software Tools for Food Safety Decisions: Risk Ranger and the Refrigeration Index (S10-5)
Tom Ross
- 12:50 GInaFiT. Revealing the Time-Dependence of Microbial Survival under Food Processing, Food Preservation or Environmental Stress Conditions (S10-6)
A.H. Geeraerd and J.F. Van Impe
- 13:00 *Lunch Break*

Session 11: Predictive Modelling Methodologies at Individual Cell Level (II)

Room Aristotle

Chairs: L. Gorris – C. Pin – J.C. Augustin

- 14:00 Development and Assessment of Growth/No Growth Models Incorporating the Effect of Cell Density on the Growth Probability of *Listeria monocytogenes* (S11-1)
K.P.M. Gysemans, A. Vermeulen, K. Bernaerts, A.H. Geeraerd, J. Debevere, F. Devlieghere and J.F. Van Impe
- 14:20 Modelling the Effect of Acid Adaptation and Inoculum Size on the Growth Boundaries of *Salmonella* Enteritidis and *Listeria monocytogenes* in Response to pH, Water Activity and Temperature (S11-2)
P.N. Skandamis
- 14:40 Effects of Non-Growth Inhibitory Concentrations of Selected Fatty Acids on the Lag Time Distribution of *Staphylococcus aureus* Single Cells (S11-3)
S. Sado-Kamdem, C. Pin, M.E. Guerzoni and J. Baranyi
- 15:00 Modelling the Effect of Sub-Lethal Temperatures on the Subsequent Germination and Outgrowth Stages Constituting the Individual Lag Times of Spores of *Bacillus subtilis* (S11-4)
J.P.P.M. Smelt, A.P. Bos and S. Brul
- 15:20 *Coffee Break*

Session 12 (Parallel): Methodological Developments for Predictive Modelling and Risk Assessment

Room Aristotle

Chairs: J. Baranyi – J. Membre – T. Ross

- 16:00 Quantification of the Adaptive Salt Stress Response of *Bacillus cereus* (S12-1)
H.M.W. den Besten, M. Mataragas, R. Moezelaar, T. Abee and M.H. Zwietering
- 16:20 Accurate Estimation of Cardinal Temperature Parameters of *Escherichia coli* from Dynamic Experiments: What Can We Gain from Optimal Dynamic Experiment Design? (S12-2)
E. Van Derlinden, K. Bernaerts and J.F. Van Impe
- 16:40 Validation and Performance of Predictive Modelling in Foods: Use of Prediction Confidence Bands (S12-3)
L. Coroller and J.P. Gauchi
- 17:00 A Global Bayesian Approach for Quantitative Risk Assessment (QRA) from Farm to Illness. Application to Campylobacteriosis through Broiler (S12-4)
I. Albert, E. Grenier, J.B. Denis and J. Rousseau

Session 13 (Parallel): Applications of Predictive Modelling in Meat Products/Processing

Room Plato

Chairs: J. Sofos – A. Geeraerd – P. Skandamis

- 16:00 A Predictive Model for Growth of *L. monocytogenes* in Meat Products with Seven Different Hurdles Variables (S13-1)
A. Gunvig, J. Blom-Hanssen, T. Jacobsen, F. Hansen and C. Borggaard
- 16:20 Probabilistic Modelling of *Pseudomonas fluorescens* Behaviour on Surfaces in Meat Processing Premises (S13-2)
 S. Peneau, B. Carpentier and **M. Cornu**
- 16:40 Combining Deterministic Models and Monte Carlo Analysis for Process Optimization in the Cooked Meat Products Industry (S13-3)
A. Esveld-Amanatidou and I.C. Verhagen
- 17:00 The Comparative Study of Growth Rate, Lag Phase and Doubling Time of *E. coli* O157:H7 in Commercial Chicken Soup Extract Affected by Some Essential Oils (*Zataria multiflora*, *Carvi carum* and *Mentha piperita*) (S13-4)
A. Fazlara, H. Najafzadeh and E. Lak

Predictive Modelling Software Demonstrations

Room Hestia

- 17:20
- USDA-Pathogen Modeling Program
 - Predictive Microbiology Information Portal
 - ComBase
 - Seafood Spoilage and Safety Predictor (SSSP)
 - Sym'Previs
 - Risk Ranger
 - Refrigeration Index
 - GInaFIT
- 17:20 **Poster Session B:** Applications of Predictive Modelling
- 20:30 *Conference Dinner*

Session 14: New Horizons Involving Systems Biology

Room Aristotle

Chairs: P. Mafart – M. Zwietering – T. Brocklehurst

- 09:00 **Key note lecture:** Microbial Systems Biology; New Frontiers Open to Predictive Food Microbiology (S14-1)
S. Brul, F. Mensonides, B. Bakker, K. Hellingwerf and J. Teixeira de Mattos
- 09:40 Application of Network Science to Describe the Changes in Gene Expression during the Lag Time of *Escherichia coli* (S14-2)
C. Pin and J. Baranyi
- 10:00 Quantitative Evaluation of Spoilage (S14-3)
P. Skandamis, M. Mataragas and **G.-J.E. Nychas**
- 10:20 *Coffee Break*

Session 15 (Parallel): Applications of Predictive Modelling in Salads, Sourdough & Fish and Seafood Products

Room Aristotle

Chairs: P. Dalgaard – D. Thuault – E. Panagou

- 11:00 Evaluation of the Microbial Safety and Stability of Salads and Sauces Based on Growth/No Growth Models for Different Micro-Organisms (S15-1)
A. Vermeulen, F. Devlieghere, K. Bernaerts, A. Geeraerd, K.P.M. Gysemans, J.F. Van Impe and J. Debevere
- 11:20 Modelling of the Functionalities of a Novel *Lactobacillus fermentum* Sourdough Starter Strain (S15-2)
G. Vrancken, T. Rimaux, L. De Vuyst and **F. Leroy**
- 11:40 Development and Field Validation of a Shelf-life Model for Emulsified Greek Appetizers (S15-3)
P.N. Skandamis, S. Manios, A. Skiadaresis, K. Karavasilis, G.-J.E. Nychas and E.H. Drosinos
- 12:00 Predicting Growth of Lactic Acid Bacteria and *Listeria monocytogenes* in Lightly Preserved Seafood – a Product-Oriented Modelling Approach (S15-4)
O. Mejlholm and P. Dalgaard
- 12:20 Optimization of Shelf Life Distribution of Frozen Shrimp Based on Modeling and TTI Monitoring (S15-5)
T. Tsironi, M. Giannakourou, E. Dermesonlouoglou and P. Taoukis
- 12:40 Development and Assessment of a Shelf Life Prediction System for Cultured Tilapia (S15-6)
Z. Xu, Q. Guo and **X. Yang**

Session 16 (Parallel): Application of Predictive Modelling in Food Products & Drinks

Room Plato

Chairs: J. Membre – C. Pin – J.P.P.M. Smelt

- 11:00 Microbial Interactions and Equilibrium during Wine Elaboration-Relationship with Wine Quality (S16-1)
V. Renouf
- 11:20 Predictive Modelling for the Recovery of *Listeria monocytogenes* on Sliced Cooked Ham after High Pressure Processing (S16-2)
S. Koseki and K. Yamamoto
- 11:40 Modeling High Hydrostatic Pressure Inactivation Kinetics of Pectinmethylesterase of Citrus Fruits (S16-3)
G.J Katsaros, B. Sidosi, T. Panagiotou, A. Polydera and P.S Taoukis
- 12:00 Effect of Ethanol Vapours on Inactivation of Fungal Spores (S16-4)
P. Dantigny, T. Dao, J. Dejardin and M. Bensoussan
- 12:20 Development of a Probabilistic Lag Model to Predict the Fate of *Bacillus cereus* Spores in Heat-treated Chilled Foods (REPFÉDs) (S16-5)
J.M. Membre, D. Kan-King-Yu and C.W. Blackburn
- 12:40 A Logistic Approach to Assess the Suitability of Aroma Compounds to Improve Stability of Soft Drinks Inoculated with *S. cerevisiae* (S16-6)
N. Belletti, R. Lanciotti, S.L. Sado Kamdem, F. Patrignani and F. Gardini
- 13:00 *Lunch Break*

Session 17: A last bird's eye view...

Room Aristotle

Chairs: T. Roberts – T. McMeekin – M. Delignette-Muller

- 14:00 What Happens to the Diversity of Bacterial Pathogens along a Processing Chain? The Example of *Bacillus cereus* in Cooked and Pasteurised Vegetable Purées (S17-1)
A.L. Afchain, F. Carlin, C. Nguyen and I. Albert
- 14:20 Evolving from High through Low Uncertainty Risk Assessments for Dairy Products Using Kinetic, Stochastic and Fault Tree Modelling (S17-2)
J.H.M. van Lieverloo, M. Fox, M. Schutyser, M.C. te Giffel and P. de Jong
- 14:40 Variability and Uncertainty in the *Campylobacter* Load and the Corresponding Risk in Consumption of Poultry in the United Kingdom (S17-3)
P.K. Malakar, G.C. Barker, N. Gomez, L.C. Chai and R. Son
- 15:00 Risk Assessment of *Salmonella* spp. in Cocoa Products (S17-4)
J. Rossis, P. Skandamis and G.-J.E. Nychas
- 15:20 Optimising Food Process and Formulation through Sym'Previous, Food Safety Management (S17-5)
O. Couvert, J.C. Augustin, P. Buche, F. Carlin, L. Coroller, C. Denis, E. Jamet, E. Mettler, A. Pinon, F. Postollec, V. Stahl, V. Zuliani and D. Thuault
- 15:40 **Poster Session B:** Applications of Predictive Modelling
- 17:00 *Closing event*

POSTER SESSION A

**Predictive Modelling Methodologies and New Modelling
Techniques/Approaches**

Growth Interaction between *Staphylococcus aureus* and Lactic Acid Bacteria during Fermentation of Milk (PA1)

L. Valik, A. Medvedova, B. Bajusova and D. Liptakova

Evolutionary Combined Neural Networks for Modelling the Growth Boundaries for a Five Strain *Staphylococcus aureus* Cocktail against Temperature, pH and Water Activity (PA2)

A. Valero, F. Perez-Rodriguez, E. Carrasco, C. Hervás, P. Gutierrez, J.C. Fernandez, R.M. Garcia Gimeno and G. Zurera

Towards a Biological Process Model for the Behavior of Food-Borne Pathogens in the Gastro-Intestinal Tract (PA3)

A. Pielat and L. Wijnands

A New Algorithm for Calculating Thermal Processes Related to Non-Log-Linear Survival Curves (PA4)

P. Mafart, H. B. Yaghlène and L. Coroller

Evolution of Biomass Distribution during Bacterial Lag Phase through Flow Cytometry, Particle Analysis and Individual-Based Modelling (PA6)

C. Prats, J. Ferrer, B. Flix, A. Giro, D. Lopez and J. Vives-Rego

Predictive Model for Growth of *Clostridium perfringens* at Temperatures Applicable to Cooling of Cooked Uncured Beef and Chicken (PA7)

V. Juneja, H. Marks, L. Huang and H. Thippareddi

Variability of the *Listeria innocua* and *Enterococcus faecalis* Inactivation in Ham by Irradiation (PA8)

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