



# MUCOSAL HEALTH in AQUACULTURE MHA 2019

September 11 – 13, 2019  
Thon Hotel Storo  
Oslo, Norway

## PROGRAMME

### Day 1

#### Wednesday – September 11

08:30

Registration

09:30

#### OPENING

Carlo C. Lazado  
Scientific Chairman, MHA2019

09:45

#### NOFIMA AND ITS ROLE IN MUCOSAL HEALTH RESEARCH IN AQUACULTURE

Gunn Berit Olsson  
Director of Research – Fish Health  
Nofima

### Session 1: Mucosal structures and functions

Session Chair: Monica F. Brinchmann, Nord University

10:00

#### Plenary talk

UTILIZING 'OMICS TECHNOLOGIES AND HOST-PATHOGEN MODELS  
TO ELUCIDATE TELEOST MUCOSAL STRUCTURES AND FUNCTIONS

Prof. Eric Peatman, Auburn University

10:45

Coffee break

11:15

#### QUANTIFIED MUCOSAL HEALTH OF FISHES: THE PROPOSED "RULES"

Pittman, K., Okubamichael, M., Merkin, G., Haddeland, S., Lazado, C.C., Jonassen, T., Øyen, S., Sørensen, M., Korsnes, K., Powell, M., Sissener, N., Andersen, L., Bogevik, A., Dang, M., Nowak, B., Kousoulaki, K., Lyngøy, A., Myre, O.J.

- 11:30 **IN SITU STUDIES OF THE FUNCTIONAL BARRIER PROPERTIES OF THE SKIN MUCUS OF YOLK-SAC SALMON FRY (*Salmo salar* L.)**  
**Nordgård, C. T.**, Gómez de la Torre Canny, S., Dunker, K., Lyseid, R.S., Sletmoen, M., Bakke, I.
- 11:45 **FUNCTIONAL CHARACTERIZATION OF THE SKIN BARRIER OF RAINBOW TROUT AND HEALING OF A SUPERFICIAL WOUND**  
**Sundh, H.**, Sundell, K.
- 12:00 **RAINBOW TROUT PREFERENTIALLY RESPOND TO THYMUS-INDEPENDENT ANTIGENS UPON ANAL ADMINISTRATION**  
Martín-Martín, A., **Díaz-Rosales, P.**, Abós, B., Simón, R., Tafalla, C.
- 12:15 **EFFECTS OF STARVATION ON THE HUMORAL DEFENCE AND SKIN CICATRIZATION ON WOUNDED GILTHEAD SEABREAM**  
**Albaladejo-Riad, N.**, Esteban, M.A.
- 12:30 **A NOVEL METHOD BASED ON IMAGE ANALYSES FOR MEASURING SKIN MELANIZATION OF ATLANTIC SALMON**  
**Jiménez-Guerrero, R.**, Larsson, T., Sigholt, T., Mørkøre, T.

12:45 – 14:00

Lunch

## Session 2: Mucosal health and nutrition

Session Chair: Ma. Angeles Esteban, University of Murcia

- 14:00 **Plenary talk**  
**OPTIMAL MUCOSAL FUNCTION REQUIRES OPTIMAL NUTRITION AND FEEDING**  
  
**Prof. Åshild Krogdahl, Norwegian University of Life Sciences**
- 14:45 *MHA2019 Student Travel Award Recipient*  
**EVALUATING THE POTENTIAL OF DIETARY LOW MOLECULAR SODIUM ALGINATE AND *Pediococcus acidilactici* ON HUMORAL AND MUCOSAL IMMUNE RESPONSES, INTESTINAL HISTOMORPHOLOGY AND LYSOZYME GENE EXPRESSION IN ASIAN SEA BASS (*Lates calcalifer*) JUVENILES**  
**Ashouri, G.**, Mahboobi S., N., Hoseinifar, S.H., Doan, V.H., Mozanzadeh, T., Carnevali, O.
- 15:00 **THE REARING ENVIRONMENT MASKS THE EFFECT OF DIETARY TREATMENT FOR SALMON LICE RESISTANCE**  
**Bogevik, A.S.**, Sveen, L., Krasnov, A., Lazado, C.C., Ytteborg, E., Karlsen, C.R., Pittman, K., Okubamichael, M., Merkin, G., Myre, O.J., Skeidsvoll, Slawski, H.

15:15 **FUNCTIONAL DIETS FOR GREATER AMBERJACK (*Seriola dumerili*) JUVENILES: MANNAN OLIGOSACCHARIDES AS REINFORCEMENT OF SKIN IMMUNE RESPONSE AND RESISTANCE TO PARASITATION WITH *Neobenedenia girellae* AND PHYTOBIOTICS TO IMPROVE WELFARE**  
**Fernández-Montero, A.**, Torrecillas, S., Roo, J., Docando, J., Acosta, F., Bravo, J., Kalinowski, T., Makol, A., Sweetman, J., Montero, D.

**15:30-16:00**

**Coffee break**

16:00 **SOYBEAN MEAL AND SEAWATER ENVIRONMENT AFFECT MUCOSAL IMMUNITY IN FISH**  
**Djordjevic, B.**, Tomás-Almenar, C., Øverland, M. and Lagos, L.

16:15 **DIETARY ADMINISTRATION OF *Shewanella putrefaciens* SpPdp11 FACILITATES THE SKIN MUCOSAL BARRIER REGENERATION OF EXPERIMENTALLY WOUNDED GILTHEAD SEABREAM (*Sparus aurata* L.)**  
Zhichu, C., Ceballos-Francisco, D., Guardiola, F.A., **Esteban, M.A.**

16:30 **DIETARY PREBIOTICS AND PHYTOGENICS IN LOW FISH MEAL AND FISH OIL BASED DIETS FOR EUROPEAN SEABASS *Dicentrarchus labrax*: AN EFFECTIVE TOOL TO BOOST MUCOSAL TISSUES HEALTH AND DISEASE RESISTANCE**  
**Torrecillas, S.**, Serradell, A, Makol, A, Terova, G., Valdenegro, V., Izquierdo MS., Acosta, F. Montero, D.

16:45 **EFFECTS OF GRADED DIETARY LEVELS OF ESSENTIAL OMEGA-3 FATTY ACIDS ON BARRIER TISSUES INTEGRITY AND COMPOSITION OF MEMBRANE LIPIDS OF POST-SMOLT ATLANTIC SALMON**  
**Bou M.**, Thomassen, M.S., Rud, I., Baeverfjord, G., Berge, G.M., Østbye, T-K., Ruyter, B.

17:00 **SEA BASS GALT AND MICROBIOTA MODULATION IN RESPONSE TO FISH MEAL REPLACEMENT BY MICROALGAE**  
Hinzmann, M., Serra, C.R., Guerra, L., Picchiatti, S., Buonocore, F., Scapigliati, G., Oliva-Teles, A., **Couto, A.**

**17:30-19:00**

**Poster Session and Networking**

**Tapas and drinks will be served**

**Day 2**  
**Thursday – September 12**

09:30                      **Invited talk**  
**MUCOSAL HEALTH FROM THE PERSPECTIVE OF A RESEARCH FUNDING AGENCY**

Sven Martin Jørgensen  
Director R&D Fish Health  
The Norwegian Seafood Research Fund

***Continuation of***  
**Session 1: Mucosal structures and functions**  
Session Chair: Monica F. Brinchmann, Nord University

09:45                      **GILL MUCIN O-GLYCOSYLATION IN HEALTHY AND AMOEBIC GILL DISEASE AFFECTED ATLANTIC SALMON**  
Benktander J., Maynard B., Padra J.T., Botwright, N., Wynne, J.W., Lindén, S.K.

10:00                      **ORAL STIMULATION OF RAINBOW TROUT WITH *Aeromonas salmonicida* AND CHARACTERIZATION OF THE ADAPTIVE IMMUNE RESPONSE ASSEMBLED: FIRST STEPS TO AN ORAL VACCINATION MODEL**  
Montero R., Munkler L., Ostermann S, Köllner B

10:15                      **MECHANICAL MODELS OF WOUND HEALING PROCESSES IN FISH— PROS AND CONS OF WOUND PREPARATION AND DOWNSTREAM ANALYSIS**  
Sveen, L. R., Karlsen, K., Ytteborg, E.Y.

10:30                      **EVIDENCE OF IgD-SECRETING PLASMABLASTS WITH SPECIFIC MOLECULAR SIGNATURES IN THE INTESTINE OF TELEOST FISH**  
Perdiguero, P., Martín-Martín, A., Benedicenti, O., Díaz-Rosales, P., Morel, E., Muñoz-Atienza, E., García-Flores, M., Simón, R., Soletto, I., Cerutti, A., Tafalla, C.

**10:45-11:15                      Coffee break**

11:15                      **IMMUNITY IN THE SEA BASS (*Dicentrarchus labrax* L.) DIGESTIVE TRACT**  
Picchietti, S., Buonocore, F., Fausto, A.M., Scapigliati G.

11:30                      **CIRCADIAN RHYTHMS AND IMMUNITY – AN OVERLOOKED RELATIONSHIP IN FISH IMMUNOLOGY**  
Lazado, C.C., Skov, P., Lund, I., Bovbjerg, P., Voldvik, V., Nayak, S., Khozin-Goldberg, I., Zilberg, D.

## Session 3: Mucosal health and microbiome

Session Chair: Christian R. Karlsen, Nofima

11:45 Plenary talk  
**HOST-MICROBIOME INTERACTIONS IN CHRONIC INFLAMMATORY CONDITIONS: LESSONS FROM HUMAN DISEASES**

**Dr. Johannes Hov, Oslo University Hospital**

12:30 *MHA2019 Student Travel Award Recipient*  
**INVESTIGATING THE ROLE OF MUCOSAL MICROBIOMES IN YELLOWTAIL KINGFISH EXHIBITING DIFFERENT HEALTH STATUS USING A MULTI-OMICS APPROACH**

**Legrand, T.P.R.A.**, Camarinha-Silva, A., Wynne, J.W., Weyrich, L.S., Oxley, A.P.A.

**12:45-14:00**

**Lunch**

14:00 Invited talk  
**TBD**

**TBD**  
**The Ministry of Trade and Industry**

14:15 **DEVELOPING NEXT GENERATION TOOLS TO SECURE A FUNCTIONAL GUT ENVIRONMENT THROUGH FEED DEVELOPMENT: THE GUTBIOM PROJECT**

**Kortner, T.M.**, Jaramillo-Torres, A., Forberg, T., Chikwati, E., Kousha, A., Mohammed, A.A., Li, Y., Krogdahl, Å.

14:30 **MUCOSAL MICROBIOME OF LUMPFISH (*Cyclopterus lumpus*)**

**Jacobsen, Á.**, Patursson, E., Østerø, S.L., Jacobsen, E.

14:45 **A NOVEL GNOTOBIOTIC HUSBANDRY SYSTEM FOR THE STUDY OF HOST-MICROBE INTERACTIONS IN ATLANTIC SALMON YOLK-SAC FRY (*Salmo salar* L.)**

**Gómez de la Torre Canny, S.**, Nordgård, C. T., Dunker, K., Sletmoen, M., Bakke, I.

15:00 **CONFOUNDING FACTORS AFFECTING ATLANTIC SALMON MICROBIOME STUDIES: ISSUES AND SUGGESTED RECOMMENDATIONS**

**Rud, I.**, Tzimirotas, D., Kirste, K.H., Karlsen, C.R.

**15:15 – 15:45**

**Coffee break**

- 15:45 *MHA2019 Student Travel Award Recipient*  
**CHARACTERISING THE ROLE OF BACTERIAL GILL FLORA ON AMOEBIC GILL DISEASE (AGD) PATHOGENICITY**  
Slinger, J., Wynne, J., Adams, M.
- 16:00 **BACTERIAL COLONIZATION OF ATLANTIC SALMON (*Salmo salar*) YOLK SAC FRY**  
Bakke, I., de la Torre Canny, S.G., Mathisen, A.J.H., Mallasvik, H., Vestrum, R.R., Wæge, D., Sletmoen, M., Dunker, K., and Vadstein, O.
- 16:15 **FULL-LENGTH 16S rRNA GENE CLASSIFICATION OF ATLANTIC SALMON BACTERIA AND EFFECTS OF USING DIFFERENT 16S VARIABLE REGIONS ON COMMUNITY STRUCTURE ANALYSIS**  
Klemetsen, T., Willassen, N.P., Karlsen, C.R.

**18:00-22:00**

**Conference dinner**

**Lavvo – Oslo Winter Park**

## **Day 3**

**Friday – September 13**

### **Session 4: Mucosal health and the changing environment**

**Session Chair: Sam Martin, University of Aberdeen**

- 09:30 Plenary talk  
**FISH HEALTH AND WELFARE IN NOVEL AQUACULTURE ENVIRONMENTS - THE IMPORTANCE OF PRIMARY BARRIERS**  
**Prof. Kristina Sundell, University of Gothenburg**
- 10:15 **STRESS INDUCED ATLANTIC SALMON SKIN MUCIN O-GLYCAN CHANGES**  
 Benktander, J. Sundh, H., Venkatakrisnan, V., Sundell, K., Padra, J.T., Murugan, A.V.M., Lindén S.K.
- 10:30 **ATLANTIC SALMON SKIN FUNCTION AND DEVELOPMENT IN THE POST-SMOLT STAGE AFTER SEAWATER TRANSFER**  
Karlsen, C.R., Ytteborg, E., Sveen, L., Timmerhaus, G., Småge S.B., Krasnov, A.

**10:45-11:15**

**Coffee break**

- 11:15 **FISH MUCUS COLLECTION STRATEGIES FOR METABOLOMICS: A DISTINCT RESPONSE TO AQUI-S AND BENZOCAINE ANAESTHETICS**

Ivanova, L., Rangel-Huerta, O.D., Tartor, H., Gjessing, M.C., Dahle, M.K., Thoen, E., Uhlig, S.

11:30 *MHA2019 Student Travel Award Recipient*  
**MUSCLE AND MUCOSAL HEALTH IN FISH REARED UNDER HIGH WATER VELOCITIES – SHOULD WE COMPROMISE?**  
Cabillon, N.A., Timmerhaus, G., Lazado, C.C., Reiten, B.K., Johansen, L.H.

11:45 **VOLATILE ORGANIC COMPOUNDS IN THE MUCUS OF SEA LICE INFECTED SALMON**  
Haugen, J.E., Difford, G., Johansen, L.H., Breiland, M.W., Jacq, C., Baranski, M., Boison, S., Moghadam, H. Hillestad, B., Leder, E.

**12:00-13:15 Lunch**

13:15 **ADAPTIVE MUCOSAL RESPONSE IN THE GILLS OF ATLANTIC SALMON (*Salmo salar*) AFTER REPEATED EXPOSURE TO PERACETIC ACID IN SEAWATER-RAS**  
Haddeland, S., Pittman, K., Merkin, G., Myhre, O.J., Okubamichael, M., Lazado, C.C., Pedersen, L.F.

13:30 **TRANSCRIPTOME RESPONSES IN SKIN OF ATLANTIC SALMON FOLLOWING TWO DIFFERENT LEVELS OF INFECTION OF SEA LICE (*Caligus rogercresseyi*)**  
Zindrili, R., Król, E., Mente, E., Douglas, A., Martin, S.A.M.

13:45 **FOURIER TRANSFORM INFRARED SPECTROSCOPY AS A PROMISING TOOL FOR CHARACTERIZATION OF SALMON SKIN MUCUS**  
Böcker, U., Sveen, L., Karlsen, C.R., Ytteborg, E.

**14:00-14:15 Coffee break**

14:15 **THE ATLANTIC SALMON GILL TRANSCRIPTOME RESPONSE TO A NATURAL OUTBREAK OF SALMON GILL POX VIRUS INFECTION INDICATES SUPPRESSION OF MUCOSAL DEFENSE**  
Gjessing, M.C, Krasnov, A., Timmerhaus, G., Brun, S., Afanasyev, S., Dale, O.B., Dahle M.K.

14:30 **MOLECULAR SIGNATURES OF ATLANTIC SALMON MUCOSA UNDER CHEMICALLY INDUCED OXIDATIVE STRESS**  
Breiland, M.W., Timmerhaus, G., Hytterød, S., Hansen, M.H., Kirste, K.H., Mohammad, S., Pedersen, L.F., Pittman, K., Rørmark, L., Lazado, C.C.

14:45 **TBD**  
Elisabeth Ytteborg

15:00

Launch of the Mucosal Health in Aquaculture Platform  
Awarding of Best Abstract, Best Poster, Best Oral Presentation  
Closing

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## List of posters

List of posters	
<b>P1</b>	<b>INTESTINAL MICROBIOTA REGULATES CIRCULATING IgD-SECRETING PLASMABLASTS IN RAINBOW TROUT</b>  Muñoz-Atienza, E., García-Flores, M., Morel, E., Díaz-Rosales, P., Tafalla, C.
<b>P2</b>	<b>STRUCTURAL AND GENETIC FEATURES OF THE NASAL MUCOSA OF LUMPFISH</b>  Lazado, C.C., Johansen, L.H.
<b>P3</b>	<b>COD SKIN AS A MODEL FOR ENVIRONMENTAL STRESSORS</b>  Ytteborg, E., Krasnov, A., Høst, V., Hansen, Ø.J.
<b>P4</b>	<b>ESTIMATING CORTISOL LEVELS IN MUCUS WHEN BLOOD SAMPLING IS NOT AN OPTION</b>  Mortensen, H., Jacobsen, Á., Jabobsen, E.
<b>P5</b>	<b>EVALUATION OF WOUND HEALING VASCULARIZATION BY REAL-TIME ULTRASONOGRAPHY IN THE SKIN OF GILTHEAD SEABREAM (<i>Sparus aurata</i> L.)</b>  Ceballos-Francisco, D.,García, N., Cuesta, A. and Esteban M.A.
<b>P6</b>	<b>CIRCADIAN RHYTHMS OF OXIDATIVE STRESS RESPONSES IN THE GILL MUCOSA OF ATLANTIC SALMON</b>  Voldvik, V., Lazado, C.C.
<b>P7</b>	<b>IMPACT OF WATERBORNE COPPER ON SKIN MUCOSAL IMMUNITY OF GILTHEAD SEABREAM (<i>Sparus aurata</i> L.)</b>  Esteban, M.A., Albaladejo-Riad, N., Guardiola, F.A.
<b>P8</b>	<b>SEARCH FOR EFFECTIVE ORAL ADJUVANTS FOR RAINBOW TROUT (<i>Oncorhynchus mykiss</i>): ADJUVANT POTENTIAL OF THE <i>Escherichia coli</i> LT(R192G/L211A) TOXOID</b>  Martín-Martín, A., González, L., Tafalla, C., Díaz-Rosales, P.
<b>P9</b>	<b>SENSITIVITY TO INCREASED LEVEL OF TOTAL RESIDUAL OXIDANTS OF MUCOSAL SURFACES IN ATLANTIC SALMON</b>  Stiller, K., Kolarevic, J., Lazado, C.C., Good, C., Summerfelt, S.T., Schroeder, J.P., Mota, V.C., Terjesen, B.F., Espmark, Å.M.O.
<b>P10</b>	<b>COORDINATION OF SYSTEMIC AND MUCOSAL STRESS RESPONSES IN ATLANTIC SALMON TREATED WITH AN ORGANIC PEROXIDE</b>  Soleng, M., Johansen. L.H., Johansson, G.S., Breiland, M., Johnsen, H., Pedersen, L.F., Lazado, C.C.
<b>P11</b>	<b>FUNCTIONAL STUDIES OF MUCOSAL GILL HEALTH IN ATLANTIC SALMON (<i>Salmo salar</i>)</b>  Costelloe, E., Douglas, A., Valdenegro, V., Bickerdike, R., Noguera, P., Krol, E., Martin, S.A.M.
<b>P12</b>	<b>MYCOTOXINS – A WORLDWIDE THREAT FOR THE BLUE REVOLUTION?</b>  Rosen, R., Doupovec, B. , Taschl, I. , Muccio, M., Unger, N.

