



ISFSI



*The 4th Congress of the  
International Society of  
Fish & Shellfish Immunology*

December 12-15, 2022 // Bodø, Norway

**WELCOME!**

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## COMMITTEES

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- *Ioannis Vatsos*
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- *Victor Mulero* **Murcia University, Spain**
- *Magdalena Chadzińska* **Jagiellonian University, Poland**
- *Jorge Galindo-Villegas* **Nord University, Norway** (Chair of the 4<sup>th</sup> ISFSI, 2022)



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## PROGRAMME AT A GLANCE

4 <sup>th</sup> ISFSI (DECEMBER 12-15, 2022)						
	SUNDAY 11	MONDAY 12	TUESDAY 13	WEDNESDAY 14	THURSDAY 15	
8:00-8:30	<b>ARRIVAL</b>	<b>REGISTRATION</b>				
08:30-9:00		<b>OPENING 4th ISFSI</b>	<b>REGISTRATION</b>			
09:05 to 10:00		Plenary <b>Ikuo Hirono</b>	Plenary <b>Irene Salinas</b>	Plenary <b>Kim Thompson</b>	Plenary <b>Kenneth Söderhäll</b>	
10:00-10:15		<b>BREAK</b>				
10:15 to 12:00		CRUSTACEAN & MOLLUSCAN IMMUNOLOGY (Chairperson: Peter Bossier)	STRESS & IMMUNE FUNCTION (Chairperson: Felipe Réyes-López)	IMMUNOSTIMULANTS, ADJUVANTS, & VACCINES (Chairperson: Simona Picchietti)	PATHOGENS & IMMUNE INTERACTIONS (Chairperson: Beatriz Novoa)	
12:00 to 13:00		<b>LUNCH</b>				
13:00 to 15:00		FISH & SHELLFISH FUNCTIONAL GENOMICS (Chairperson: Gregory D. Wiens)	NEW TECHNOLOGIES FOR IMMUNE EVALUATION I (Chairperson: Gyri Teien Haugland)	ADAPTIVE IMMUNITY I (Chairperson: Ingvill Jensen)	NUTRITIONAL MODULATION OF IMMUNITY (Chairperson: Daniel Montero)	
15:00-15:15		<b>REGISTRATION OPEN</b> (Quality Ramstalt Hotel)		<b>BREAK</b>		<b>4th ISFSI Closing &amp; ISFSI Assembly</b>
15:15 to 16:15		MYELOID CELLS (Chairperson: Jorge Galindo-Villegas)	II (Chairperson: Magdalena Chadzińska)	II (Chairperson: Irene Salinas)		
16:15-16:45		<b>WELCOME DRINK</b> (Salmon Center)	Featured <b>N. Steinel</b>	Featured <b>E. Villablanca</b>	<b>NETWORKING</b>	
16:45-17:00	<b>BREAK</b>					
17:00 to 18:00		<b>POSTER FLASH TALKS I</b> <small>Moderated by: Tosca A. van Gelderen</small>	<b>POSTER FLASH TALKS II</b> <small>Moderated by: Joshua Superio</small>			
	<b>FREE</b>					
20:00 to 23:30		<b>Northern Lights SAFARI I &amp; II</b> (Guided by: Polar Tours)  *Both tours are complimentary for Delegates		<b>President's RECEPTION</b> (Quality Ramsalt Hotel)  *Dress code: Smart Casual		



## SUNDAY

- 15:00-16:00 Registration Open at Congress Venue. (Quality Ramsalt Hotel -Lobby)
- 16:15 Welcome Drink at Salmon Center. (Sjøgata 21, 8006 Bodø). Five minutes walking from the Congress Venue.

## MONDAY

08:30-09:00 **Opening Ceremony**

- **Jorge Galindo-Villegas** (Chair of the 4<sup>th</sup> ISFSI Congress)
- **Mette Sørensen** (Dean, Faculty of Biosciences and Aquaculture. Nord University)
- **Kristina S. Hansen** (State Secretary, Ministry of Fisheries and Sea)
- **Ida Pinnerød** (Bodø Mayor)
- **Beatriz Novoa** (President, International Society of Fish & Shellfish Immunology)

## PLENARY LECTURE

09:00-10:00 **K-1 Using beneficial bacteria and its products for development of prevention methods against infectious diseases in shrimp aquaculture** Ikuo Hirono

10:00-10:15 **BREAK**

## CRUSTACEAN & MOLLUSCAN IMMUNOLOGY

(Chairperson: Peter Bossier)

- 10:15 **O-01** The evolutionary particularity of expanded immune gene families in mussel and their relationship with functional specificity  
**Amaro Saco**, Marco Gerdol, Magali Rey-Campos, Beatriz Novoa, Antonio Figueras
- 10:30 **O-02** Characterization of plasma neutralizing factor(s) in shrimp survivors from white spot disease outbreak  
**Phasini Buathongkam**, Jiraporn Srisala, Suparat Taengchaiyaphum, Kallaya Sritunyalucksana, Siripong Thitamadee
- 10:45 **O-03** White Spot Syndrome Virus Infection was aided in Glutamic-Pyruvic Transaminase  
**Shu-Wen Cheng**, Han-Ching Wang
- 11:00 **O-04** Involvement of WSSV proteins in regulating shrimp LDH  
**Yen Siong Ng**, Saengchan Senapin, Pakkukul Sangsuriya, Han-Ching Wang
- 11:15 **O-05** The pathological changes in the hepatopancreas are mediated by cathepsin L in EHP (*Enterocytozoon hepatopenaei*)-infected white shrimp (*Litopenaeus vannamei*)  
**Yun-Ru Chiang**, John Han-You Lin
- 11:30 **O-06** The presence and differential expression of mucin in the digestive tract of the female freshwater prawn, *Macrobrachium rosenbergii*, during the ovarian cycle  
**Warinthip Vetkama**, Ruchanok Tinikul, Prasert Sobhon, Yotsawan Tinikul
- 11:45 **O-07** Epigenetic Mechanisms Regulate Adaptive-Like Innate Immune Responses to Pathogen Encounter in Farmed Crustaceans: Lessons Learned from the Artemia Model  
**Parisa Norouzitalab**, Suvra Roy, Kartik Baruah, Peter Bossier, Daisy Vanrompay

12:00-13:00 **LUNCH**

## FISH & SHELLFISH FUNCTIONAL GENOMICS

(Chairperson: Gregory D. Wiens)

- 13:00 **O-08** Linking increased thermotolerance to disease resistance in *Artemia franciscana*  
Wisarut Junprung, Parisa Norouzitalab, Daisy Vanrompay, Stephanie De Vos, Anchalee Tassanakajon, Nguyen Viet Dung, Gilbert Van Stappen, **Peter Bossier**
- 13:15 **O-09** RNA-Seq analysis reveals that spring viraemia of carp virus induces a broad spectrum of PIM kinases in zebrafish kidney that promote viral entry  
**Patrícia Pereiro**, Margarita Álvarez-Rodríguez, Valentina Valenzuela-Muñoz, Cristian Gallardo-Escárate, Antonio Figueras, Beatriz Novoa
- 13:30 **O-10** Transcriptome-wide mapping of immune responses in lumpfish leukocytes upon in vitro Poly I:C exposure  
**Shreesh Rao**, Harald S. Lunde, Amanda KS. Fond, Kjell Petersen, Tomasz Furmanek, Gyri T. Haugland
- 13:45 **O-11** Single cell analysis of immunological responses in Atlantic salmon liver and the conservation of immune cell repertoires across organs  
**Richard S. Taylor**, Rose Ruiz Daniels, Ross Dobie, Jianxuan Sun, Carl Milton, Shahmir Naseer, Thomas C. Clark, Neil C. Henderson, Pierre Boudinot, Samuel A.M. Martin, Daniel J. Macqueen

- 14:00 **O-12** Assessing immune-related roles of dre-miR-210-5p by a gonadal primary cell culture of zebrafish  
**Tosca A. van Gelderen**, Laia Ribas
- 14:15 **O-13** Uncovering immune biomarkers of proliferative kidney disease: First insights into the early gill transcriptomic response following parasite exposure  
Marc N. Faber, Davina Deros, Konstantinos Apostolakis, Nicole Strepparava, Helmut Segner, Christopher J. Secombes, **Jason W. Holland**
- 14:30 **O-14** Transcriptome studies of viral hemorrhagic septicemia resistant and susceptible rainbow trout strains give insight into resistance associated immune pathways  
**Torben Krebs**, Clemens Falker-Gieske, Marek Matras, Alberto Falco, Michal Reichert, Christian Lodder, Jens Tetens, Dieter Steinhagen, Mikolaj Adamek
- 14:45 **O-15** A transcriptomic atlas of Atlantic salmon spleen cells and their responses to challenge by *Aeromonas salmonicida*  
**Jianxuan Sun**, Richard S. Taylor, Rose Ruiz Daniels, Ross Dobie, Neil C. Henderson, Samuel A. Martin, Daniel J. Macqueen

15:00-15:15

**BREAK**

## MYELOID CELLS

*(Chairperson: Jorge Galindo-Villegas)*

- 15:15 **O-16** Melano-macrophages and their relation to muscle inflammation in the Atlantic salmon (*Salmo salar*)  
**Håvard Bjørgen**, Espen Rimstad, Ivar Hordvik, Erling Olaf Koppang
- 15:30 **O-17** Doing the impossible: common carp *Cyprinus carpio* red blood cells as modulators of the immune response in parasitic infections with the myxozoan *Sphaerospora molnari*  
**Jovana Majstorović**, Amparo Picard-Sánchez, Justin T. H. Chan, Gema Alama-Astrid, Astrid S. Holzer, Tomáš Korytář
- 15:45 **O-18** The role of neutrophils and macrophages in resistance against a fish parasite in zebrafish (*Danio rerio*)  
Heidi Mathiessen, Moonika Haahr Marana, Sebastian Nintemann, Sara Gelskov, **Louise von Gersdorff Jørgensen**
- 16:00 **O-19** Neutrophil polarization in fish  
**Magdalena Maciuszek**, Ewa Bucon, Magdalena Chadzińska
- 16:15-16:45 **F-1;** **Featured:**  
**O-20** Evolutionary gain and loss of fibrotic immune response to parasitism  
**Natalie C. Steinel**, Jesse N. Weber, Foen Peng, Kum Chuan Shim, Brian K. Lohman, Lauren Fuess, Swapna Subraminian, Stephen de Lisle, Daniel I. Bolnick

16:45-17:00

**BREAK**

## 17:00-18:00 POSTER, FLASH TALKS I

*(Moderator: Ph.D. cand., Tosca A. van Gelderen)*

## TUESDAY

### PLENARY LECTURE

- 09:00-10:00 **K-2** **The emerging field of neuroimmune communication in fish: From mucosal barriers to the CNS and back** Irene Salinas

10:00-10:15

**BREAK**

## STRESS & IMMUNE FUNCTION

*(Chairperson: Felipe E. Reyes-López)*

- 10:15 **O-21** A multi-omics approach provides a deeper understanding of the immune response of sea cucumber coelomocytes to lipopolysaccharides  
**Noé Wambreuse**, Jérôme Delroisse, Vanessa Tagliatti, Igor Eeckhaut, Laura Borrello, Guillaume Caulier
- 10:30 **O-22** Effects of stress on the antiviral response in Atlantic salmon red blood cells  
**Thomas Tsoulia**, Randi Faller, Maria K. Dahle
- 10:45 **O-23** Cooperation between ER stress, autophagy, mitochondrial stress, and vesicle trafficking in the RBCs response to vaccines  
**Maria Elizabeth Salvador-Mira**, Alba Manso Aznar, Paula Gimenez Moya, Ester Sánchez Córdoba, Ivan Nombela, Sara Puente-Marin, Veronica Chico, Luis Perez, Ana Joaquina Perez-Berna, Maria del Mar Ortega-Villaizan

- 11:00 **O-24** Chronic thermal stress effects on innate immune response induced by bacterial challenge in Russian sturgeon  
**Marcio Aversa-Marnai**, Mauricio Castellano, Ana María Benitez, Ignacio Quartiani, Daniel Conijeski, Alejandro Perretta, Andrea Villarino, Valeria Silva-Álvarez, Ana María Ferreira
- 11:15 **O-25** Mechanisms regulating stress-induced redistribution of fish neutrophils  
**Katarzyna Klak**, Magdalena Maciuszek, Lukasz Pijanowski, Magdalena Marcinkowska, Joanna Homa, Krzysztof Rakus, Magdalena Chadzińska
- 11:30 **O-26** Immune response in southern sand flathead, *Platycephalus bassensis*, affected by muscle melanisation from Deceitful Cove in the Tamar Estuary (Tasmania, Australia)  
**Khattapan Jantawongsri**, Chun Kit Ooi, Trevor Lewis, James Haddy, Amanda L. Patchett, James W. Wynne, Kelli C. Anderson, Ruth Eriksen, Barbara F. Nowak
- 11:45 **O-27** The molecular identification of *glucocorticoid receptor 1 (gr1)* and *gr2* reveals their differential modulation to stress in gilthead sea bream (*Sparus aurata*) mucosal tissues  
**Eva Vallejos-Vidal**, Beatriz Sanz-Milián, Ali Reza Khansari, Mariana Teles, Sebastián Reyes-Cerpa, Juan Miguel Mancera, Lluís Tort, Felipe E. Reyes-López

12:00-13:00

LUNCH

## NEW TECHNOLOGIES FOR IMMUNE EVALUATION I

(Chairperson: Gyri Teien Haugland)

- 13:00 **O-28** CRISPR-Cas induced IRF3 and MAVS knockouts in a salmonid cell line disrupt PRR signaling and affect viral replication  
Yorick A. van der Wal, Allan Akandwanaho, Henriette Nordli, Linn Greiner-Tollersrud, Jaap Kool, **Jorunn B. Jørgensen**
- 13:15 **O-29** Aquatic plastic contaminants and the fish immune system: Nanoplastics and surgical masks (the COVID-19 effect).  
**Beatriz Novoa**, Marta Sendra, Patricia Pereiro, Antonio Figueras
- 13:30 **O-30** Plasma proteome and cellular responses in zebrafish following  $\lambda$ -carrageenan-induced inflammation  
**Joshua Superio**, Ives Charlie-Silva, Natália M. Feitosa, Andrea C. Perez, Thiago M. Cunha, Marco A.A. Belo, Jorge Galindo-Villegas
- 13:45 **O-31** Electrochemical detection of white spot syndrome virus using a homemade disposable electrode composed of graphene quantum dots and gold nanoparticle-embedded polyaniline  
Kenshin Takemura, Jun Satoh, Jirayu Boonyakida, Sungjo Park, Ankan Dutta Chowdhury, **Enoch Y. Park**
- 14:00 **O-32** Plasma Proteomic Profiling of Bacterial Cold-Water Disease Resistant and Susceptible Rainbow Trout Lines and Identification of a Novel Disease Biomarker  
**Gregory D. Wiens**, David P. Marancik, Christopher C. Chadwick, Ross M. Reid, Keira Osbourn, Timothy D. Leeds
- 14:15 **O-33** Is ADAR-mediated RNA editing during Ostreid herpesvirus-1 infection pro- or anti-viral?  
**Umberto Rosani**, Enrico Bortoletto, Adnan M. Niazi, Lu-Sheng Xin, Eivind Valen, Paola Venier, Chang-Ming Bai
- 14:30 **O-34** Development and characterization of primary contracting salmonid heart cell cultures: A new tool for cardiac virus studies?  
**Sarah Graff**, Julia Bauer, Torben Krebs, Dieter Steinhagen, Mikolaj Adamek, Henrike Seibel, Marina Gebert
- 14:45 **O-35** Proteomics and flow cytometry give new insight into immunosuppression observed during carp edema virus-induced gill disease  
**Mikolaj Adamek**, Justin T.H. Chan, Mariola Dietrich, Maria Zawisza, Felix Teitge, Natalia Kodzik, Verena Jung-Schroers, Magdalena Chadzińska, Alberto Falco, Andrzej Ciereszko, Krzysztof Rakus, Tomas Korytar, Dieter Steinhagen

15:00-15:15

BREAK

## NEW TECHNOLOGIES FOR IMMUNE EVALUATION II

(Chairperson: Magdalena Chadzińska)

- 15:15 **O-36** Brain and immunity in teleost fish: new insights from *Dicentrarchus labrax*  
**Valeria Pianese**, Andrea Miccoli, Anna Maria Fausto, Giuseppe Scapigliati, Simona Picchiatti
- 15:30 **O-37** Evaluation of eDNA concentration of *Vibrio anguillarum* correlated with infection and immune response in zebrafish (*Danio rerio*)  
**Cyril Henard**, Hanxi Li, Manuel Blonç, Yajiao Duan, Louise von Gersdorff Jørgensen
- 15:45 **O-38** VHSV propagation, gene expression pattern and morphology of Viperin knockout zebrafish  
**K.A.S.N Shanaka**, K.P. Madushani, Sumi Jung, Myoung-Jin Kim, Jehee Lee
- 16:00 **O-39** Antibacterial and cytotoxic activities of a NK-lysin homologue from the Antarctic teleost *Trematomus bernacchii*  
**Simona Picchiatti**, Laura Guerra, Anna Rita Taddei, Paolo Roberto Saraceni, Marco Gerdol, Fernando Porcelli, Francesca Bugli, Andrea Miccoli, Anna Maria Fausto, Giuseppe Scapigliati, Francesco Buonocore

16:15-16:45

**F-2; Featured:**

**O-40** Devising zebrafish models to study genetic-environment interactions leading to the initiation of autoimmunity

Rodrigo A. Morales, Bianca C. Kern, Oscar E. Diaz, Srustidhar Das, **Eduardo J. Villablanca**

16:45-17:00

BREAK



17:00-18:00

## POSTER, FLASH TALKS II

(Moderator: Ph.D. cand., Joshua Superio)

## WEDNESDAY

### PLENARY LECTURE

09:00-10:00 **K-3 Addressing novel nanovaccine strategies for Tilapia**

Kim Thompson

10:00-10:15

**BREAK**

### IMMUNOSTIMULANTS, ADJUVANTS & VACCINES

(Chairperson: Simona Picchiatti)

- 10:15 **O-41** Does the protection by essential oils or their components against vibriosis in *Artemia* depend on immunostimulation?  
Xiaoting Zheng, Daisy Vanrompay, **Peter Bossier**
- 10:30 **O-42** Functional feed additives favor vaccine effectiveness against *Vibrio anguillarum* in sea bass (*Dicentrarchus labrax*) juveniles  
**Daniel Montero**, Jorge Galindo-Villegas, Antonio Serradell, Artem Nedoluzhko, Álvaro Fernández-Montero, Alex Makol, Luis Monzón-Atienza, Victoria Valdenegro, Félix Acosta, Silvia Torrecillas
- 10:45 **O-43** Antigen persistence and antibody responses in vaccinated Atlantic salmon (*Salmo salar* L.) throughout a commercial production cycle  
**Marwa Mechlaoui**, Endre Nordstrand, Ingwill Jensen, Tore Seternes
- 11:00 **O-44** Antibody responses to salmonid alphavirus (SAV) in Atlantic salmon immunized against pancreas disease (PD) using licensed vaccines  
**Ragnar Thorarinnsson**, Hilde Sindre, Øystein Evensen
- 11:15 **O-45** Molecular identification, pathogenesis, and functional genomics of *Edwardsiella piscicida* as a basis for rational design of a live attenuated vaccine against Edwardsiellosis in fish  
**Rakesh Das**, Cheng Xu, Zhen Tao, Saurabh Dubey, Hetron M. Munang'andu, Øystein Evensen
- 11:30 **O-46** Development and testing of a VLP-based vaccine against furunculosis in rainbow trout  
**Jeong In Yang**, Dagoberto Sepulveda, Jakob Skov, Niels Lorenzen
- 11:45 **O-47** B cell distribution in the gills of juvenile and adult Atlantic salmon and the effects of systemic vaccination on B cell abundance  
**Fran Barac**, Pedro Luis Castro Alonso, Tom Hansen, Per Gunnar Fjellidal, Ivar Hordvik, Håvard Bjørgen, Erling Olaf Koppang

12:00-13:00

**LUNCH**

### ADAPTIVE IMMUNITY I

(Chairperson: Ingwill Jensen)

- 13:00 **O-48** Effect of seasonal photoperiod on the antigen-dependent immune response in rainbow trout (*Oncorhynchus mykiss*) head kidney  
Merari Golstein, Eva Vallejos-Vidal, Valentina Wong-Benito, Lluís Tort, Felipe E. Reyes-Lopez, **Mónica Imarai**
- 13:15 **O-49** Development of monoclonal antibody against non-classical MHC class I, L-lineage, in Rainbow trout *Oncorhynchus mykiss*  
**Megumi Matsumoto**, Goshi Kato, Uwe Fischer
- 13:30 **O-50** Two diverse T cell receptor beta regions in Atlantic salmon potentially serving different functions  
**Unni Grimholt**, Arvind Y. M. Sundaram, Cathrine Arnason Bøe, Maria K. Dahle, Morten Lukacs
- 13:45 **O-51** IgM<sup>+</sup> B cells proliferate and differentiate in a spatiotemporal manner, producing antibodies that protect the common carp against infection by the myxozoan *Sphaerospora molnari*  
**Justin T. H. Chan**, Amparo Picard-Sánchez, Astrid S. Holzer, Tomáš Korytář
- 14:00 **O-52** Teleost fish IgM<sup>+</sup> plasma-like cells possessing IgM-secreting, phagocytosis, and antigen-presentation capacities  
**Liting Wu**, Yanjian Yang, Along Gao, Jun Li, Jianmin Ye
- 14:15 **O-53** Regulatory responses of two non-classical major histocompatibility L-lineage complexes following SAV3 challenge and interferon stimulation in Atlantic salmon (*Salmo salar*)  
**Maryam Imam**, Shripathi Bhat, Vishesh Dubey, Mehrdad Sobhkhez, Linn Greiner-Tollersrud, Balpreet Singh Ahluwalia, Eva-Stina Edholm
- 14:30 **O-54** Identification of the impact of carp edema virus (CEV) infection on T and B cell responses and vaccination success in common carp  
**Maria Zawisza**, Justin T.H. Chan, Miriam Mojzesz, Walter Fuchs, Magdalena Chadzińska, Tomas Korytar, Mikolaj Adamek, Krzysztof Rakus

14:45 O-55 Structure and expression of the polymeric Ig receptor gene from Antarctic teleosts  
Alessia Ametrano, Simona Picchiotti, Laura Guerra, Stefano Giacomelli, Umberto Oreste, **Maria Rosaria Coscia**

15:00-15:15

BREAK

## ADAPTIVE IMMUNITY II

(Chairperson: Irene Salinas)

15:15 O-56 Diversification and conservation of non-classical MHC I genes in Salmonids provides clues to the function of potential lipid presenting MHC in fish  
**Agata T. Gondek-Wyrozemska**, Eva-Stina I. Edholm

15:30 O-57 Ontogeny of the thymus and T cell receptors in Ballan wrasse (*Labrus bergylta*)  
**Angela Etayo**, Kai K. Lie, Ivar Hordvik, Øystein Sæle

15:45 O-58 The B-cell response to salmonid alphavirus 3 in Atlantic salmon  
**Ingvill Jensen**, Shiferaw Jenberie, Ma. Michelle D. Peñaranda, Henriette Nordli, Guro Strandskog, Linn Greiner-Tollersrud, Jorunn B. Jørgensen

16:00 O-59 Development and characterization of monoclonal antibodies against zebrafish IgM  
**Fumio Takizawa**, Hiroumi Ueno, Kazuya Yamamoto, Yuto Shimizu, Maki Ohtani, Toshiaki Miyadai, Hiroaki Suetake

16:15-17:00

NETWORKING

19:00-23:30

Conference Dinner (Quality Hotel Ramsalt)

## THURSDAY

### PLENARY LECTURE

09:00-10:00 K-4 Blood cells formation in crustaceans

Kenneth Söderhäll

10:00-10:15

BREAK

## PATHOGENS & IMMUNE INTERACTIONS

(Chairperson: Beatriz Novoa)

10:15 O-61 Responses towards eyefluke (*Diplostomum pseudospathaceum*) in different genetic lineages of rainbow trout  
**Asma M. Karami**, Yajiao Duan, Per W. Kania, Kurt Buchmann

10:30 O-62 LsLGP3 from Salmon Louse (*Lepeophtheirus salmonis*) Causes Cell Death in Atlantic salmon (*Salmo salar*) Leukocytes  
**Helena Marie Doherty Midtbø**, Gyri Teien Haugland, Andreas Borchel, Craig Morton, Aina-Cathrine Øvergård

10:45 O-63 A comparative study on gene expression in rainbow trout (*Oncorhynchus mykiss*, Walbaum 1792) challenged with five pathogens in five parallel experiments  
**Per Walter Kania**, Kurt Buchmann

11:00 O-64 Experimentally induced immunity against red mark syndrome in rainbow trout, *Oncorhynchus mykiss*  
**Jacob G. Schmidt**, Valentina L. Donati, Niels Lorenzen

11:15 O-65 Comparison of whole blood transcriptome responses of Atlantic salmon infected by three Piscine orthoreovirus variants  
**Thomas Tsoulia**, Arvind Y.M. Sundaram, Espen Rimstad, Øystein Wessel, Maria K. Dahle

11:30 O-66 Red and melanized focal changes in white skeletal muscle in Atlantic salmon (*Salmo salar*): Analysis of farmed, wild and hybrid fish kept under identical rearing conditions  
**Malin Brimsholm**, Erling Olaf Koppang, Tom Hansen, Håvard Bjørgen, Per Gunnar Fjelldal

11:45 O-67 Susceptibility and immunological status of Atlantic salmon parr, persistently infected with piscine orthoreovirus (PRV-1), following superinfection with salmonid alphavirus (SAV3)  
Dhamotharan Kannimuthu, Hyeonjin Roh, Ma. Michelle D. Peñaranda, Stig Mæhle, Bjørn Olav Kvamme, Søren Grove, **Hugh Craig Morton**

## NUTRITIONAL MODULATION OF IMMUNITY

(Chairperson: Daniel Montero)

- 13:00 **O-68** Bidens pilosa as a multifunctional additive of feedstuff to enhance disease resistance and growth performance in farmed aquatic animals  
**Che-Chun Chen**, Wen-Yi Lin, Hsin-Yun Lu, Zhong-Fu Zhang, Chyng-Hwa Liou, Ying-Ning Ho, Chang-Wen Huang, Wen-Chin Yang, Li-Li Chen, Hong-Yi Gong
- 13:15 **O-69** Glucose and Glutamine Contributed to De Novo Nucleotide Synthesis to Support White Spot Syndrome Virus Pathogenesis  
**Cong-Yan Chen**, Der-Yen Lee, Shih-Shun Lin, Chun-Hung Liu, Han-Ching Wang
- 13:30 **O-70** Effects of fermented black soldier fly (*Hermetia illucens*) larvae solubles to substitute soybean meal on growth performance and immune response of tilapia (*Oreochromis* sp.)  
**Kuan-Yu Chen**, Han-Ju Ho, Jenn-Kan Lu
- 13:45 **O-71** Dietary supplementation of *Bacillus velezensis* improves *Vibrio anguillarum* clearance in European sea bass by activating essential innate immune mechanisms  
**Luis Monzón-Atienza**, Jimena Bravo, Álvaro Fernández-Montero, Ives Charlie-Silva, Daniel Montero, José Ramos-Vivas, Jorge Galindo-Villegas, Félix Acosta
- 14:00 **O-72** Long-term evaluation of black soldier fly larvae meal on Atlantic salmon health in net pens  
**Gopika Radhakrishnan**, Antony Jesu Prabhu Philip, Nina Sylvia Liland, Marianne Wethe Koch, Erik-Jan Lock, Ikram Belghit
- 14:15 **O-73** Bile salts as a potential dietary supplement in aquaculture: Effect on regulation of lipid metabolism, intestinal immunity, and gut microbial communities  
**Alberto Ruiz**, Karl B. Andree, Dolores Furones, Ignasi Sanahuja, Paul G. Holhorea, Josep Calduch-Giner, Marc Viñas, Jaume Pérez-Sánchez, Enric Gisbert
- 14:30 **O-74** Modulating Shrimp Gut Health to Explore the Microbiota Resilience in Response to the Shift Between Health and Disease  
**Han-Ching Wang**

## E-POSTERS

\*The 4th ISFSI will conduct all the e-Posters displays and discussions online. However, some authors selected to pitch their work in a live serial session. At the end of the full session, authors and attendants will discuss emerging questions at a single round table led by the moderator.

3 min  
(Flash  
Talks)

## MONDAY

### FISH IMMUNOLOGY

- P-01** Zebrafish: Generation of MyD88 knockout model to understand the viral recognition and the immune gene expression against VHSV  
**K.P. Madushani**, K.A.S.N Shanaka, Sumi Jung, Myoung-Jin Kim, Jehsee Lee
- P-02** Host-pathogen interactions of two breeds of common carp on koi herpesvirus infection  
**Radek Machat**, Lubomir Pojezdal, Jan Gebauer, Radek Tesarik, Jan Matiasovic, Hana Minarova, Nikola Hodkovicova, Martin Faldyna
- P-03** Immune response induced by recombinant interleukin-22 (IL-22) in primary gill cells of Japanese medaka, *Oryzias latipes*  
**Mika Watanabe**, Yo Okamura, Tomoya Kono, Masahiro Sakai, Jun-ichi Hikima
- P-04** Comparison of phagocytic activity in different European fish species  
**Hana Minarova**, Ivana Papezikova, Hana Bandouchova, Jiri Pikula, Martin Faldyna, Miroslava Palikova
- P-05** Characterization of IL-12p40 paralogues and IL-12 receptor subunits in lumpfish  
**Patrick A. Nelson**, Håvard Ø. Eggsetøl, Sara A. Straumsnes, Harald S. Lunde, Gyri T. Haugland
- P-06** Inhibition of lysozyme lytic activity by Ivy derived from *Photobacterium damsela* subsp. *piscicida* and prediction of its lysozyme-binding ability  
**Aki Nishihara**, Takechiyo Sumiyoshi, Shinya Yasumoto, Masakazu Kondo, Tomoya Kono, Masahiro Sakai, Jun-ichi Hikima
- P-07** Characterization of the turbot (*Scophthalmus maximus*) interleukin-18: Identification of splicing variants, phylogeny, synteny and expression analysis  
**Patricia Pereiro**, Raquel Lama, Antonio Figueras, Beatriz Novoa
- 01 -1** **P-08** Specific antibody production in common carp (*Cyprinus carpio*), gibel carp (*Carassius gibelio*) and F1 hybrids after infection with carp Springvivirus  
**Lubomir Pojezdal**, Stanislava Reschova, Lukas Vetesnik, Andrea Simkova
- 02 -1** **P-09** Isolation of antigen-capturing cells from spleen elipsoids in Tiger puffer  
**Yuto Shimizu**, Fumio Takizawa, Toshiaki Miyadai, Hiroaki Suetake

- P-10** Emergence of *Enteromyxum leei* (Myxozoa, Myxosporea) in seawater and infection dynamics of cultured olive flounder in farms on Jeju Island, South Korea  
**Hanchang Sohn**, Chang Nam Jin, Bong Jo Kang, Sang Phil Shin, Jehee Lee
- P-11** Cd63 knockout in zebrafish enhances immune defense against VHSV infection  
**Sumi Jung**, Myoung-Jin Kim, Jehee Lee
- P-12** Identification and functional characterization of TNFSF15 receptors (death receptor 3 and decoy receptor 3) in rock bream (*Oplegnathus fasciatus*)  
**Sungjae Ko**, Suhee Hong
- P-13** Atlantic Cod (*Gadus morhua*) MHC I localizes to lysosomes independently of sorting signals  
**Synne Arstad Bjørnstad**, Monica Hongrø Solbakken, Kjetill S Jakobsen, Sissel Jentoft, Oddmund Bakke, Cinzia Progida
- 03 -I** **P-14** Understanding zebrafish resistance to white spot disease through transcriptomic analysis  
**Heidi Mathiesen**, Miyako Kodama, Morten Tønnsberg Limborg, Louise von Gersdorff Jørgensen
- 04 -I** **P-15** Catch me if you can: Elucidating the importance of antibody responses in the prevention of myxozoan parasite *Sphaerospora molnari*  
**Tomáš Korytá**, Justin T. H. Chan, Jovana Majstorovič, Astrid S. Holzer
- P-16** Eye fluke effects on Danish freshwater fish: Field and experimental investigations  
**Yajiao Duan**, Louise von Gersdorff Jørgensen, Per Walter Kania, Asma M. Karami, Azmi Al-Jubury, Kurt Buchmann
- P-17** The role of European Sea Bass red blood cells in nervous necrosis virus infection  
**Celia García-Quintanilla**, Maria Elizabeth Salvador-Mira, Veronica Chico, Manuel Solivella, Luis Perez, Miguel Ángel García-Álvarez, Alberto Cuesta, María del Mar Ortega-Villaizán
- P-18** Protection of skin and gill functions is essential for the survival of fish from infections caused by epitheliotropic viruses  
**Mikolaj Adamek**, Krzysztof Rakus, Marek Matras, Alexander Rebl, Maria Zawisza, Magdalena Stachnik, Muhammad Abdullah, Torben Krebs, Verena Jung-Schroers, Lars Schröder, Walter Fuchs, Michal Reichert, Dieter Steinhagen
- 05 -I** **P-19** Modulation of immune genes in skin wound repair of pre-smolt Atlantic salmon (*Salmo salar*)  
**Bárbara Robles-Planells**, Camila Arancibia-Carvalho, Loreto P. Araos, Silvana Guerra-Arredondo, Rodrigo Zañartu-Mellado, Fernanda Jeria, Mabel Vidal, Eva Vallejos-Vidal, Felipe E. Reyes-López
- P-20** Conserved function of zebrafish (*Danio rerio*) Gdf15 as a sepsis tolerance mediator  
**Patricia Pereiro**, Marta Librán-Pérez, Antonio Figueras, Beatriz Novoa
- 06 -I** **P-21** The biological clock polarization of carp macrophages  
**Mikolaj Mazur**, Magdalena Maciuszek, Lukasz Pijanowski, Magdalena Chadzińska
- 07 -I** **P-22** Modulation of the expression of i1/i2 axis genes in Atlantic salmon head kidney induced by IL4/13A and antagonized by IFN $\gamma$   
**Daniela Ruiz Higgs**, Ana María Sandino, Mónica Imarai, Eva Vallejos-Vidal
- P-23** Evaluation of immune gene expression during co-infection with *Piscirickettsia salmonis* genogroups in Atlantic salmon  
**Gabriela Carril**, Marie Løvoll, Hanne Winther-Larsen, Henning Sørum
- 08 -I** **P-24** Correlation between IL-6, IL-6r, and gp130 and mRNA expression profiles in orange-spotted grouper (*Epinephelus coioides*) under immune stimulation  
**Yun-Ru Chiang**, Hao-Chun Chang, John Han-You Lin

## CRUSTACEAN IMMUNOLOGY

- P-25** Pyrimidine synthesis after virus infection of white shrimp  
**Chih-Ling Chen**, Han-Ching Wang
- P-26** Crayfish Hemocyte Proteins – effects of injection  
**Charlotta Ekblom**, Kenneth Söderhäll, Irene Söderhäll
- P-27** Development and application of immune markers for immunotoxic hazard assessment of continental water bodies  
**Melissa Palos Ladeiro**, Damien Rioult, Magalie Charlé, Olivier Geffard, Marc Bonnard, Alain Geffard
- P-28** Single-cell RNA sequencing of hematopoietic cells and hemocytes in freshwater crayfish  
**Irene Söderhäll**, Erik Fasterius, Charlotta Ekblom, Kenneth Söderhäll
- 09 -I** **P-29** Studies on pathogenic mechanisms in *Tenacibaculum mesophilum* isolated from the gills of kuruma shrimp *Penaeus japonicus* with Fusarium disease  
**Yohei Sakamoto**, Satoshi Kawato, Kentaro Imaizumi, Miho Furukawa, Kayo Konishi, Reiko Nozaki, Keiichiro Koiwai, Hidehiro Kondo, Ikuo Hirono
- 10 -I** **P-30** Behavioral fever in shrimp (*Litopenaeus vannamei*) in response to white spot syndrome virus infection can suppress mortality rate  
**Mostafa Rakhshaninejad**, Liping Zheng, Hans Nauwynck
- 11 -I** **P-31** Comparison of performance between a rapid test kit and QPCR method for white spot syndrome virus (WSSV)  
**Jeff Chia-Kai Hsu**, Te-Ken Hsu, Li-Li Chen
- 12 -I** **P-32** The effect of starvation on mucin expression and its association with neuropeptide F in the digestive organs of the female freshwater prawn, *Macrobrachium rosenbergii*  
**Warinthip Vetkama**, Ruchanok Tinikul, Prasert Sobhon, Yotsawan Tinikul



## MOLLUSCAN IMMUNOLOGY

- P-33** Differential expression of long non-coding RNA (lncRNA) in Mediterranean mussel (*Mytilus galloprovincialis*) hemocytes under immune stimuli  
**Antonio Figueras**, Patricia Pereiro, Rey-Campos Magalí, Beatriz Novoa
- P-34** Genomic and transcriptomic identification of the cathepsin superfamily in the Mediterranean mussel *Mytilus galloprovincialis*  
**Alejandro Romero**, Beatriz Novoa, Antonio Figueras
- P-35** The freshwater snail *Pomacea canaliculata* immunity relies on hemocyte- and organ-dependent responses  
**Davide Malagoli**, Giulia Bergamini, Francesco Demetrio Lofaro, Alice Montanari, Agnese Ferrari, Federica Boraldi

3 min  
(Flash  
Talks)

## TUESDAY

## INTERACTIONS BETWEEN MICROBIOTA AND THE IMMUNE SYSTEM

- P-36** Effects of heat treatment on environmental microbiota dynamics and host responses in farmed fish in Singapore  
**Tze Hann Ng**, Thiviya Nair D/O Madhavan, M. Sobana, Giana Bastos Gomes
- P-37** The Immunoregulatory Role of Fish Specific Type II SOCS via Inhibiting Metaflammation in Gut-Liver Axis  
**Junwei Shan**, Guangxin Wang, Heng Li, Xuyang Zhao, Weidong Ye, Qingsong Zhu, Yuhang Liu, Yingyin Cheng, Nan Wu, Xiao-Qin Xia
- P-38** Gallic Acid Relieves Fish Gut-Liver Symptom via Enhancing PPAR $\gamma$ -Mediated Anti-inflammation and Lipid Metabolism  
**Xuyang Zhao**, Lei Zhang, Jiayuan Xie, Yuhang Liu, Lian Su, Weidong Ye, Yingyin Cheng, Wanting Zhang, Nan Wu, Xiao-Qin Xia

## STRESS AND IMMUNE FUNCTION

- P-39** Immune and physiological responses of clams (*Polititapes rhomboides*) under sediment mobilization and seawater warming conditions  
**María M. Costa**, Camino Gestal, Jose MF Babarro, Miguel Gilcoto, Nicolás Villaceros-Robineau, Luc A. Comeau, Susana Darriba, Elsa Silva, Lourdes Nieto, Hugo Feio, Jaime Pérez, Sonia Dios
- P-40** GOT1/2 may be involved in WSSV-induced glutamine metabolism  
**Guan-Lun Huang**, Chun-Hung Liu, Han-Ching Wang
- P-41** Transcriptomic responses of European sea bass (*Dicentrarchus labrax* L) and zebrafish (*Danio rerio*) against a nodavirus infection  
**Raquel Lama**, Patricia Pereiro, Antonio Figueras, Beatriz Novoa
- P-42** Deciphering how chronic heat stress alters Russian sturgeon (*Acipenser gueldenstaedtii*) liver response to bacterial infection  
**Alicia Costábile**, Mauricio Castellano, Marcio Aversa-Marnai, Ignacio Quartiani, Daniel Conijeski, Alejandro Perretta, Andrea Villarino, Valeria Silva-Álvarez, Ana María Ferreira
- P-43** Assessing the impact of oxidative stress and antioxidants on the spotted wolffish (*Anarhichas minor*) immune-reproductive axis  
**Joshua Superio**, Bjørnar Eggen, Jorge Galindo-Villegas
- 01 -II** **P-44** Motility of bivalve immune cells: a new potential biomarker of immunotoxicity?  
**Héloïse Gendre**, Mélissa Palos-Ladeiro, Alain Geffard, Agnès Poret, Frank Le Foll, Yosra Ben Cheikh
- 02 -II** **P-45** Time course and dynamics of fecal corticoid metabolites (FCM) in Atlantic salmon (*Salmon salar* L.) post-acute stress exposure.  
**Jingwen Ding**, Anne Stene, Bengt Finstad, Grete Hansen Aas, Lars Christian Gansel, Stig Atle Tuene, Snorre Bakke, and Yanran Ca

## FISH AND SHELLFISH FUNCTIONAL GENOMICS

- P-46** Expression of Vascular and Immune System Markers in Eyes of North Atlantic Lumpfish  
**Tatiana Hyde**, Helene Paradis, Robert Gendron

## NEURO-IMMUNE INTERACTIONS

- P-47** Effect of African basil (*Ocimum gratissimum*) on orexigenic factors and zootechnical performance of African catfish (*Clarias gariepinus*)  
**Ojo P. Oke**, Oluyemi K. Gbadamosi, Tosin S. Olayeni

## IMMUNOSTIMULANTS, ADJUVANTS & VACCINES

- 03 -II** **P-48** Silkworm pupa as a vehicle for delivering VP15-derived products through oral administration for immunization of kuruma shrimp  
**Jirayu Boonyakida**, Takafumi Nakanishi, Jun Satoh, Yoshiko Shimahara, Tohru Mekata, Enoch Y. Park
- 04 -II** **P-49** Evaluation of a Chitosan-PLGA encapsulated trivalent vaccine complex containing inactivated VHSV, *Streptococcus parauberis* and *Miamiensis avidus* in *Paralichthys olivaceus*  
**Sajal Kole**, Young-Hyeok Kwon, Su-Mi Shin, Sung-Ju Jung



- P-50** Natural extracts for application as antivirals in aquaculture against Red Grouper Nervous Necrosis Virus  
**Celia García-Quintanilla**, Veronica Chico, Miguel Ángel García-Álvarez, Jose Antonio Girau, David Verdiell, Luis Perez, Alberto Cuesta, María del Mar Ortega-Villaizán
- P-51** Phloroglucinol treatment of brine shrimp induces transgenerational epigenetic inherited resistance against *Vibrio parahaemolyticus*  
**Suvra Roy**, Vikash Kumar, Peter Bossier, Parisa Norouzitalab, Daisy Vanrompay
- P-52** Ccombody, a next-generation antibody as passive immune vaccine against acute hepatopancreatic disease (AHPND) in shrimp  
**Jaesung Kim**, Junghyun Kim, Dennis Bela-ong, Kim D. Thompson, Tae Sung Jung
- P-53** *Laminaria hyperborea*-derived laminarin-immunomodulatory effects in Atlantic salmon cells  
**Ruth Montero**, Veronica F. Blihovde, Lele Fu, Olav A. Aarstad, Finn L. Aachmann, Anne Tøndervik, Håvard Sletta, Liv T Mydland, Margareth Øverland
- 05 -II** **P-54** Efficacy of a novel glycovaccine for protection against *Aeromonas hydrophila* infection in Nile tilapia (*Oreochromis niloticus*)  
**Sreeja Lakshmi**, Sivakumar S, Anbazhagan V, Baskaralingam Vaseeharan, Nopadon Pirarat, Sean J. Monaghan, Andrew Desbois, Kim Thompson, Preetham Elumalai

## NUTRITIONAL MODULATION OF IMMUNE FUNCTION

- P-55** Fabrication of electrospun nanofibers loaded with piscidin for antibacterial applications  
**Rocío Díaz-Puertas**, Enrique Rodríguez-Cañas, Marta Fernández-Oliver, Patricia Pereiro, Beatriz Novoa, Alberto Falcó, Ricardo Mallavia
- P-56** Study of toxicity of potential immunomodulating compounds for the development of oral metabolic therapies  
**Marta Fernández-Oliver**, Rocío Díaz-Puertas, Patricia Pereiro, Beatriz Novoa, Ricardo Mallavia, Alberto Falcó
- P-57** Effect of prolonged administration of  $\beta$ -glucan on the innate immunity of tilapia, *Oreochromis niloticus*  
**Camino Fierro-Castro**, Ingrid Camargo dos Reis, Basia Schlichting Moromizato, Jaqueline Dalbello Biller
- P-58** Therapeutic Role of Hemp (*Cannabis sativa*) Against Copper Induced Toxicity in *Labeo rohita* and *Cirrhinus mrigala*  
**Azam Jan Afridi**, Amina Zuberi, Ali Muhammad Yousafzai
- P-59** Dietary *Debaryomyces hansenii* promotes the integrity and immune response of the skin in gilthead sea bream (*Sparus aurata*): an interactome study  
**Ignasi Sanahuja**, Laura Fernandez-Alacid, Joana P. Firmino, Felipe E. Reyes-Lopez, Alberto Ruiz, Eva Vallejos-Vidal, Lluís Tort, Dariel Tovar-Ramirez, Antoni Ibarz, Enric Gisbert
- 06 -II** **P-60** Interactions of predominantly plant-based feeding and handling stress on the expression of selected immune markers in rainbow trout (*Oncorhynchus mykiss*)  
**Henrike Seibel**, Finn-Thorbjörn Fichtner-Grabowski, Marvin Suhr, Alexander Rebl, Carsten Schulz, Stéphanie Céline Hornburg
- P-61** Potential probiotic *Lactococcus lactis* isolated from the intestinal content of Nile tilapia regulates immune-related genes on tilapia alevins  
**Javier Fernando Melo-Bolívar**, Ruth Yolanda Ruiz-Pardo, María Ximena Quintanilla Carvajal, Luis Eduardo Díaz, Juan F. Alzate, Howard Junca, Jorge Alberto Rodríguez Orjuela, Luisa Villamil
- 07 -II** **P-62** Fucoidan fractions from Sugar kelp (*Saccharina latissima*) modulated immune-related biomarkers in Atlantic salmon head kidney cells  
**Byron Morales-Lange**, Ruth Montero, Leszek Michalak, Sergio Rocha, Liv Torunn Mydland, Margareth Øverland

## NEW TECHNOLOGIES FOR IMMUNE SYSTEM EVALUATION

- P-63** Optimization of CRISPR-Cas protocols for precise genome editing in salmon cell lines  
**Miroslav Bobrik**, Eva-Stina Edholm, Ole Morten Seternes
- 08 -II** **P-64** Validation of ADDIGENE-BKD kit as a tool for early *Renibacterium salmoninarum* diagnostics in field  
**Verónica García**, María José Barra, Alexis Martínez, Jaime A. Tobar
- P-65** Elucidating the roles of viral pattern recognition receptors in antiviral immunity in Atlantic salmon using CRISPR/Cas9 technology  
**Atefeh Kianian**, Ole Morten Seternes, Eva Stina Edholm
- P-66** Innate immune responses as markers for viral replication in long-lasting salmonid cardiac primary cultures  
**Torben Krebs**, Sarah Graff, Julia Bauer, Marina Gebert, Øystein Wessel, Espen Rimstad, Dieter Steinhagen, Mikolaj Adamek
- 09 -II** **P-67** In vitro models for virus infections in salmonids  
**Sarah Graff**, Torben Krebs, Dieter Steinhagen, Mikolaj Adamek, Henrike Seibel, Marina Gebert
- 10 -II** **P-68** Gut transcriptome in Atlantic salmon (*Salmo salar*) after nutritional programming with a plant rich diet  
**Marwa Mamdouh Tawfik**, Marlene Lorgen-Ritchie, Monica Betancor, Stuart McMillan, Elżbieta Król, Alex Douglas, Samuel A. M. Martin
- 11 -II** **P-69** Characterization of the branchial cavity lymphoid organization using 3D high-resolution imaging in zebrafish and other fish  
**Julien Rességuier**, Mai-Eva N'Guyen-Chi, Martin Gross, Alf Dalum, Irene Salinas, Erling Koppang, Geert Wiegertjes, Pierre Boudinot and Gareth Griffiths

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