Special Issue: Abstracts of the 9th International Conference on Environmental Health Science, 2-3 November 2016, Incheon, Republic of Korea

Global Issues in Marine Environmental Conservation and Health Diagnosis

November 2 (Wed) – 3 (Thu), 2016
Ghent University Songdo Global Campus
Incheon, Republic of Korea

Program Chair: Taejun Han, Ph.D.

KoEHS Headquarters
Building # 9-214, 119 Academy-ro Yeonsu-gu, Incheon 22012, Republic of Korea
Telephone: +82-32-835-4564 E-mail: koehsoffice@gmail.com
Web Site: www.ehs.or.kr
## Conference Schedule of Events

### Wednesday, Nov 2

| Time          | Event                                      |
|---------------|--------------------------------------------|
| 08:30-10:20   | Registration                               |
| 10:20-10:30   | Opening Ceremony & Welcoming Address       |

### SYMPOSIUM I

**Climate Change and Ecosystems**  
Session Chair: Dr. Jang Kyun Kim (Incheon Nat’l Univ., Korea)

| Time          | Speaker                                      | Topic                                             |
|---------------|----------------------------------------------|---------------------------------------------------|
| 10:30-11:00   | Dr. Peimin He (Shanghai Ocean Univ., China)  | Mechanisms of green tides in the Yellow Sea       |
| 11:00-11:30   | Dr. Tae-Wook Kim (Incheon Nat’l Univ., Korea) | Ocean acidification of Korean coastal waters      |
| 11:30-12:00   | Dr. Jinyoung Jung (KOPRI, Korea)             | Atmospheric inorganic nitrogen input via dry, wet, and sea fog deposition to the subarctic western North Pacific |
| 12:00-13:30   |                                               | Lunch & Poster Social & Booth Tour                |

### SYMPOSIUM II

**Application and Future Challenges in Marine Species**  
Session Chair: Dr. Seungshic Yum (KIOST., Korea)

| Time          | Speaker                                      | Topic                                             |
|---------------|----------------------------------------------|---------------------------------------------------|
| 13:30-14:00   | Dr. Yunxiang Mao (Ocean University of China, China) | Laver genome: challenges and advances               |
| 14:00-14:30   | Dr. Shan Lu (Nanjing Univ., China)           | Deciphering the carotenoid biosynthetic pathway in premitive red algae |
| Time       | Session/Activity                                                                                   |
|------------|----------------------------------------------------------------------------------------------------|
| 14:30-15:00| **Dr. Jin-Hyoung Kim (KOPRI, Korea)**<br>Transgenic fish research in Canada: phenotypic evaluation and risk assessment of genetically engineered finfish |
| 15:00-15:20| **Coffee Break & Poster Social & Booth Tour**                                                      |
| 15:20-15:40| **YOUNG SCIENTIST SESSION – I**<br>Session Chair: Dr. JinHee Kim (Sejong Univ., Korea)            |
|            | **Ade Yamindago (University of Science and Technology, Korea)**<br>Transcriptomic analysis in an antidepressant exposed Hydra |
| 15:40-16:00| **Ms. Jihae Park (Incheon Nat’l Univ., Korea)**<br>Comparing the acute sensitivity of growth and photosynthetic endpoints in three *Lemna* species exposed to four herbicides |
| 16:00-16:30| **SYMPOSIUM III**<br>Diagnosis technology and diseases<br>Session Chair: Dr. Ji-Young Ahn (Chungbuk Univ., Korea) |
|            | **Prof. Stefan Magez (Ghent University, Belgium)**<br>Nanobody based diagnostics for a rapid screening of infectious diseases |
| 16:30-17:00| **Prof. Magdalena Radwanska (Ghent University, Belgium)**<br>Vaccine failure due to chronic infection |
| 17:00-18:00| **Warm Up Time for Gala Dinner Buffet**                                                          |
| 18:00-19:30| **GALA DINNER RECEPTION**<br>Welcoming Reception Excellent Science Prize Awards & Hae-Rang Scholarship & Fortune Tickets |
| 19:30-22:00| **Talent Competition**                                                                          |
| Time          | Presenter                  | Title                                                                 |
|--------------|----------------------------|----------------------------------------------------------------------|
| 10:00-10:30  | Dr. Myoung-Hwan Park       | Enhanced isolation and release of circulating tumor cells using nanoparticle binding and ligand exchange in a microfluidic chip |
| 10:30-11:00  | Dr. Eunhee Jeoung          | Fabrication of Biocompatible Protein Films                            |
| 11:00-11:30  | Dr. Eunjoo Kim             | Circulating biomarkers for toxicity evaluation, diagnosis and therapy |
| 11:30-12:00  | Dr. Kyung-Taek Rim         | Occupational and environmental issues in the future focus on rare earths |
| 12:00-13:30  | Lunch & Poster Social & Booth Tour |
| 13:30-13:50  | Ms. Ka-Young Park          | Expression of Recombinant Epitope of Stx2eA as Toxoid Vaccine against Porcine Edema Disease |
| 13:50-14:10  | Ms. Lyu Jie                | Biostimulatory of algal extracts on radish                           |
| 14:10-15:00  |                             | General Assembly                                                      |
| 15:00-15:10  |                             | Closing Remarks                                                       |
**S1**

**Mechanisms of green tides in the Yellow Sea**

Peimin He, Yuanzi Huo, Jianheng Zhang, Kefeng Yu & Hailong Wu  
College of Fisheries and Life Sciences, Shanghai Ocean University, 999# Huchenghuan Road, Shanghai 201306, China

---

**S2**

**Ocean acidification of Korean coastal waters**

Dongseon Kim, Tae-Wook Kim & Yujeong Choi  
1Chemistry & Geochemistry Research Center, Korea Institute of Ocean Science and Technology (KIOST), Ansan, Republic of Korea  
2Department of Marine Science, Incheon National University, Incheon, Republic of Korea

---

**S3**

**Atmospheric inorganic nitrogen input via dry, wet, and sea fog deposition to the subarctic western North Pacific Ocean**

Jinyoung Jung, Hiroshi Furutani, Mitsuo Uematsu, Sang-Woo Kim & Soon-Chang Yoon  
1Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Japan  
2School of Earth and Environmental Sciences, Seoul National University, Seoul, Republic of Korea  
3Division of Polar Ocean Science, Korea Polar Research Institute, Incheon, Republic of Korea

---

**S4**

**Laver genome: challenges and advances**

Yunxiang Mao, Min Cao, Kuipeng Xu, Fanna Kong, Peipei Sun & Guiqi Bi  
1Key Laboratory of Marine Genetics and Breeding (Ministry of Education), Ocean University of China, Qingdao 266003, China  
2Qingdao National Laboratory for Marine Science and Technology, Qingdao 266200, China

---

**S5**

**Deciphering the carotenoid biosynthetic pathway in premitive red algae**

Li-En Yang, Xing-Qi Huang, Tian-Jun Cao, Yin-Yin Deng & Shan Lu  
1State Key Laboratory of Pharmaceutical Biotechnology, School of Life Sciences, Nanjing University, Nanjing 210023, China  
2Jiangsu Institute of Oceanology and Marine Fisheries, Nantong 226007, China

---

**S6**

**Transgenic fish research in Canada: Phenotypic evaluation and risk assessment of genetically engineered finfish**

Jin-Hyoun Kim, Daniel J. Macqueen, James R Winton & Robert H. Devlin  
1Unit of Polar Genomics, Korea Polar Research Institute, Republic of Korea  
2Institute of Biological and Environmental Sciences, University of Aberdeen, United Kingdom  
3Fish Health Section, Western Fisheries Research Center, USA  
4Centre for Aquaculture and Environmental Research, Fisheries and Oceans Canada, Canada
Nanobody based diagnostics for the rapid screening of infectious diseases

Stefan Magez\textsuperscript{1,2}

\textsuperscript{1}Laboratory for Cellular and Molecular Immunology, Vrije Universiteit Brussel, Belgium
\textsuperscript{2}Biomedical Research Centre, Ghent University Global Campus, Songdo-Incheon, Republic of Korea

Vaccination failure in infectious diseases – trypanosome infection model

Magdalena Radwanska

Center for Biomedical Research, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea

Enhanced isolation and release of circulating tumor cells using nanoparticle binding and ligand exchange in a microfluidic chip

Myoung-Hwan Park

Department of Chemistry at Sahmyook University Hwarangro-815 Nowon-gu, Seoul, 1st Science Building room #203, Republic of Korea

Fabrication of biocompatible protein films

Eunhee Jeoung

Department of Chemistry, Gangneung-Wonju National University, Gangneung, Gangwon-do 210-702, Republic of Korea

Circulating biomarkers for toxicity evaluation, diagnosis and therapy

Eunjoo Kim

Division of Nano & Energy Convergence Research, Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu, Republic of Korea

Occupational and environmental Issues in the Future; focus on rare earths

Kyung-Taek Rim

Chemicals Toxicity Research Bureau, Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency (OSHRI, KOSHA)#339-30 Expo-ro, Yuseong-gu, Daejeon 34122, Republic of Korea
Transcriptomic analysis in an antidepressant exposed hydra

Ade Yamindago

University of Science and Technology, Republic of Korea

Comparing the acute sensitivity of growth and photosynthetic endpoints in three Lemna species exposed to four herbicides

Jihae Park1,2,3, Murray T. Brown4, Stephen Depuydt2, Jang K. Kim5, Dam-Soo Won6 & Taejun Han5

1Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
2Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
3Institutie of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
4School of Marine Science & Engineering, Plymouth University, Plymouth, Devon, United Kingdom
5Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
6Water Supply Operations & Maintenance Department, Korea Water Resources Corporation, Daedeok-gu, Daejeon, Republic of Korea

Expression of recombinant epitope of Stx2eA as toxoid vaccine against porcine edema disease

Ga-Young Park, Se Hee Lee, Gna Ahn, Eunji Lee, Yang-Hoon Kim & Ji-Young Ahn

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea

Biostimulatory effect of algal extracts on radish

Lyu Jie1,2, Lalit Kumar Pandey2,3, Jihae Park1,2,4, Soyeon Choi1,2, Hojun Lee2,3 & Taejun Han3

1Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
2Institutie of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
3Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
4Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
P1  Cd exposure to human induced pluripotent stem cell-derived alveolar epithelial progenitor type II cells
Hye-Ryeon Heo¹,², Jeeyoung Kim², Woo Jin Kim¹,², Yoonki Hong¹,², Seon-Sook Han¹, Seung-Joon Lee¹ & Seok-Ho Hong¹,²
¹Department of Internal Medicine, School of Medicine, Kangwon National University, Chuncheon 24341, Republic of Korea
²Environmental Health Center, Kangwon National University Hospital, Chuncheon 24341, Republic of Korea

P2  Suppression of TLRs signaling pathways by 1-[5-methoxy-2-(2-nitrovinyl)phenyl]pyrrolidine
Hyeon-Myeong Shin, Ah-Yeon Kim, Hyun-Jin Shim & Hyung-Sun Youn
Department of Biomedical Laboratory Science, College of Medical Sciences, SoonChunHyang University, Chungnam, Asan 31538, Republic of Korea

P3  Eupatorium makinoi suppresses Toll-like receptor signaling pathways
Hyeon-Myeong Shin, Ah-Yeon Kim, Hyun-Jin Shim & Hyung-Sun Youn
Department of Biomedical Laboratory Science, College of Medical Sciences, SoonChunHyang University, Chungnam, Asan 31538, Republic of Korea

P4  Aster yomena suppresses LPS-induced cyclooxygenase-2 and Inducible Nitric Oxide synthase expression
Hyeon-Myeong Shin, Ah-Yeon Kim, Hyun-Jin Shim & Hyung-Sun Youn
Department of Biomedical Laboratory Science, College of Medical Sciences, SoonChunHyang University, Chungnam, Asan 31538, Republic of Korea

P5  Somatotype analysis of sports athletes according to weight division for health science research
Min-Suk Kim¹, Ji-Woong Noh¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim¹, Lim-Kyu Lee¹, Byong-Sun Park¹, Seung-Min Yang¹, Won-Deok Lee¹, Yong-Sub Shin¹, So-Jung Kim¹ & Junghwan Kim¹
¹Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

P6  Historical trends of chlorinated, brominated and fluorinated contaminants in sediment cores from Jinhae Bay, Korea
Jeong-Uk Lee¹, Won-Deok Lee², Ju-Hyun Kim³, Mee-Young Kim², Lim-Kyu Lee², Byong-Sun Park², Seung-Min Yang², Ji-Woong Noh², Yong-Sub Shin², So-Jung Kim² & Junghwan Kim²
¹Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea
²Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
³Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
P7  Dermatologic characteristics of healthy men according to the parts of the body

So-Jung Kim¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim¹, Lim-Kyu Lee¹, Byong-Sun Park¹, Seung-Min Yang¹, Won-Deok Lee³, Ji-Woong Noh¹, Yong-Sub Shin¹ & Junghwan Kim¹

¹Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

P8  Dermatologic characteristics of healthy women according to the parts of the body: A Randomized Controlled Pilot Trial

So-Jung Kim¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim¹, Lim-Kyu Lee¹, Byong-Sun Park¹, Seung-Min Yang¹, Won-Deok Lee³, Ji-Woong Noh¹, Yong-Sub Shin¹ & Junghwan Kim¹

¹Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

P9  Analysis of walking and muscle activity in chronic stroke patients for health science research

Ju-Hyun Kim¹, Byong-Sun Park², Jeong-Uk Lee³, Mee-Young Kim², Lim-Kyu Lee², Seung-Min Yang², Won-Deok Lee², Ji-Woong Noh², Yong-Sub Shin², So-Jung Kim² & Junghwan Kim²

¹Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
²Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

P10  Contamination analysis of water quality at water treatment plants classified by type

Lim-Kyu Lee¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim¹, Byong-Sun Park¹, Seung-Min Yang¹, Won-Deok Lee¹, Ji-Woong Noh¹, Yong-Sub Shin¹, So-Jung Kim¹ & Junghwan Kim¹

¹Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

P11  Differentially expressed genes in polyp of moon jelly Aurelia aurita under acidified seawater condition

Nayoung Lee, Nayun Lee, Ye Jin Jo & Seungshic Yum

South Sea Environment Research Division, Korea Institute of Ocean Science and Technology (KIOST), Geoje, Republic of Korea
| Session | Title                                                                 | Authors                                                                 | Institutions                                                                 |
|---------|-----------------------------------------------------------------------|-------------------------------------------------------------------------|------------------------------------------------------------------------------|
| P12     | Rapid kit development for harmful algal detection                     | Nayun Lee, Seonock Woo & Seungshic Yum                                   | South Sea Environment Research Division, Korea Institute of Ocean Science and Technology (KIOST), Geoje, Republic of Korea |
| P13     | Effects of antifouling agents on molecular and biochemical defense system in the Pacific oyster | Ye-Ji Rhee¹, Mi Seon Park², Young Dae Kim², Jang K. Kim¹ & Jae-Sung Rhee¹ | ¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea; ²Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong 46083, Republic of Korea |
| P14     | Comparative transcriptome analysis in tolerant and susceptible Pacific oysters exposed to thermal stress | Do-Hee Lee¹, Hyun-Jeong Lim², Ik-Young Choi³ & Jae-Sung Rhee¹ | ¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea; ²West Sea Fisheries Research Institute, National Fisheries Research and Development Institute, Incheon 22383, Republic of Korea; ³Department of Agriculture and Life Industry, Kangwon National University, Chuncheon 24341, Republic of Korea |
| P15     | Molecular and biochemical responses in the microcystin-LR-exposed embryo and larvae of the mangrove killifish | Kwang-Sik Choi¹, Bo-Mi Kim² & Jae-Sung Rhee¹ | ¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea; ²Unit of Polar Genomics, Korea Polar Research Institute, Incheon 21990, Republic of Korea |
| P16     | Nonylphenol induces mortality and reduces hatching rate through increase of cell damage and dysfunction of antioxidant defense system in marine medaka embryo | Sang-Eun Nam, Ye-Ji Rhee & Jae-Sung Rhee | Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea |
| P17     | Effects of biocides and antifouling agents on cyst hatching success, acetylcholinesterase activity, and mortality in the brine shrimp Artemia salina | Hye-Jin Eom, Hyeon-Jeong Choi, Inseon Baek & Jae-Sung Rhee | Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea |
| P18     | Terrigenous source of styrene oligomers (SOs) in aquatic system         | Gi-Yun Sung¹ & Seung-Kyu Kim¹,² | ¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea; ²Research Institute of Basic Sciences, Incheon National University, Incheon 22012, Republic of Korea |
| P19     | Development of analytical methods for microplastics in bed-sediment: pilot study | Ji Woo Noh¹ & Seung-Kyu Kim¹,² | ¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea; ²Research Institute of Basic Sciences, Incheon National University, Incheon 22012, Republic of Korea |
P20 A pilot study to measure microplastics in wastewater treatment plant (WWTPs)
Nan-Seon Song1 & Seung-Kyu Kim1,2
1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2Research Institute of Basic Sciences, Incheon National University, Incheon 22012, Republic of Korea

P21 Transcriptional responses and prediction of metabolic changes in marine medaka fish (Oryzias javanicus) to acute exposure to endocrine disrupting chemicals
Ye Jin Jo, Nayoung Lee, Nayun Lee & Seungshic Yum
South Sea Environment Research Division, Korea Institute of Ocean Science and Technology (KIOST), Geoje, Republic of Korea

P22 Detecting of MERS-coronavirus by using one-pot reverse transcription loop-mediated isothermal amplification (RT-LAMP)
Se Hee Lee1, Ga-Young Park1, Gna Ahn1, Eunji Lee1, Yang-Hoon Kim1, Hong-Soo Choi2, Yun Hee Baek3, Min-Suk Song3 & Ji-Young Ahn1
1Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea
2National Institute of Animal Science, RDA, Republic of Korea
3College of Medicine and Medical Research Institute, Chungbuk National University, Cheongju, Republic of Korea

P23 Detection of plant-pathogenic viroid by using loop-mediated isothermal amplification based on reverse transcription and application in field
Se Hee Lee, Ga-Young Park, Gna Ahn, Eunji Lee, Yang-Hoon Kim, Hong-Soo Choi & Ji-Young Ahn
Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea

P24 Construction of whole-cell neutralizing system using CWP2 signaling for PED Virus
Eunji Lee, Ga-Young Park, Gna Ahn, Se Hee Lee, Yang-Hoon Kim & Ji-Young Ahn
Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea

P25 Protein expression of astacin-like zinc-metalloprotease and toxicity test from the Nemopilema nomurai
Gna Ahn, Ga-Young Park, Se Hee Lee, Eunji Lee, Yang-Hoon Kim & Ji-Young Ahn
Department of Microbiology, Chungbuk National University, Cheongju 28644, Republic of Korea

P26 The ameliorative effect of K. parviflora extract on the inflammatory responses in P. acnes-infected cells
Solee Jin1, A-Reum Ryu1 & Mi-Young Lee1,2
1Department of Medical Science, College of Medical Science, SoonChunHyang University, Asan, Chungnam 31538, Republic of Korea
2Department of Medical Biotechnology, College of Medical Science, SoonChunHyang University, Asan, Chungnam 31538, Republic of Korea
| Abstract   | Title                                                                 | Authors                                                                 | Department                          | University                        | Country     |
|-----------|----------------------------------------------------------------------|------------------------------------------------------------------------|-------------------------------------|-----------------------------------|------------|
| **P27**   | Acute toxicity and superoxide dismutase (SOD) activity in brackishwater cladoceran *Diaphanosoma celebensis* exposed to heavy metals | Chulhee Bae & Young-Mi Lee                                              | Department of Life Science          | College of Natural Sciences       | Republic of Korea |
| **P28**   | Oxidative stress of cadmium and copper in marine ciliate *Euplotes crassus* | Ji-Soo Kim & Young-Mi Lee                                              | Department of Life Science          | College of Natural Sciences       | Republic of Korea |
| **P29**   | Role of ACN9 gene in the pathogenesis of chronic obstructive pulmonary disease | Jeeyoung Kim$^{1,2}$, Hye-Ryeon Heo$^{1,2}$, Seok-Ho Hong$^{1,2}$ & Woo Jin Kim$^{1,2}$ | $^{1}$Department of Internal Medicine, School of Medicine, Kangwon National University, Chuncheon 24341, Republic of Korea | $^{2}$Environmental Health Center, Kangwon National University Hospital, Chuncheon 24289, Republic of Korea |          |
| **P30**   | The effect of umbelliferone on melanogenesis in B16F10 melanoma cells  | Yun Jung Lee & Eun-Mi Choi                                              | Department of Chemistry             | Incheon National University       | Republic of Korea |
| **P31**   | Gene expression profiling of human placenta cell line (JEG3) exposed to particulate matter (PM)2.5 | Woong Kim$^{1,4}$, Mi-Kyung Song$^{2}$, Yoon cho$^{1}$, Jung-hee Lim$^{1}$, Myung Chan Gye$^{4}$ & Jae-Chun Ryu$^{1,3}$ | $^{1}$Cellular and Molecular Toxicology Laboratory, Korea Institute of Science & Technology P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea | $^{2}$National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea | $^{3}$Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea | $^{4}$Department of Life Science, College of Natural Sciences, Hangyang University, Seoul 133-791, Republic of Korea |
| **P32**   | Gene expression Profiles on a human breast cancer cell line (MCF7) and human vascular endothelial cell line (EA.hy926) after two different PM2.5 exposures | Woong Kim$^{1,4}$, Mi-Kyung Song$^{2}$, Yoon cho$^{1}$, Jung-hee Lim$^{1}$, Myung Chan Gye$^{4}$ & Jae-Chun Ryu$^{1,3}$ | $^{1}$Cellular and Molecular Toxicology Laboratory, Korea Institute of Science & Technology P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea | $^{2}$National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea | $^{3}$Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea | $^{4}$Department of Life Science, College of Natural Sciences, Hangyang University, Seoul 133-791, Republic of Korea |
P33 Transcriptome profile analysis of the *in vitro* aldehydes exposure system and non-small cell lung cancer (NSCLC) related to pulmonary toxicity

**Yoon Cho**1,3, Mi-Kyung Song2, Woong Kim1, Jung-hee Lim1, Tae Sung Kim3 & Jae-Chun Ryu1,4

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST) P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea
3School of Life Sciences and Biotechnology, Korea University, Anam-Dong, Seoungbuk-Gu, Seoul 136-701, Republic of Korea
4Human and Environmental Toxicology, University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea

P34 DNA methylation-based biomarkers of saturated aliphatic aldehydes associated with pulmonary toxicity: the *in vitro* system and primary NSCLC tissue

**Yoon Cho**1,3, Mi-Kyung Song2, Woong Kim1, Jung-hee Lim1, Tae Sung Kim3 & Jae-Chun Ryu1,4

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST) P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea
3School of Life Sciences and Biotechnology, Korea University, Anam-Dong, Seoungbuk-Gu, Seoul 136-701, Republic of Korea
4Human and Environmental Toxicology, University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea

P35 Identification of microRNA (miRNA) biomarkers for low-molecular-weight saturated aliphatic aldehydes exposure and non-small cell lung cancer (NSCLC)

**Yoon Cho**1,3, Mi-Kyung Song2, Woong Kim1, Jung-hee Lim1, Tae Sung Kim3 & Jae-Chun Ryu1,4

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST) P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea
3School of Life Sciences and Biotechnology, Korea University, Anam-Dong, Seoungbuk-Gu, Seoul 136-701, Republic of Korea
4Human and Environmental Toxicology, University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea

P36 Gene expression profiles of exosomal and cellular miRNA from human promyelocytic leukemia cells (HL-60) exposed to xylene

**Jung-hee Lim**1,3, **Yoon Cho**1, Woong Kim1, Sung Ok Han3 & Jae-Chun Ryu1,2

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST), Republic of Korea
2Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea
3Department of Biotechnology, Korea University, Seoul 131-701 Republic of Korea
Differentially expressed microRNA and mRNA profiles in HL-60 human promyelocytic leukemia cells and exosomes under toluene exposure

Jung-hee Lim$^{1,3}$, Mi-Kyung Song$^2$, Yoon Cho$^1$, Woong Kim$^1$, Sung Ok Han$^3$ & Jae-Chun Ryu$^{1,4}$

$^1$Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST), Republic of Korea

$^2$National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea

$^3$Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea

$^4$Department of Biotechnology, Korea University, Seoul 131-701 Republic of Korea

Evaluation of nutrient bioextraction capacity by shellfish aquaculture in Korea

Ye-Ho Kang, Da-Eun Kim, Min-Jeong Kim, Jin-Hee Park & Jang K. Kim

Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea

N-terminal specific responses of aryl hydrocarbon receptor (AHR) in Polar bear (Ursus maritimus)

Jihee Hwang$^1$, Kurunthachalam Kannan$^2$, Thomas J. Evans$^3$, Hisato Iwata$^4$ & Eun-Young Kim$^{1,5}$

$^1$Department of Life and Nanopharmaceutical Science, Kyung Hee University, Hoegi Dong, Dongdaemun-Gu, Seoul 130-701, Republic of Korea

$^2$Wadsworth Center, New York State Department of Health, New York, USA

$^3$United States Fish and Wildlife Service, Anchorage, Alaska, USA

$^4$Center for Marine Environmental Studies (CMES), Ehime University, Bunkyo-cho 2-5, Matsuyama, 790-8577, Japan

$^5$Department of Biology, Kyung Hee University, Hoegi Dong, Dongdaemun-Gu, Seoul 130-701, Republic of Korea

Transactivation of avian aryl hydrocarbon receptor by natural ligands

Dong-Hee Koh$^1$, Hisato Iwata$^3$ & Eun-Young Kim$^{1,2}$

$^1$Department of Life and Nanopharmaceutical Science, Kyung Hee University, Hoegi Dong, Dongdaemun-Gu, Seoul 130-701, Republic of Korea

$^2$Department of Biology, Kyung Hee University, Hoegi Dong, Dongdaemun-Gu, Seoul 130-701, Republic of Korea

$^3$Center for Marine Environmental Studies (CMES), Ehime University, Bunkyo-cho 2-5, Matsuyama, 790-8577, Japan

Effect of salinity on the growth of Gracilaria vermiculophylla and Ulva prolifera

Beomjoon Son$^1$, Hailong Wu$^1$, Taejun Han$^{1,2}$, Hojun Lee$^1$, Jihae Park$^{3,4}$, Soyeon Choi$^3$, Je-Woo Jung$^1$, Sojin Jang$^1$, Mi Seon Park$^6$, Young-Dae Kim$^6$, Byung-Hwa Min$^6$ & Jang K. Kim$^1$

$^1$Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea

$^2$Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea

$^3$College of Life and Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 22012, Republic of Korea

$^4$Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21995, Republic of Korea

$^5$Department of Cosmetic Science & Management, Incheon University, Yeonsu-gu, Incheon 22012, Republic of Korea

$^6$Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam 46085, Republic of Korea
P42 Nutrient bioextraction of the sea cucumber, *Apostichopus japonicus* in an integrated multi-tropic aquaculture (IMTA) system

Haram Jung¹, Hailong Wu¹, Taejun Han¹,², Hojun Lee¹, Jihae Park³,⁴, Soyeon Choi³, Je-Woo Jung¹, Sojin Jang¹, Mi Seon Park⁶, Young-Dae Kim⁶, Byung-Hwa Min⁶ & Jang K. Kim¹

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
³College of Life and Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 20212, Republic of Korea
⁴Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
⁵Department of Cosmetic Science & Management, Incheon University, Yeonsu-gu, Incheon 22012, Korea
⁶Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam 46083, Republic of Korea

---

P43 Reversible phase transfer of highly stabilized gold nanorods between organic and aqueous solutions

Sundo Jeong & Myoung-Hwan Park

Department of Chemistry, Sahmyook University, Seoul 01795, Republic of Korea

---

P44 Fabrication of highly photoluminescent quantum dot-polymer composite micropatterned surface using thiol-ene chemistry

Min-Chul Jo, Chung-Hyeon Kim & Myoung-Hwan Park

Department of Chemistry, Sahmyook University, Seoul 01795, Republic of Korea

---

P45 Growth and nutrient bioextraction of *Gracilaria vermiculophylla*, *Gracilariopsis lemaneiformis* and *Ulva prolifera* in response to different salinities and nitrogen sources

Hailong Wu¹, Jang K. Kim¹, Taejun Han¹,², Hojun Lee¹, Jihae Park³,⁴, Soyeon Choi³, Je-Woo Jung¹, Sojin Jang¹, Mi Seon Park⁶, Young-Dae Kim⁶, Byung-Hwa Min⁶ & Peimin He⁷

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
³College of Life and Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 20212, Republic of Korea
⁴Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
⁵Department of Cosmetic Science & Management, Incheon University, Yeonsu-gu, Incheon 22012, Korea
⁶Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam 46083, Republic of Korea
⁷College of Life and Fisheries, Shanghai Ocean University, Shanghai, China

---

P46 Nutrient bioextraction by year-round seaweed aquaculture in Jiangsu coasts, China

Hailong Wu¹,², Jang K. Kim¹, Peimin He⁷, Weiping Dai³, Yongdong Zhou⁴ & Xinming Yang⁵

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
³Laver Association of Jiangsu Province, Nantong, Jiangsu Province, China
⁴Yancheng Hairui Food Company, Dafeng, Jiangsu Province, China
⁵Jiangsu Xianzhiyuan Aquatic Food Company, Rudong, Jiangsu Province, China
P47 Periphytic diatom community as a biomonitoring tool for assessing the ecological health of Korean waterbodies

Lalit Kumar Pandey1,2, Jihae Park1,3,4, Lyu Jie1,3, Soyeon Choi1,3, Hojun Lee1,2 & Taejun Han2

1Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
2Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
3Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
4Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea

P48 Rapid response of the aquatic macrophyte Spirodela polyrhiza after short time exposure to toxicants

Soyeon Choi1,2, Jihae Park1,2,3, Youn-Jung Kim4 & Taejun Han4

1Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
2Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
3Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
4Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea

P49 Effects of heavy metals on frond area and re-growth of roots in Spirodela polyrhiza

Mirae Kim1, Jihae Park2,3,4, Jang K. Kim1, Soyeon Choi2,4, Hojun Lee1,4, Ki Jun Yang1 & Taejun Han1

1Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
2Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
3Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
4Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea

P50 A comparison of nutrient uptake capacity of Gracilaropsis lemaneiformis and Ulva australis in an integrated multi-trophic aquaculture (IMTA) system

Hojun Lee1, Jihae Park2,3,4, Soyeon Choi2, Juseon Lee3, Hailong Wu1, Eun A Seo1, Je-Woo Jung1, So Jin Jang1, Mi Seon Park5, Young-Dae Kim5, Byung-Hwa Min5, Young-Hyun Do5, Taejun Han1,6 & Jang K. Kim1

1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2College of Life and Sciences and Bioengineering, Incheon National University, 119, Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
3Department of Cosmetic Science & Management, Incheon University, 119 Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
4Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea
5National Institute of Fisheries Science, 361, Yeong-un-ri, Sanyang-eup, Tongyeong-si, Gyeonsangnam-do 53085, Republic of Korea
6Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea

P51 Effect of salinity on the chlorophyll fluorescence of Gracilaropsis lemaneiformis (Gracilariales, Rhodophyta)

Hojun Lee1, Taejun Han1,2 & Jang K. Kim1

1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2Ghent University Global Campus, Songdo, Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea
**P52** Comparative sensitivity of different life stages of *Spirodela polyrhiza* exposed to paraquat

Ki Jun Yang¹, Jihae Park²,³,⁴, Jang K. Kim¹, Soyeon Choi²,⁴, Hojun Lee¹,⁴, Mirae Kim¹ & Taejun Han¹

¹Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
²Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
³Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
⁴Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea

**P53** Nutrient bioextraction by seaweed aquaculture in Korea

Je-Woo Jung¹, Sojin Jang¹, Euna Seo¹, Hailong Wu¹, Hojun Lee¹, Jihae Park²,³, Soyeon Choi², Juseon Lee⁴, Mi Seon Park⁵, Young-Dae Kim⁵, Byung-Hwa Min⁵, Taejun Han¹,⁶ & Jang K. Kim¹

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²College of Life and Sciences and Bioengineering, Incheon National University, 119, Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
³Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea
⁴Department of Cosmetic Science & Management, Incheon University, 119 Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
⁵Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong 46083, Republic of Korea
⁶Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea

**P54** Toxicogenomic approach for the investigation of lead-induced genotoxic effect in rat kidney in terms of biological pathway

Hyun Soo Kim, Hyun Jin Lee, Yeo Jin Kim, Won Hee Jang & Young Rok Seo

Institute of Environmental Medicine for Green Chemistry, Department of Life Science, Dongguk University Biomedical Campus, 32, Dongguk-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do 10326, Republic of Korea

**P55** Toxicogenomic analysis for elucidating the lead-induced response under low-level exposure in rat liver in terms of repair activity

Hyun Soo Kim, Sang Min Lee, Yeo Jin Kim, Won Hee Jang & Young Rok Seo

Institute of Environmental Medicine for Green Chemistry, Department of Life Science, Dongguk University Biomedical Campus, 32, Dongguk-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do 10326, Republic of Korea

**P56** Removal of mercury by using the mixture of silver nanoparticles and nanowires

Mu Lei & Sung Ik Yang

Department of Applied Chemistry, Kyung Hee University, Yongin 446-701, Republic of Korea

**P57** Characterization of indoor airborne fungi in public facilities

Dong-Jin Kang, Ji-Yeon Lee, Eun-Min Cho & Sung Ik Yang

Department of Applied Chemistry, Kyung Hee University, Yongin 446-701, Republic of Korea
The effects of silver nanoparticles and silver ions on airborne fungi

Ji-Yeon Lee, Hye Ji Jang, Seung Kyun Shin, Eun-Min Cho & Sung Ik Yang

Department of Applied Chemistry, Kyung Hee University, Yongin 446-701, Republic of Korea

Expression profiles of Th2-type chemokine genes for atopic dermatitis by the Pyropia yezoensis extract in HaCaT cells

Yuna Ha¹, Do Yeon Seo², Taejun Han¹,² & Youn-Jung Kim¹,²

¹Department of Cosmetic Science & Management, Graduate School, Incheon National University, Incheon, Republic of Korea
²Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea

Effects of the emulsifying agent on the safety of nanoparticles in sunscreens

Ga-Young Seo¹, Ji Hyun Lee², Jin Hyeok Kim², Jung Been Shim², Hyun Joon Hong², Kim Eunsung² & Youn-Jung Kim¹,³

¹Department of Cosmetic Science and Management, Graduate school, Incheon National University, Incheon, Republic of Korea
²Incheon Academy of Science and Arts, Incheon, Republic of Korea
³Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea

Transcriptional profile of Pyropia yezoensis extracts in HaCaT cell

Young-Jin Lee¹, Do Yeon Seo¹, Taejun Han¹,² & Youn-Jung Kim¹,²

¹Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea
²Department of Cosmetic Science & Management, Graduate School, Incheon National University, Incheon, Republic of Korea

Analysis of human plasma protein expression by toluene, ethylbenzene and xylene exposure using antibody array

Sungwoo Seo¹, Do Yeon Seo¹, Jae-Chun Ryu², Seung-Yong Hwang³ & Youn-Jung Kim¹,⁴

¹Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea
²Cellular and Molecular Toxicology Laboratory, Center for Integrated Risk research, Korea Institute of Science & Technology, Seoul, Republic of Korea
³Department of Biochemistry, Hanyang University, Sangrokgu, Ansan, Gyeonggi-do, Republic of Korea
⁴Department of Cosmetic Science & Management, Graduate School, Incheon National University, Incheon, Republic of Korea

Association of phthalate exposures with oxidative stress markers in prenatal and postnatal environments

Jin Hee Kim¹, Jangwoo Lee², Hyo-Bang Moon³, Jeongim Park⁴, Kyungho Choi², Sung Koo Kim⁵ & Sungkyoon Kim²

¹Department of Integrative Bioscience & Biotechnology, Sejong University, Republic of Korea
²Department of Environmental Health, Seoul National University, Republic of Korea
³Department of Marine Sciences and Convergent Technology, Hanyang University, Republic of Korea
⁴College of Natural Sciences, Soochunhyang University, ⁵College of Medicine, Hallym University, Republic of Korea
**P64** A comparison of nutrient bioextraction capacity of Pacific oysters and blue mussels in an integrated multi-trophic aquaculture (IMTA) system

Sojin Jang\(^1\), Hailong Wu\(^1\), Taejun Han\(^{1,2}\), Hojun Lee\(^1\), Jihae Park\(^{3,4}\), Soyeon Choi\(^3\), Je-Woo Jung\(^1\), Mi Seon Park\(^5\), Young-Dae Kim\(^6\), Byung-Hwa Min\(^6\) & Jang K. Kim\(^1\)

\(^1\)Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
\(^2\)Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
\(^3\)College of Life and Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 22012, Republic of Korea
\(^4\)Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
\(^5\)Department of Cosmetic Science & Management, Incheon University, Yeonsu-gu, Incheon 22012, Republic of Korea
\(^6\)Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam 46083, Republic of Korea

**P65** Species-specific characteristics and variability of carbon acquisition strategies on coastal macroalgae: implications for ocean acidification

Ju-Hyoung Kim

Faculty of Marine Applied Biosciences, Kunsan National University, Gunsan, Republic of Korea

**P66** Selection of peptides for detection, neutralizing of botulinum toxin type E by phage display

Ga-Young Park, Se Hee Lee, Gna Ahn, Eunji Lee, Yang-Hoon Kim & Ji-Young Ahn

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea

**P67** The detection of *Rosellinia necatrix* caused pear white root rot based on loop-mediated isothermal amplification

Se Hee Lee & Ji-Young Ahn

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea

**P68** Identification of LAMP condition to amplify dsDNA template for detection of *Rosellina necatrix* scaffold

Se Hee Lee & Ji-Young Ahn

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea

**P69** Induction of thioredoxin reductase 1 by crotonaldehyde as an adaptive mechanism in human umbilical vein endothelial cells

Hong Duck Yun\(^1\), Seung Eun Lee\(^2\), Hye Rim Park\(^1\) & Yong Seek Park\(^2\)

\(^1\)Department of Biomedical Science, Graduate School, Kyung Hee University, Seoul, Republic of Korea
\(^2\)Department of Microbiology, School of Medicine, Kyung Hee University, Seoul, Republic of Korea

**P70** Expression profiling of microRNA in crotonaldehyde-stimulated human endothelial cells

Hye Rim Park\(^1\), Seung Eun Lee\(^2\), Hong Duck Yun\(^1\) & Yong Seek Park\(^2\)

\(^1\)Department of Biomedical Science, Graduate School, Kyung Hee University, Seoul, Republic of Korea
\(^2\)Department of Microbiology, School of Medicine, Kyung Hee University, Seoul, Republic of Korea
| Abstract ID | Title                                                                 | Authors                                                                                                                                  |
|------------|----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| S20        | Integrative cross-species analysis on insulin resistance expression profile in white adipose tissues | Junghyun Jung¹, Gowoon Kim², Sunghyun Chung² & Wonhee Jang¹ |
|            |                                                                      | ¹Department of Life sciences, Dongguk University, Seoul 100-713, Republic of Korea  
|            |                                                                      | ²Department of Pharmacology and Clinical Pharmacy, College of Pharmacy, Kyung Hee University, Seoul 130-701, Republic of Korea |
| P71        | A study on relationship between coplanar PCBs and heart diseases via meta-analysis | Kyoungyoung Hah & Wonhee Jang |
|            |                                                                      | Department of Life Sciences, Dongguk University, Seoul 100-713, Republic of Korea |
| P72        | Exploring the association between single nucleotide polymorphisms and risk of Korean serous ovarian cancer at stage IIIC through genomic approach | Yeo Jin Kim¹, Hyun Soo Kim¹, Woong Shick Ahn², Jee Young Kwon³ & Young Rok Seo¹ |
|            |                                                                      | ¹Department of Life Science, Institute of Environmental Medicine for Green Chemistry, Dongguk University Biomedical Campus, Goyang-si, Gyeonggi-do, Republic of Korea  
|            |                                                                      | ²Department of Obstetrics and Gynecology, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea  
|            |                                                                      | ³The Jackson Laboratory for Genomic Medicine, Farmington, USA |
| P73        | Exploring the potential biomarker of cadmium in Daphnia magna through comparative network analysis using BLAST | Hyo Jeong Kim¹, Jun Hyuek Yang¹, Sang Min Lee¹, Yeo Jin Kim¹, Bo-Mi Kim² & Young Rok Seo¹ |
|            |                                                                      | ¹Institute of Environmental Medicine for Green Chemistry, Department of Life Science, Dongguk University Biomedical Campus, 32, Dongguk-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do, Republic of Korea  
|            |                                                                      | ²Unit of Polar Genomics, Korea Polar Research Institute, Incheon 21990, Republic of Korea |
| P74        | Comparative genotoxicity investigation in HepG2 human hepatoma cells using comet and gamma-H2AX assays | Hyo Jeong Kim¹, Yeo Jin Kim¹, Preeyaporn Koedrith¹,³, Hyun Soo Kim², Wook Jun Yu⁴, Jong Choon Kim⁵,⁶ & Young Rok Seo¹,⁶ |
|            |                                                                      | ¹Institute of Environmental Medicine for Green Chemistry, Dongguk University Biomedical Campus, Gyeonggi-do, Republic of Korea  
|            |                                                                      | ²Department of Life Science, Dongguk University Biomedical Campus, Gyeonggi-do, Republic of Korea  
|            |                                                                      | ³Faculty of Environment and Resource Studies, Mahidol University, NakhonPathom, Thailand  
|            |                                                                      | ⁴Korea Institute of Toxicology, Daejeon, Republic of Korea  
|            |                                                                      | ⁵College of Veterinary Medicine, Chonnam National University, Gwangju, Republic of Korea  
|            |                                                                      | ⁶Department of Dermatology, Korea University Medical Center, Seoul, Republic of Korea |
| P75        | Environmental health-risk assessment of volatile organic compounds exposure using integrated analysis | Ji Young Hong¹, So-Yeon Yu², Gi Won Kim², Ha Jeong Song¹, Kwang Ho Lee², Sang Wook Son³ & Seung Yong Hwang¹,² |
|            |                                                                      | ¹Department of Bio-Nanotechnology, Hanyang University, Sangnok-gu, Ansan, Gyeonggi-do, Republic of Korea  
|            |                                                                      | ²Department of Molecular & Life Science, Hanyang University, Sangnok-gu, Ansan, Gyeonggi-do, Republic of Korea  
|            |                                                                      | ³Department of Dermatology, Korea University Medical Center, Seoul, Republic of Korea |
10.1007/s13530-016-0286-9

S1 Mechanisms of green tides in the Yellow Sea

Peimin He, Yuanzi Huo, Jianheng Zhang, Kefeng Yu & Hailong Wu
College of Fisheries and Life Sciences, Shanghai Ocean University, 999# Huchenghuan Road, Shanghai 201306, China

Since 2007, green tides with the largest scale in the world have bloomed in the Yellow Sea ever year, and try to reveal the mechanism of green tides blooming in Yellow Sea. In every year, the green tide started in Rudong coast area, Jiangsu province in April or May, and ended along Shandong coastline in August or September. The largest covering area was about 400-600 km\(^2\) and the largest involved area was 20000-40000 km\(^2\). The average growth rate of covering area for green tides was about 15% per day, and the maximum growth rate was up to about 40% per day. In 2013, the largest biomass was estimated to be 4100 kt fresh weight. With molecular identification (ITS and SS), we found that there were four species (\(U.\) prolifera, \(U.\) compressa, \(U.\) linza and \(U.\) flexuosa) for free-floating in Jiangsu coasts, but there was only \(U.\) prolifera free-floating in Shandong coastline. It indicated that \(U.\) prolifera is powerful and resistant species. And the Type I of \(U.\) prolifera was replaced by Type II of \(U.\) prolifera totally in 2016. In lab, the special daily growth rates of green tide algae \(U.\) prolifera were 127%, 70-80% and 20-30% for baby sporelings (100-500 \(\mu\)m), small sporelings (3-4 cm) and adult thallus, respectively. While in field, the average and maximum special daily growth rates of green tide algae \(Ulva\) prolifera were about 15% and 45%, respectively. It indicated that \(U.\) prolifera grew very fast. For air sacs forming along thallus and branch forming underwater for \(U.\) prolifera, the free-floating patches could float from Jiangsu coast to Shandong coast for long distance transporting with seasonal winds. It indicated that \(U.\) prolifera can avoid high lights.

S2 Ocean acidification of Korean coastal waters

Dongseon Kim\(^1\), Tae-Wook Kim\(^2\) & Yujeong Choi\(^1\)

\(^1\)Chemistry & Geochemistry Research Center, Korea Institute of Ocean Science and Technology (KIOST), Ansan, Republic of Korea
\(^2\)Department of Marine Science, Incheon National University, Incheon, Republic of Korea

An understanding of the impacts of ocean acidification is particularly important in coastal regions, which are critical habitats for many marine organisms highly vulnerable to reduced pH and CaCO\(_3\) saturation. In particular, the mixing of seawater and freshwater usually worsens ocean acidification because freshwater generally has low pH and CO\(_3^{2-}\) concentrations. In this study, however, an opposite case is presented. We investigated ocean acidification parameters during all four seasons in Busan coastal area and found that enhancement of CaCO\(_3\) saturation with decreasing salinity during spring and summer. It appeared that increased phytoplankton uptake of CO\(_2\) under enhanced water column stratification (induced by freshwater input and solar radiation) decreased dissolved inorganic carbon concentrations in seawater and increased pH, resulting in an increase in CaCO\(_3\) saturation.
Atmospheric inorganic nitrogen input via dry, wet, and sea fog deposition to the subarctic western North Pacific Ocean

Jinyoung Jung1,2,3, Hiroshi Furutani1, Mitsuo Uematsu1, Sang-Woo Kim2 & Soon-Chang Yoon2

1Atmosphere and Ocean Research Institute, The University of Tokyo, Kashiwa, Japan
2School of Earth and Environmental Sciences, Seoul National University, Seoul, Republic of Korea
3Division of Polar Ocean Science, Korea Polar Research Institute, Incheon, Republic of Korea

Aerosol, rainwater, and sea fog water samples were collected during the cruise conducted over the subarctic western North Pacific Ocean in the summer of 2008, in order to estimate dry, wet, and sea fog deposition fluxes of atmospheric inorganic nitrogen (N). During sea fog events, mean number densities of particles with diameters larger than 0.5 μm decreased by 12-78%, suggesting that particles with diameters larger than 0.5 μm could act preferentially as condensation nuclei (CN) for sea fog droplets. Mean concentrations of nitrate (NO3−), methanesulfonic acid (MSA), and non sea-salt sulfate (nss-SO42−) in sea fog water were higher than those in rainwater, whereas those of ammonium (NH4+) in both sea fog water and rainwater were similar. These results reveal that sea fog scavenged NO3− and biogenic sulfur species more efficiently than rain. Mean dry, wet, and sea fog deposition fluxes for atmospheric total inorganic N (TIN; i.e. NH4+ + NO3−) over the subarctic western North Pacific Ocean were estimated to be 4.9 μmol m−2 d−1, 33 μmol m−2 d−1, and 7.8 μmol m−2 d−1, respectively. While NO3− was the dominant inorganic N species in dry and sea fog deposition, inorganic N supplied to surface waters by wet deposition was predominantly by NH4+. The contribution of dry, wet, and sea fog deposition to total deposition flux for TIN (46 μmol m−2 d−1) were 11%, 72%, and 17%, respectively, suggesting that ignoring sea fog deposition would lead to underestimate of the total influx of atmospheric inorganic N into the subarctic western North Pacific Ocean, especially in summer periods.

Laver genome: challenges and advances

Yuxiang Mao1,2, Min Cao1, Kuipeng Xu1, Fanna Kong1, Peipei Sun1 & Guiqi Bi1

1Key Laboratory of Marine Genetics and Breeding (Ministry of Education), Ocean University of China, Qingdao 266003, China
2Qingdao National Laboratory for Marine Science and Technology, Qingdao 266200, China

Laver is the economically important marine crop and model organism of the intertidal zone for studying mechanisms of stress tolerance. During the process of laver genome studies, four major technical challenges have to be faced, including bacteria contamination, high GC content of nuclear DNA, high proportion of organelle DNA, and DNA contamination by polysaccharide. To solve these problems, we explored and established an integrated technical protocol for constructing the unbiased and/or long-insert sequencing libraries. Then the genome of a laver species, Pyropia haitanensis, was sequenced and assembled. With the hybrid assemble method, 4,379 contigs with total of 77.8 Mb were generated. The N50 of assembled contigs was 28.8 Kb and the average GC content of the contigs was as high as 68.6%. 9,475 protein-coding genes were predicted, of which 5,516 genes were functionally annotated, with percentage of 58.2%. On average, there existed 1.5 exons in each gene. Repeats elements analysis revealed ~8.0 Mb interspersed repeats and ~3.8 Mb SSRs (51628) accounting for 10.3% and 4.9% of the assembled genome, respectively. This genome dataset may serve as a valuable resource to study the mechanisms involved in abiotic stress tolerance in intertidal seaweeds and for laver breeding as well.
S5 Deciphering the carotenoid biosynthetic pathway in premitive red algae
Li-En Yang1,2, Xing-Qi Huang1, Tian-Jun Cao1, Yin-Yin Deng1,2 & Shan Lu1
1State Key Laboratory of Pharmaceutical Biotechnology, School of Life Sciences, Nanjing University, Nanjing 210023, China
2Jiangsu Institute of Oceanology and Marine Fisheries, Nantong 226007, China

Although most of land plants accumulate carotenoid with both β- and ε-ionone rings, such as β-carotene (β,β-carotene) and lutein (β,ε-carotene), red algae do not share a common carotenoid profile. For example, the simplest unicellular red alga Cyanidioschyzon merolae synthesize only β-carotene and its derivative zeaxanthin, suggesting an absence of the activity for the ε-ring. Among those genes for carotenoid metabolism, only a few members, such as lycopene β-cyclase (LCYB) gene from C. merolae was previously reported in the entire red algae phylum (Rhodophyta). It is almost unknown how carotenoid metabolism is operated in multicellular red algae that also have lutein as their major carotenoid components. Benefited from the Porphyra umbilicalis genome sequence project sponsored by JGI (US DOE), we cloned the genes for geranylgeranyl diphosphate synthase (PuGGPPS), PuLCYB and carotene β-hydroxylase (PuCHYB), and functionally characterized their catalytic activities. Although these enzymes are all encoded by multiple copies of genes in higher plants, we only found a single gene for each of them in P. umbilicalis. Our phylogenetic analysis suggested that the occurrences of both PuGGPPS and PuLCYB were before the divergence of the heterokonts and the green lineage organisms, whereas that of PuCHYB1 was probably after that.

S6 Transgenic fish research in Canada: Phenotypic evaluation and risk assessment of genetically engineered finfish
Jin-Hyoung Kim1,4, Daniel J. Macqueen2, James R Winton3 & Robert H. Devlin4,*
1Unit of Polar Genomics, Korea Polar Research Institute, Republic of Korea
2Institute of Biological and Environmental Sciences, University of Aberdeen, United Kingdom
3Fish Health Section, Western Fisheries Research Center, USA
4Centre for Aquaculture and Environmental Research, Fisheries and Oceans Canada, Canada

Since the U.S. Food and Drug Administration approved the salmon genetically engineered as food in 2015, the issue of genetically modified organism (GMO) has been highlighting globally concerning food safety and environmental consequences. Recently, the Canadian government followed suit and, after carrying out a review, determined in May 2016 that the salmon does not raise concerns related to food safety. Since the early of 90s, Fisheries and Oceans Canada have accumulated successfully many scientific knowledge regarding the growth-enhanced transgenic salmon by performing various experiments. It has been confirmed that the growth-enhanced transgenic salmon has a significantly enhanced metabolism and altered life history and thus provide an excellent model for understanding biological rhythms at the molecular level. Significant opportunities exist to alter the phenotype of fish for aquaculture, industry, medicine, environmental sciences, and the pet trade. Although food safety is still main concerns to public, the issue is largely manageable. However, major challenges remain for assessment of ecological effects of transgenic fish, particularly when information is restricted to laboratory studies for species originating from large complex ecosystems. So far, reproductive containment methods (sterility) are currently highly but not completely effective. New transgenic methods on the horizon may provide effectively complete containment.
S7 Nanobody based diagnostics for the rapid screening of infectious diseases

Stefan Magez1,2

1Laboratory for Cellular and Molecular Immunology, Vrije Universiteit Brussel, Belgium
2Biomedical Research Centre, Ghent University Global Campus, Songdo-Incheon, Republic of Korea

Nanobodies are small recombinant antibody fragments that are produced using the coding sequence of the minimal binding domain of a camelid single-chain antibody. The size of a nanobody is about 10 times smaller than a conventional antibody, which allows it to be used in various novel antibody-based technologies. One problem often encountered in the design of immunodiagnostic tools for infectious agents is the fact that the infecting organism itself is inducing host antibodies. Hence, detection of pathogen released or secreted molecules can subsequently only be done if diagnostic antibodies can somehow be raised that are ‘better’ than the host antibodies, and that can outcompete the latter when immune complexes are formed. This result is very hard to obtain with conventional antibodies as they are targeting their epitopes in a similar manner as would infection-induced host antibodies do. Using nanobodies allows circumventing this issue. Indeed, as single-chain antibodies are forced to interact with their epitopes in a different way as compared to conventional VH-VL antibodies, this characteristic can be used to circumvent competition. Besides infectious diseases, a number of other malignant conditions are being targeted at our laboratory by the use of nanobodies, including tumor targeting and anti-toxin treatment.

S8 Vaccination failure in infectious diseases – trypanosome infection model

Magdalena Radwanska

Center for Biomedical Research, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea

Trypanosoma species infect broad range of animals as well as human. These protozoan parasites are transmitted by insect vectors and in case of aquatic hosts by leeches. Wild and domestic animals serve as a diseases reservoir. Beside drug development various attempts are focusing on the development of a vaccine. Using a mouse model we have investigated the impact of trypanosome infection by Trypanosoma brucei brucei on various B cell populations and memory responses. The results show that trypanosomes (i) cause the loss of various B cell populations, (ii) disable the hosts’ capacity to raise a long-lasting specific protective anti-parasite antibody response, and (iii) abrogate vaccine-induced protective response to a non-related human pathogen such as Bordetella pertussis. Various B cells stained positive for Annexin V and had increased caspase-3 enzyme activity. Elevated caspase-3 mRNA levels coincided with decreased mRNA levels of the anti-apoptotic Bcl-2 protein and BAFF receptor (BAFF-R), indicating the onset of apoptosis. Moreover, affected B cells became unresponsive to stimulation by BCR cross-linking with anti-IgM Fab fragments. B cell maturation was abrogated by infection-induced apoptosis of transitional B cells of both the T1 and T2 populations which was not uniquely dependent on TNF-, Fas-, or prostaglandin-dependent death pathways. Results obtained from ex vivo co-cultures of living bloodstream form trypanosomes and splenocytes demonstrate that trypanosome surface coat-dependent contact with T1/2 B cells triggers their deletion. We conclude that infection-induced and possibly parasite-contact dependent depletion of transitional B cells prevents replenishment of mature B cell compartments during infection thus contributing to a loss of the host's capacity to sustain antibody responses against recurring parasites. These results call for detailed studies of the effect of trypanosomes on B cell memory recall responses in humans and animals, prior to the planning of any mass vaccination campaign in endemic areas.
S9 Enhanced isolation and release of circulating tumor cells using nanoparticle binding and ligand exchange in a microfluidic chip

Myoung-Hwan Park

Department of Chemistry at Sahmyook University Hwarangro-815 Nowon-gu, Seoul, 1st Science Building room #203, Republic of Korea

The detection of rare circulating tumor cells (CTCs) in the blood of cancer patients has the potential to be a powerful and noninvasive method for examining metastasis, evaluating prognosis, assessing tumor sensitivity to drugs, and monitoring therapeutic outcomes. In this study, we have developed an efficient strategy to isolate CTCs from the blood of breast cancer patients using a microfluidic immune-affinity approach. Additionally, to gain further access to these rare cells for downstream characterization, our strategy allows for easy detachment of the captured CTCs from the substrate without compromising cell viability, enabling further molecular analysis and ex vivo cell culture. To achieve this, a chemical ligand-exchange reaction was engineered to release cells attached to a gold nanoparticle coating bound to the surface of a herringbone microfluidic chip (NP-HBCTC-Chip). As compared to the use of the unmodified HBCTC-Chip, our approach provides several advantages, including enhanced capture efficiency and recovery of isolated CTCs.

S10 Fabrication of biocompatible protein films

Eunhee Jeoung

Department of Chemistry, Gangneung-Wonju National University, Gangneung, Gangwon-do 210-702, Republic of Korea

Thin films comprised of proteins have been used for a variety of applications such as lithographic resists, food packaging, drug delivery, and tissue engineering. Proteins are attractive precursors to manufacture augmented surfaces due to their aqueous process ability and minimal environmental impact. Protein films provide an inherently biocompatible and sustainable platform for the generation of functional materials. Maintaining film stability under aqueous conditions is crucial for successful implementation in biological applications. However, current protein based films are limited to using specific structural proteins or require the addition of harmful additives such as crosslinking agents. We describe a generalized nanoimprint lithography (NIL) based method for the fabrication of stable, patterned protein films. The NIL process involves the physical deformation of a thin film deposited on a substrate using a rigid mold precisely controlling the temperature and pressure applied. Parametric variation of processing conditions revealed that films have tunable biodegradability, are stable to cell culture conditions, and promote selective cellular adhesion. Furthermore, by imprinting with patterned molds, the films directed cell growth along nanoscale features. This generalized method is amenable to a wide variety of proteins and expands the toolkit to create patterned, functional materials from the previously underused library of available proteins.
S11 Circulating biomarkers for toxicity evaluation, diagnosis and therapy

Eunjoo Kim

Division of Nano & Energy Convergence Research, Daegu Gyeongbuk Institute of Science and Technology (DGIST), Daegu, Republic of Korea

For disease diagnosis and monitoring, circulating molecules in body fluids are promising biomarkers to evaluate personal status. They can reflect the expression level of the genes and proteins in tissues, which are changed in various pathological conditions. The molecules adopted as circulating biomarker are including proteins, miRNAs, mRNAs, and exosomal contents released from tissues. In this presentation, the deregulation of circulating miRNAs in aged animals and their application to reverse-aging are reported. Delivery of specific miRNAs to target tissues was performed using the circulatory system, to modulate cellular pathways related to aging process in tissues. Tissue-specific in vivo transfection of miRNAs enabled the modulation of aging biomarkers in liver. The results indicated that the genes such as Mre11a, p16INK4a, and Mtor exhibited a reversed expression in the liver. In addition, isolated exosomes from whole blood was also transfected to the tissues in aged mice, to induce reverse-expression of aging-related molecules. As for another type of circulating biomarkers, exosomes are important to convey signals to other cells and serve as a reservoir of enriched biomarkers. In this presentation, the biocompatibility of nanomaterials in human cells is evaluated by the analysis of exosomal contents. In order to comprehensively evaluate the toxicity of nanomaterials, we analyzed the exosomes secreted from human cells, which were released during cellular stress. The results showed that there was obvious intensification of miRNA expression signals in the exosomes compared with that of the parent cells, which suggested that exosomal biomarkers could be detected more sensitively than those of whole cellular extracts.

S12 Occupational and environmental Issues in the Future; focus on rare earths

Kyung-Taek Rim

Chemicals Toxicity Research Bureau, Occupational Safety and Health Research Institute, Korea Occupational Safety and Health Agency (OSHRI, KOSHA) #339-30 Expo-ro, Yuseong-gu, Daejeon 34122, Republic of Korea
For correspondence: rim3249@gmail.com

REEs are a group of metals comprised of yttrium, scandium and fourteen lanthanide elements, which have been called ‘industrial vitamins’ and a ‘treasury’ of novel materials due to their dominant role in technical progress and in the development of traditional industries. Rare earth elements (REEs) are gaining ubiquitous importance in modern technology and have been touted as the “sauce of high-tech industries.” They help technologies perform better and have their own unique characteristics. Many high-technology industries depend heavily on these unique elements for the manufacture of permanent magnets and batteries, which are vital to efficient military and green technologies, such as wind turbines and hybrid engines, as well as in smartphones and laptops. Despite the growing interest, information that has become available over the last two decades regarding RREs is relatively premature and scarce, and there are many environmental and health issues associated the production, processing, and utilization of REEs. This report offers the impacts of REE exposure to cells, animals, and plants, in order to explain disease and occupational poisoning of local residents, water pollution, and farmland destruction as well as evaluation of the occupational health hazards of REEs, recent trends in occupational toxicology and efforts to promote occupational health, along with prospects of industrial toxicology in REE-exposed workers. Conversely, a body of evidence has shown REE-associated antioxidant effects in the treatment of many diseases. It is important to review the toxicological studies to improve the current understanding of REE compounds in the field of occupational health. It will also help to establish a sustainable, safe, and healthy working environment for REE industries.
Y1 Transcriptomic analysis in an antidepressant exposed Hydra

Ade Yamindago
University of Science and Technology, Republic of Korea

Fluoxetine hydrochloride is one of the most-prescribed medications to treat depressive disorders. Although relative concentration is relatively low, continuous discharge of the drug may impact to aquatic environment. Transcriptomics analysis was used to investigate possible effect of fluoxetine hydrochloride in Hydra magnipapillata at relevant environmental concentration. The differentially expressed genes showed strong correlation of the dose given to exposure time. Based on the change in gene expressions, Gene Ontology of functional analysis annotated terms polysaccharide metabolic process, chitin metabolic process and aminoglycan metabolic process and extracellular region as well as nitrogen metabolism pathway. The results indicated potential adverse effects in regeneration, development and microbial community composition.

Y2 Comparing the acute sensitivity of growth and photosynthetic endpoints in three Lemna species exposed to four herbicides

Jihae Park1,2,3, Murray T Brown4, Stephen Depuydt3, Jang K. Kim5, Dam-Soo Won6 & Taejun Han5

1Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
2Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
3Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
4School of Marine Science & Engineering, Plymouth University, Plymouth, Devon, United Kingdom
5Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
6Water Supply Operations & Maintenance Department, Korea Water Resources Corporation, Daejeon, Republic of Korea

An ecological impact of four herbicides (atrazine, diuron, paraquat and simazine) was assessed using the aquatic floating vascular plants, Lemna gibba, L. minor and L. paucicostata as test organisms. The sensitivity of relevant parameters (increase in frond area, root length, maximum and effective quantum yield of PSII and ETRmax) were compared after 72h exposure to herbicides. The present test methods require relatively small volume, shorter exposure times, simple and quick procedures as compared with standard Lemna assays. Sensitivity ranking of endpoints, based on EC50, differed depending on herbicides. The most toxic herbicides were diuron and paraquat and the most sensitive endpoints were root length and ETRmax for paraquat and effective quantum yield for diuron. Growth and chlorophyll a fluorescence in three Lemna species were sensitive enough to detect toxic levels of diuron and parquat in water samples in excess of allowable concentrations set by international standards. CV of all EC50s were in the range of 2.8-24.33%, indicating a high level of repeatability for adoption of toxicity test methods as international standards. Our new Lemna methods may provide useful information for the assessment of toxicity risk of residual herbicides in aquatic ecosystems.
Y3 Expression of recombinant epitope of Stx2eA as toxoid vaccine against porcine edema disease

Ga-Young Park, Se Hee Lee, Gna Ahn, Eunji Lee, Yang-Hoon Kim & Ji-Young Ahn*

1Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea
Fax: +82-(43)-263-2301 E-mail address: jyahn@chungbuk.ac.kr

Recently, outbreak of porcine edema disease is on the increase. Edema disease (ED) is caused by Shiga toxin-producing E. coli (STEC). Among several serotype of Shiga toxin (Stx), Stx2e is known as causing ED in pigs. Stx2e is consist of A-subunit monomer and B-subunit pentamer. The A-subunit has N-glycosidase activity that cleavage adenine base of 28S rRNA, The B-subunit pentamer bind to the glycolipid receptor on the cell. The A-subunit internalize into cell, and consequently protein synthesis of host cell is inhibited. In this study, Epitope of Stx2eA was predicted using epitope prediction program, hydrophilicity analysis, secondary structure prediction program. Full Stx2eA, predicted epitope of stx2eA were expressed in E. coli system. Toxicity of recombinant stx2eA protein was tested by cytotoxicity test. As a results, recombinant stx2A protein hadn’t toxicity. Neutralizing of anti-stx2eA epitope was tested by neutralizing test. Recombinant stx2eA protein can utilize as a toxoid vaccine of porcine edema disease.

Keywords: Shiga toxin type2e, Stx2e, toxoid vaccine, porcine edema disease

Y4 Biostimulatory effect of algal extracts on radish

Lyu Jie1,2*, Lalit Kumar Pandey2,3, Jihae Park1,2,4, Soyeon Choi1,2*, Hojun Lee2,3 & Taejun Han3

1Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
2Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
3Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
4Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea

A study on the potential of nineteen marine algal seaweed species as biostimulant was conducted using radish seeds. Different concentrations (0%, 0.01%, 0.025%, 0.05%, 0.1%, 0.2%) of seaweed extracts were added and plant growth was observed over a period of 12 days. Effect of algal extracts on radish was found to depend on both the species of seaweed and their concentration. Among nineteen species of algal extracts, only three species with lower concentration showed biostimulatory effects on growth and development of radish. Concentrations of algal extracts with a biostimulatory effect ranged from 0.01% to 0.1%. This article provides a comprehensive data of the effect of algal extracts on radish growth and development with an emphasis on the use of these environmentally friendly biosources in sustainable agricultural systems.
P1 Cd exposure to human induced pluripotent stem cell-derived alveolar epithelial progenitor type II cells

Hye-Ryeon Heo1,2, Jeeyoung Kim2, Woo Jin Kim1,2, Yoonki Hong1,2, Seon-Sook Han1, Seung-Joon Lee2 & Seok-Ho Hong1,2

1Department of Internal Medicine, School of Medicine, Kangwon National University, Chunchon 24341, Republic of Korea
2Environmental Health Center, Kangwon National University Hospital, Chunchon 24341, Republic of Korea

Pluripotent stem cells (PSCs) have a great attention for the treatment of various diseases as well as drug and toxicity screening for evaluating harmful chemicals such as heavy metals and particulate matter. A variety of studies have been undertaken to clarify the effects of cadmium (Cd) as a component of cigarette and microdust on pathological mechanisms and prevention of various pulmonary diseases. We previously found that Cd induces inflammatory response, ER stress, and apoptosis in human bronchial epithelial cell line by modulating a set of genes. Thus, in this study, we asked if Cd induces similar set of genes and inflammatory responses in alveolar epithelial progenitor type II (AETII) cells derived from human PSCs using optimized stepwise protocols. We generated AETII cells derived from hiPSCs based on sequential induction protocol and characterized their phenotypes and functional markers. AETII cells were treated with varying concentrations of Cd (1, 5, and 10 μM) for 24 hrs and we evaluated the morphological changes and inflammatory responses in AETII cells compared with BEAS-2B cells. This study showed that AETII cells exposed to Cd exhibits lower release of inflammatory cytokines compared with BEAS-2B cells, suggesting that AETII cells may have some effective protective mechanisms (anti-oxidative stress and anti-apoptotic) against toxic materials such as heavy metals. This work provides a good example of how hiPSC-derived AETII cells can be used for toxicity screening. Further study will be needed to optimize and standardize the toxicity screening platform using hiPSC-derived AETII cells. This platform will provide more efficient and precise tool to evaluate biologically harmful effects of various toxic materials included in microdust and smoke.

Acknowledgement: This research was supported by Global Ph.D Fellowship Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education (2016H1A2A1909769).

P2 Suppression of TLRs signaling pathways by 1-[5-methoxy-2-(2-nitrovinyl)phenyl]pyrrolidine

Hyeon-Myeong Shin, Ah-Yeon Kim, Hyun-Jin Shim & Hyung-Sun Youn

Department of Biomedical Laboratory Science, College of Medical Sciences, SoonChunHyang University, Chungnam, Asan 31538, Republic of Korea

Toll-like receptors (TLRs) play significant roles in recognizing the pathogen-associated molecular patterns that induce innate immunity, and subsequently, acquired immunity. In general, TLRs have two downstream signaling pathways, the myeloid differential factor 88 (MyD88)-dependent and toll-interleukin-1 receptor domain-containing adapter-inducing interferon-β (TRIF)-dependent pathways, which lead to the activation of nuclear factor-kappa B (NF-κB) and interferon regulatory factor 3 (IRF3). 1-[5-methoxy-2-(2-nitrovinyl)phenyl]pyrrolidine (MNP) has been previously synthesized in our laboratory. To evaluate the therapeutic potential of MNP, its effect on signal transduction via the TLR signaling pathways was examined. MNP was shown to inhibit the activation of NF-κB and IRF3 induced by TLR agonists, as well as to inhibit the expression of cyclooxygenase-2, inducible nitric oxide synthase, and interferon inducible protein-10. MNP also inhibited the activation of NF-κB and IRF3 induced by the overexpression of downstream signaling components of the MyD88- or TRIF-dependent signaling pathways. These results suggest that MNP can modulate MyD88- and TRIF-dependent signaling pathways of TLRs, leading to decreased inflammatory gene expression.

Acknowledgement: This work was carried out with the support of “Cooperative Research Program for Agriculture Science & Technology Development (Project Title: A study on anti-allergic mechanism of Aster yomena by clinical research, Project No: PJ0108262015)” Rural Development Administration, Republic of Korea.
Eupatorium makinoi suppresses Toll-like receptor signaling pathways

Hyeon-Myeong Shin, Ah-Yeon Kim, Hyun-Jin Shim & Hyung-Sun Youn

Department of Biomedical Laboratory Science, College of Medical Sciences, SoonChunHyang University, Chungnam, Asan 31538, Republic of Korea

Toll-like receptors (TLRs) recognize microbial molecules that are widely presented by pathogens and initiate innate immune system. TLR signaling is divided into two different signaling pathways, the myeloid differential factor 88 (MyD88)- and Toll-interleukin-1 receptor domain-containing adapter inducing interferon-β (TRIF)-dependent pathways. *Eupatorium makinoi*, a plant species in Asteraceae, is used for medicinal purposes in China, Korea, and Japan. Through our previous research, we found that an ethanol extract of *E. makinoi* (EEM) suppresses inducible nitric oxide synthase (iNOS) and cyclooxygenase-2 (COX-2) expression. In this study, we investigated the effect of EEM on TLRs signaling pathways. EEM suppresses NF-κB activation and iNOS and COX-2 expressions induced by TLR2 or TLR4 agonists. Also, EEM suppresses the activation of IRF3 induced by TLR3 or TLR4 agonists. All results indicate that EEM suppresses MyD88- and TRIF-dependent signaling pathways of TLRs and the expressions of target genes derived from the activation of TLRs.

Acknowledgement: This work was carried out with the support of “Cooperative Research Program for Agriculture Science & Technology Development (Project Title: A study on anti-allergic mechanism of *Aster yomena* by clinical research, Project No: PJ0108262015)” Rural Development Administration, Republic of Korea.

Aster yomena suppresses LPS-induced cyclooxygenase-2 and inducible nitric oxide synthase expression

Hyeon-Myeong Shin, Ah-Yeon Kim, Hyun-Jin Shim & Hyung-Sun Youn

Department of Biomedical Laboratory Science, College of Medical Sciences, SoonChunHyang University, Chungnam, Asan 31538, Republic of Korea

Inflammation is a pathological process that is known to be involved in numerous diseases. Microbial infection or tissue injury activates inflammatory responses, resulting in the induction of proinflammatory proteins including cyclooxygenase-2 (COX-2) and inducible nitric oxide synthase (iNOS). *Aster yomena* is used in traditional Korean remedies to treat cough, asthma, and insect bites. Here, we investigated the effects of *A. yomena* extract (EAY) on the expression of COX-2 and iNOS induced by LPS. EAY inhibited LPS-induced NF-κB activation and COX-2 and iNOS expression. These results suggest that EAY has the potential to be developed as a potent anti-inflammatory drug.

Acknowledgement: This work was carried out with the SoonChunHyang University Research Fund and with the support of “Cooperative Research Program for Agriculture Science & Technology Development (Project Title: A study on anti-allergic mechanism of *Aster yomena* by clinical research, Project No: PJ0108262015)” Rural Development Administration, Republic of Korea.
**P5** Somatotype analysis of sports athletes according to weight division for health science research

Min-Suk Kim¹, Ji-Woong Noh¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim¹, Lim-Kyu Lee², Byong-Sun Park¹, Seung-Min Yang¹, Won-Deok Lee¹, Yong-Sub Shin¹, So-Jung Kim² & Junghwan Kim¹

¹Department of Physical Therapy, College of Public Health & Welfare, Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

Somatotypes were compared between combat sport athletes based on body weight to determine physical characteristics and to establish a reference for studies of training and rehabilitation. This study consisted of judo, ssireum, taekwondo, boxing, and wrestling elite athletes. The participants were divided into four weight categories: light weight, middle weight, heavy weight, and super heavy weight. Ssireum athletes had higher endomorphic and mesomorphic characteristics values and lower ectomorphic characteristics compared to other athletes. Somatotype component values for judo and wrestling athletes were similar. Boxing athletes had the same endomorphic and ectomorphic values and higher mesomorphic characteristic values. Correlations between endomorphic characteristics and body weight were significant among all athletes except for gyorugi athletes. Correlations between mesomorphic characteristics and body weight were significant among judo, ssireum, boxing, and wrestling athletes, but taekwondo athletes did not show any correlation. The correlation between ectomorphic characteristics and body weight were significantly negative among judo, ssireum, gyorugi, boxing, and wrestling athletes and negative among poomsae athletes. Therefore, injured or ahead-of-the-game elite combat athletes require different methods of rehabilitation and training based on sport type and body weight.

**P6** Differences in body pressure-related sensory changes between the floor and mattress in the static prone position for environmental health science research

Jeong-Uk Lee¹, Won-Deok Lee², Ju-Hyun Kim³, Mee-Young Kim², Lim-Kyu Lee², Byong-Sun Park², Seung-Min Yang², Ji-Woong Noh², Yong-Sub Shin², So-Jung Kim² & Junghwan Kim²

¹Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea
²Department of Physical Therapy, College of Public Health & Welfare, Yongin University, Yongin 17092, Republic of Korea
³Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea

There are limited comparative studies examining physiotherapy performed in various environments and positions. Thus, we conducted a physiotherapy study, investigating the difference in body pressure-related sensory changes between the floor and mattress while in the static, prone position. We used the Body Pressure Measurement System (Tech storm, Korea) to analyze changes in body pressure. In this measurement system, sensors are attached to existing mattresses and floor surfaces beneath the subjects. The level of pain was evaluated using pain score tools (VAS, FPRS, IPT). We measured five time points (before body placement and 1, 5, 10, and 15 minutes after body placement) and five body points (head, both shoulders [BoS], both arms [BoA], abdomen, both legs [BoL]) while placed in the static, prone position. There were no significant differences found in body pressure between floor and mattress placement. However, the pain score values for the arm and abdomen were significantly higher in the floor group compared to the mattress group. In addition, pain score values increased with time for the mattress and floor groups. These results suggest that the properties of time, posture, and environment need to be carefully considered when applying physical rehabilitation.
**P7 Dermatologic characteristics of healthy men according to the parts of the body**

So-Jung Kim¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim¹, Lim-Kyu Lee², Byong-Sun Park³, Seung-Min Yang¹, Won-Deok Lee¹, Ji-Woong Noh¹, Yong-Sub Shin² & Junghwan Kim¹

¹Department of Physical Therapy, College of Public Health & Welfare
Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang
Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam
University, Gwangju 62399, Republic of Korea

Studies have demonstrated that some cutaneous biophysical properties vary with the part of the body. The results to date of skin conditions in human skin of multiple parts of the body have not yet been well established. In this study, we assessed the differences in the skin’s sebum, moisture, pores, wrinkles, pigmentation, and elasticity of each body part in Korean men in their 20s. A total of healthy 32 men were enrolled. A Skin Diagnosis Meter was used to measure the skin’s surface sebum, moisture, pores, wrinkles, pigmentation, and elasticity of each body part. The sebum content was significantly higher on the face than at other sites. Moisture was significantly higher on the feet. Pores were significantly high on the face. Wrinkles were significantly high on the face. Pigmentation was high on the face and neck, but not significantly. Elasticity was significantly high on the hands.

**P8 Dermatologic characteristics of healthy women according to the parts of the body: A randomized controlled pilot trial**

So-Jung Kim¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim¹, Lim-Kyu Lee¹, Byong-Sun Park³, Seung-Min Yang¹, Won-Deok Lee¹, Ji-Woong Noh¹, Yong-Sub Shin² & Junghwan Kim¹

¹Department of Physical Therapy, College of Public Health & Welfare
Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang
Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam
University, Gwangju 62399, Republic of Korea

The skin is the largest organ of the body, whose main function is to protect the body against the loss of physiologically important components as well as harmful environmental insults. The results to date of skin conditions in human skin of multiple parts of the body have not yet been well established. In this study, we assessed the differences in the skin’s sebum, moisture, pores, wrinkles, pigmentation, and elasticity of each body part in Korean women in their 20s. A total of healthy 30 women were enrolled. The sebum content was significantly higher on the face than at other sites. Moisture was significantly high on the face and feet, but not significantly. Pores were significantly high on the face. Wrinkles were significantly high on the foot. Pigmentation was high on the face and neck, but not significantly. Elasticity was significantly high on the face, ear hands, but not significantly. In the correlation analysis results, moisture and pigmentation were positive correlated, but sebum and moisture, moisture and elasticity and wrinkle and elasticity were negatively correlated. The results show that skin’s surface sebum, moisture, pores, wrinkles, pigmentation, and elasticity vary with the part of the body and the correlation.
**P9** Analysis of walking and muscle activity in chronic stroke patients for health science research

Ju-Hyun Kim¹, Byong-Sun Park², Jeong-Uk Lee³, Mee-Young Kim⁴, Lim-Kyu Lee⁵, Seung-Min Yang⁶, Won-Deok Lee⁶, Ji-Woong Noh⁶, Yong-Sub Shin⁶, So-Jung Kim⁷ & Junghwan Kim⁷

¹Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
²Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

This study aimed to predict the effect of trunk exercises on trunk muscle activity and gait parameter in chronic stroke patients. The participants of this study included six hemiplegic patients (three males and three females). The inclusion criteria to select of subjects were as follows: (1) have a history of only one cerebrovascular accident, (2) independent in gait (with or without assistive device), (3) stable cardiovascular status, (4) no significant musculoskeletal problems, and (5) MMSE score > 24 point. The trunk exercises consisted of six subparts: bridge exercise, curl-up with arm crossed, curl-up with straight reaching, curl-up with diagonal reaching, abdominal hollowing, and quadruped exercise. The outcomes were surface electromyography and spatiotemporal gait parameters. No statistically difference was found between pre-training and post-training of maximal voluntary isometric contraction (MVIC)% in RA and EO, but it tended to increase. No statistically difference was found between pre-training and post-training in MVIC% of TrA/IO and RVC% of ES. The gait parameter significantly increased in walking speed, walking cycle, affected stride length. We expect the trunk exercises to improve walking ability in stroke patients. However, this study requires further research to obtain clear effects of the trunk exercises on stroke walking.

**P10** Contamination analysis of water quality at water treatment plants classified by type

Lim-Kyu Lee¹, Ju-Hyun Kim², Jeong-Uk Lee³, Mee-Young Kim⁴, Byong-Sun Park⁵, Seung-Min Yang⁶, Won-Deok Lee⁶, Ji-Woong Noh⁶, Yong-Sub Shin⁶, So-Jung Kim⁷ & Junghwan Kim⁷

¹Department of Physical Therapy, College of Public Health & Welfare Yongin University, Yongin 17092, Republic of Korea
²Department of Physical Therapy, College of Health Welfare, Wonkwang Health Science University, Iksan 54538, Republic of Korea
³Department of Physical Therapy, College of Health Science, Honam University, Gwangju 62399, Republic of Korea

Water is a vital requirement for all living organisms, including humans. Many water treatment plants are set up to clean contaminated water. The purpose of this study is to evaluate the influent and effluent water quality at various treatment plants and to compare the values of water quality variables by plant type. Sampling was conducted at 29 water treatment plants in Korea for 1 year. Biochemical oxygen demand (BOD), chemical oxygen demand, and concentrations of suspended solids, total nitrogen, and total phosphorus were analyzed using the standard methods of environment analysis. The values of most variables were higher in the influent than in the effluent samples. Compared with other plant types, livestock excretion plants showed higher values of variables in the influent. In correlation analysis, BOD and other variables showed a positive correlation. Therefore, this study suggests that improvement measures are required to better the water quality of effluent from water treatment plants.

**P11** Differentially expressed genes in polyp of moon jelly *Aurelia aurita* under acidified seawater condition

Nayoung Lee, Nayun Lee, Ye Jin Jo & Seungshic Yum

South Sea Environment Research Division, Korea Institute of Ocean Science and Technology (KIOST), Geoje, Republic of Korea

The transcriptional impact of ocean acidification in polyp of *Aurelia aurita* was evaluated using an oligo-microarray which contains oligonucleotide probes of 29,524 unigenes of *A. aurita*. The polyps were incubated at pH 7.5 condition for 6, 24, and 48 h to predict the biological responses to the acidified condition at transcription level. As the results, we identified 33 differentially expressed genes (DEGs) in 6 h exposed group, 36 DEGs in 24 h exposed group, and 96 DEGs in 48 h exposed group. The metabolic and physiological changes will be predicted and discussed after considering the functional aspects of these DEGs.
**P12 Rapid kit development for harmful algal detection**

Nayun Lee, Seonock Woo & Seungshic Yum

South Sea Environment Research Division, Korea Institute of Ocean Science and Technology (KIOST), Geoje, Republic of Korea

Invention of more quick, accurate, and efficient method which could have predictive and prognostic function is necessary to overcome the difficulties of conventional method for microorganisms monitoring. We have challenged to develop the immunochromatography based rapid kit for microalgae detection. As a result a rapid kit using monoclonal antibodies (mAbs) raised against RuBisCo (Ribulose-1,5-bisphosphate carboxylase/oxygenase) large subunit of Alexandrium tamarense, a candidate of harmful algal bloom species in the coast of Korea. The western blot analysis showed that the mAb detect five dinoflagellates, A. tamarense, H. circularisquama, H. pygmaea, A. sanguinea and C. polykrikoides. But do not detect H. triqueta, s. costatum, C. closterium. The mAb showed no signal in one dinoflagellate and two diatom species, Cylindrotheca closterium, and Skeletonema costatum. The rapid kit showed a positive signal at about 1,000 cells of A. tamarense and H. triqueta, 50,000 cells of A. sanguinea and so on.

**P13 Effects of antifouling agents on molecular and biochemical defense system in the Pacific oyster**

Ye-Ji Rhee¹, Mi Seon Park², Young Dae Kim³, Jang K. Kim¹ & Jae-Sung Rhee¹,*

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong 46083, Republic of Korea

In this study, we analyzed a series of biochemically responsive systems of the Pacific oyster Crassostrea gigas to predict potential mode of action of antifouling agents (i.e., tributyltin (TBT), diuron, and irgarol) after exposure to different concentrations (0.01, 0.1, and 1 μg/L) for 96 h. As a result, the three antifouling biocides strongly induced antioxidant defense system. TBT reduced both enzymatic activity and mRNA expression of Na⁺/K⁺-ATPase and acetylcholinesterase (AChE). Diuron inhibited Na⁺/K⁺-ATPase activity and AChE mRNA expression, while irgarol treatment reduced only the transcriptional expression of AChE gene. We also analyzed transcript profile of heat shock protein (Hsp) superfamily in same experimental conditions. All antifouling biocides tested in this study significantly modulated mRNA expression of Hsp superfamily with strong induction of Hsp70 family and reduction of total hemocytes. Taken together, overall results indicate that representative organotin TBT and alternatives have potential hazardous effects on the gill of C. gigas within relatively short time period.

**P14 Comparative transcriptome analysis in tolerant and susceptible Pacific oysters exposed to thermal stress**

Do-Hee Lee¹, Hyun-Jeong Lim², Ik-Young Choi³ & Jae-Sung Rhee¹,*

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²West Sea Fisheries Research Institute, National Fisheries Research and Development Institute, Incheon 22383, Republic of Korea
³Department of Agriculture and Life Industry, Kangwon National University, Chuncheon 24341, Republic of Korea

To understand the potential effect of temperature change on the whole transcriptome of tolerant and susceptible Pacific oyster Crassostrea gigas, we compared whole mRNA profiles of the tolerant and susceptible oysters after exposure to 32°C for 72 h. RNA-seq and subsequent bioinformatics application revealed differentially expressed stress responsive Gene Ontology (GO) term and related transcripts following heat shock. As a result, clearest patterns were observed between tolerant and susceptible oysters with dramatic differences in transcriptional profiles of the whole heat shock protein (Hsp) gene family. GO term and transcripts typically involved in the oxygen binding activity were also repressed in the susceptible oysters compared to that of tolerant oysters. Thus, our results suggest insights into the significant differences in molecular response of tolerant and susceptible oyster to heat stress and the results will be helpful to understand a basis of molecular adaptation in C. gigas.

**P15 Molecular and biochemical responses in the microcystin-LR-exposed embryo and larvae of the mangrove killifish**

Kwang-Sik Choi¹, Bo-Mi Kim² & Jae-Sung Rhee¹,*

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Unit of Polar Genomics, Korea Polar Research Institute, Incheon 21990, Republic of Korea

Microcystins (MCs) are cyclic polypeptide hepatotoxins, which can induce injury and cell death in liver tissues. In this study, we examined the acute effects of MC on embryos and larvae of the mangrove killifish. Different concentrations of MC exposures induced dose-dependent mortality in larvae, while no significant effect was observed embryos. Entire enzymatic activities of antioxidant defense system were significantly increased in larvae upon MC exposure, but only two oxidative stress-related enzymes, glutathione S-transferase (GST) and superoxide dismutase (SOD) were induced in embryo. Transcriptional profiles of whole antioxidant defense system showed similar expressions with those of enzymatic activities. In addition, mRNA expressions of whole heat shock protein (Hsp) family were significantly increased in a dose-dependent manner. Our results suggest that MC exposure induced cellular and oxidative stress in the fish, while chorion membrane can reduce the detrimental effects of MC by inhibiting its direct penetration.
**P16 Nonylphenol induces mortality and reduces hatching rate through increase of cell damage and dysfunction of antioxidant defense system in marine medaka embryo**

Sang-Eun Nam, Ye-Ji Rhee & Jae-Sung Rhee*

Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea

Nonylphenol (NP) is a hydrophobic xenobiotic compound classified as an endocrine disrupter and accumulates in environmental compartments due to its extensive use. In this study, toxic effect of NP was investigated in the marine medaka *Oryzias melastigma* embryos and novel insights into their toxicities are provided. NP treatment (200-1000 µg/L) during post fertilization led to inhibition of the hatching rate in a dose-dependent manner. Exposure to waterborne NP induced oxidative stress and dysfunction of antioxidant defense system, which ultimately led to induction of apoptotic cellular death. Of hatched larvae, the survival rate was decreased as the exposure concentrations increasing via persistent effects of NP on larval survival. Our study provides evidences of cellular stress induction and toxicity by NP treatment in the marine medaka embryos.

**P17 Effects of biocides and antifouling agents on cyst hatching success, acetylcholinesterase activity, and mortality in the brine shrimp Artemia salina**

Hye-Jin Eom, Hyeon-Jeong Choi, Inseon Baek & Jae-Sung Rhee*

Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea

Acetylcholinesterase (AChE, EC3.1.1.7) is an important serine esterase that catalyzes the hydrolysis of acetylcholine in the cholinergic system. Using the brine shrimp *Artemia salina*, we estimated the effects of four biocides (carbofuran, chlorpyrifos, dimethoate, and endosulfan) and three antifouling agents (tributyltin; TBT, Diuron, and Irgarol 1051) on nauplii mortality and AChE activity. Lethal concentration 50 (LC50) was calculated for 24, 48, and 72 h in order to select a relevant value for the suite of AChE assays. Selected doses within the LC50 value of most biocides and antifouling agents significantly inhibited AChE activity for 24 h. In addition, these concentrations reduced dose-dependently hatching rate of *A. salina* cysts. This result suggested that both cysts and nauplii have sensitivities to their toxicity. Also, AChE approach with *A. salina* nauplii revealed that these chemicals may have a toxic cholinergic effect by inhibiting AChE activity.

**P18 Terrigenous source of styrene oligomers (SOs) in aquatic system**

Gi-Yun Sung‡ & Seung-Kyu Kim1,2,*

1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2Research Institute of Basic Sciences, Incheon National University, Incheon 22012, Republic of Korea

It is estimated that plastics of 300 million tons were produced in 2013 globally and 10% of produced ones enter the ocean. Polystyrene (PS) is one of the largest produced plastics. By natural weathering, inert plastic can be broken down to smaller particles and further release some single molecules that makes up the backbone chain of inert plastic. The representative backbone-molecules of PS are styrene oligomers (SOs) including styrene-monomers, -dimers, and -trimers. Thus, these SOs might be a quantitative indicator to trace PS pollution. Furthermore, these SOs are known to be endocrine disrupting chemicals. Recent studies have showed ubiquitous distribution of SOs in coastal and open-ocean, and suggested the possibility of reaching from PS debris deposited on beach sediment. Considering the small portion of plastic debris entering the marine environment, however we infer that significant amounts of SOs originate from the terrestrial products/wastes rather than marine plastic debris. This study aimed to confirm the terrestrial source of SOs and to estimate riverine burden of SOs. For that, influents and effluents of four municipal wastewater treatment plants (m-WWTPs) and neighboring surface river waters were investigated. Total SOs concentrations were the highest in influents (266±64.2 ng/L), followed by effluents (10.7±4.74 ng/L) and river water (5.63±3.80 ng/L). Furthermore, change of composition pattern was remarkable from influent (e.g., contribution of SD-2 was 97% of total SOs) to effluent and river water (44%). This indicates the m-WWTPs as a potential source. Further study will be performed to calculate the mass balance in m-WWTP including sorption/deposition to sludge as a removal process.

Acknowledgement: This work was supported by the National Research Foundation of Korean Grant (no. 2015R1A2A04003958).
P19 Development of analytical methods for microplastics in bed-sediment: pilot study

Ji Woo Noh1 & Seung-Kyu Kim1,2,*

1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2Research Institute of Basic Sciences, Incheon National University, Incheon 22012, Republic of Korea

It is known that about 10% of plastic waste produced enter the ocean and 60-80% of plastic debris found in marine environment originate from the land. As a consequence of study results, a big gap was found between the amounts entering the ocean and found in the global oceanic water. Sinking of plastic debris to bed-sediment can be suggested as one of plausible explanation. Not only plastics having higher density than that of water can normally deposit to the sediment but also even lower-density plastics may move below the water column due to the change in its physical property caused by weathering. Recent studies have shown the presence of micro-sized plastic particles (microplastics < 5 mm) in freshwater and marine bed-sediment. Identifying and quantifying the transfer of plastic from water column to bed-sediment is of importance in the sustainability of benthic ecosystem as well as in solving the uncertainty in mass balance of plastic debris. However, data of sedimentary microplastics is still scarce in the relevant field as methodology to separate microplastics from natural particles in the sediment has not been well established. In this study, we tried to develop the analytical method to separate and measure microplastics in sediment in terms of identification and quantification. As a pilot study, we tested the recovery efficiency of fragmented plastic particles which were spiked to pretreated clean sediment. In a procedure developed, we applied ZnCl2 solution to float plastic particles with a wide range of densities (0.9 to 1.3 g/cm3) and gained good recoveries as for various plastics. Various microplastics were found with abundance of 0.22 particles/g ww in brackish sediment by newly developed method. This was compared with the result of that polyethylene alone was found when NaCl solution was used for density separation. This method is still in improvement for detection of microplastics with various shapes.

Acknowledgement: This work was supported by the National Research Foundation of Korean Grant (no. 2015R1A2A04003958).

P20 A pilot study to measure microplastics in wastewater treatment plant (WWTPs)

Nan-Seon Song1 & Seung-Kyu Kim1,2,*

1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2Research Institute of Basic Sciences, Incheon National University, Incheon 22012, Republic of Korea

Plastic pollution in the marine/ocean is a global concern because their micro-sized plastics (MPs) can be transferred into marine food-web through ingestion by organisms in various trophic levels and hazardous additives can be released into surrounding environment. So far, most of MP studies has focused on marine system and freshwater system has been rarely studies. Considering that most of plastic debris found in marine environment originate from the land and MP amount found in marine environment was too small than estimate for discharge from land to ocean, significant amounts of plastic debris is inferred to stay in the freshwater system. Particularly, wastewater treatment plant (WWTPs) in urban area can be a significant source and sinker because wastes produced from human activities are treated through drainage system. This study aimed to develop the analytical method for MPs in wastewaters and to screen distribution characteristics of MPs in WWTP system. In this pilot study, two WWTPs with different treatment process (A2O/MBR vs. MLE) were investigated. Various shapes and polymers were observed with average total abundance of ~0.2 particles/L in effluents. Major polymer was different for two WWTPs: polyurethane vs. polyethylene. We are going to measure MPs in influent to calculate mass balance of MPs.

Acknowledgement: This work was supported by the National Research Foundation of Korean Grant (no. 2015R1A2A04003958).

P21 Transcriptional responses and prediction of metabolic changes in marine medaka fish (Oryzias javanicus) to acute exposure to endocrine disrupting chemicals

Ye Jin Jo, Nayoung Lee, Nayun Lee & Seungshic Yum

South Sea Environment Research Division, Korea Institute of Ocean Science and Technology (KIOST), Geoje, Republic of Korea

The differentially expressed genes in the liver tissue of the marine medaka fish, Oryzias javanicus, were profiled using an oligo-microarray (EnviHaz-Fish Array) which contains oligonucleotide probes for 22,796 unigenes of O. javanicus. After the fish were exposed to five kinds of endocrine disrupting chemicals (EDCs), bisphenol A (BPA), 17β-estradiol (E2), nonylphenol (NP), perfluorooctanesulfonate (PFOS), and triclosan (TCS) for 12, 24, 48, or 72 h to predict the metabolic and physiological changes with exposure time. The transcriptomic changes were highly dynamic in the EDC-exposed fish groups by the exposure time. The differentially expressed genes were used to predict the changes that occurred in the metabolic pathways and processes in response to EDCs exposure.
P22 Detecting of MERS-coronavirus by using one-pot reverse transcription loop-mediated isothermal amplification (RT-LAMP)

Se Hee Lee¹, Ga-Young Park¹, Gna Ahn¹, Eunji Lee¹, Yang-Hoon Kim¹, Hong-Soo Choi², Yun Hee Baek³, Min Suk Song³ & Ji Young Ahn¹,*

¹Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea
²National Institute of Animal Science, RDA, Republic of Korea
³College of Medicine and Medical Research Institute, Chungbuk National University, Cheongju, Republic of Korea
Fax: +82-(43)-263-2301 E-mail address: jyahn@chungbuk.ac.kr

Middle East Respiratory Syndrome (MERS) is viral respiratory disease that has symptom febrility, cough, sputum, difficult breathing, renal insufficiency and acute pneumonia. Pathogen caused the disease is coronavirus, which have been named MERS-CoV. Because the virus has plus-single strand RNA fragment as genome, molecular biological methods such as reverse transcription (RT) PCR, real-time (q) RT-PCR have been used for detection of the virus. Loop-mediated isothermal amplification (LAMP) is recently spotlighted as tool of detection and diagnosis of pathogens because the method can amplify nucleic acid without change of temperature. The method doesn’t have to use expensive temperature-change equipment and professional manpower. Then, we have studied detecting assay of MERS-CoV by conjugating LAMP methods combined reverse transcription. At first, primer set was selected and RT-LAMP conditions such as reaction time and enzyme concentration were optimized by comparison of amplification efficiency. Sensitivity of RT-LAMP was compared with conventional PCR and Real-time qRT-PCR. Also, to detect and diagnose in field, on-chip and various colorimetric agents were utilized for observation of result without additional identification process such as gel electrophoresis.

Acknowledgement: This work was carried out with the support of “Cooperative Research Program for Agriculture Science & Technology Development (Development of fast sensing platform for viroids in subtropical plants, PJ011642)” Rural Development Administration, Republic of Korea.

P23 Detection of plant-pathogenic viroid by using loop-mediated isothermal amplification based on reverse transcription and application in field

Se Hee Lee, Ga-Young Park, Gna Ahn, Eunji Lee, Yang-Hoon Kim, Hong-Soo Choi & Ji Young Ahn*

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea
Fax: +82-(43)-263-2301 E-mail address: jyahn@chungbuk.ac.kr

Viroid are short single strand RNA fragments have been associated with economically important plant diseases [1]. Also, it is difficult to diagnosis viroid diseases in serological methods because of the lack of protein expression capacity associated with replication. The detection methods of viroid are blotting by using specific probe and reverse transcription-based real-time PCR. But development of enhanced methods, which are applicable in field is now essential due to requirement of complex procedure, much expensive equipment and time consuming process of conventional methods. Thus, we studied simple detection of viroid on the basis of loop-mediated isothermal amplification (LAMP), which can be used detection of pathogen in field by amplifying nucleic acid without change of temperature [2]. At first, four specific primer sets of each viroid were designed, each one set was selected by comparison of efficiency. LAMP conditions such as temperature, reaction time, concentration of primer and enzymes were optimized by systematic experiments. It was performed to compare sensitivity of LAMP with conventional RT-PCR and real-time qRT-PCR. Also, various colorimetric agents (such as SYBR green I, Evagreen, HNB, Malachite green and so on.) based on observation by naked eye and UV-based fluorescence were used to identify of result for diagnosis of viroid in field.

Acknowledgement: This work was carried out with the support of “Cooperative Research Program for Agriculture Science & Technology Development (Development of fast sensing platform for viroids in subtropical plants, PJ011642)” Rural Development Administration, Republic of Korea.
P24 **Construction of whole-cell neutralizing system using CWP2 signaling for PED Virus**

**Eunji Lee, Ga-Young Park, Gna Ahn, Se Hee Lee, Yang-Hoon Kim & Ji-Young Ahn***

*Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea*

Fax: +82-(43)-263-2301  E-mail address: jyahn@chungbuk.ac.kr

Porcine epidemic diarrhea virus (PEDV) is a coronavirus that affects pigs, causing porcine epidemic diarrhea. Here we describe the whole-cell neutralizing system for PEDV based on the arming technology in yeast. The neutralizing epitopes of 2014-Korean strain of PEDV are genetically immobilized on the whole-cell surface by anchoring with the yeast cell-wall surface domain (CWP2). The expression vector pYES2 includes a PEDV DNA sequences constructed from the signal sequence of CWP2, HA tag, the systemically designed PEDV spike genes, and a DNA fragment encoding the CWP2. To test for the proper expression and functional anchoring to the yeast surface, the resulting constructs for a PEDV spike protein was transformed into a yeast host, *S. cerevisiae*. The whole-cell neutralizing epitopes were visualized by confocal microscope analysis using anti-HA antibody, indicating successful expression of the viral spike fragment gene. Western blotting and thermal denaturation experiment indicated that the both expression and anchoring efficiency are much stable. Our system is able to induce the production of neutralizing antibodies following oral-immunization in pigs.

**Keywords:** PED Virus, CWP2, Surface display, whole-cell neutralizing system, Saccharomyces cerevisiae, oral-immunization

Acknowledgement: This work was supported by the Human Resource Training Program for Regional Innovation and Creativity through the Ministry of Education and National Research Foundation of Korea (NRF-2015H1C1A1035921).

P25 **Protein expression of astacin-like zinc-metalloprotease and toxicity test from the Nemopilema nomurai**

**Gna Ahn, Ga-Young Park, Se Hee Lee, Eunji Lee, Yang-Hoon Kim & Ji-Young Ahn***

*Department of Microbiology, Chungbuk National University, Cheongju, Republic of Korea*

TEL: +82-43-261-2301, FAX: +82-43-264-9600

*A Nemopilema nomurai (N. nomurai)* is one of the largest jellyfish in the world, a diameter 2 meter and a body weight of 200 kg and it contains high-toxic proteins that cause serious damage to human. Among these many toxic proteins, astacin-like zinc-metalloprotease is well known to toxic protein in many organisms such as spider, snake and so on. Additionally in this study, our group has studied astacin that belongs to zinc-metalloprotease family. The purpose of this study is to proceed with the protein expression and toxicity test to identify independent function the protein. Our group processed cloning by using pGEX 4T-1 or pET28b vector system to find a best protein expression condition and toxic protein yielded through protein expression in *E.coli* BL21(DE3)pLysS. To identify toxicity effect of the venom proteins, it has been conducted by treating venom proteins to Vero cell for cell damage test and enzyme activity test.

**Keywords:** Nemopilema nomurai, astacin, zinc-metalloprotease, toxic protein, jellyfish, protein expression.

Acknowledgement: This work was supported by "CRP for Agriculture Science & Technology Development (PJ010530)” Rural Development Administration, Republic of Korea.
P26 The ameliorative effect of *K. parviflora* extract on the inflammatory responses in *P. acnes*-infected cells

Solee Jin¹, A-Reum Ryu¹ & Mi-Young Lee¹ ²

¹Department of Medical Science, College of Medical Science, SoonChunHyang University, Asan, Chungnam 31538, Republic of Korea
²Department of Medical Biotechnology, College of Medical Science, SoonChunHyang University, Asan, Chungnam 31538, Republic of Korea

*Kaempferia parviflora*, known as Thai black ginger or krachai dum, is an herbaceous plant in the family Zingiberaceae. *K. parviflora* has traditionally been used as a health promoting, stimulating and vitalizing agent. Functional effects of the extract include improvement of peripheral blood circulation, reducing triglycerides, preventing diabetes, anti-allergic effect and so on. Acne vulgaris, a chronic skin disease of the pilosebaceous unit, is one of the most common skin disorders, the 8th most common disease worldwide. It is characterized by the formation of comedones, papules, pustules, nodules, and/or cysts. The growth of the bacteria *Propionibacterium acnes*, which is normally present on the skin, is involved in the obstruction and inflammation of pilosebaceous units. There are a variety of acne treatments, including antibiotics and hormonal therapy. Although these treatments confer various benefits for the management of acne, there are increasing concerns regarding imperative potential side effects including antibiotic resistance. In this investigation, the ameliorative effect of *K. parviflora* extract on the inflammatory mediators in *P. acnes*-infected cells was examined.

Acknowledgement: This work (Grants No. C0399051) was supported by Business for Academic-industrial Cooperative establishments funded Korea Small and Medium Business Administration in 2016.

P27 Acute toxicity and superoxide dismutase (SOD) activity in brackishwater cladoceran *Diaphanosoma celebensis* exposed to heavy metals

Chulhee Bae & Young-Mi Lee

Department of Life Science, College of Natural Sciences, Sangmyung University, Seoul 110-743, Republic of Korea

Aquatic organisms are exposed a huge variety of chemical compounds like heavy metals that influence ecosystem by being concentrated to higher tropical level. Many research of negative effect of heavy metals to aquatic organisms have been reported. In particular, heavy metals can generate reactive oxygen species (ROS), leading to oxidative stress. Herein, we investigated the acute toxic effect of cadmium (Cd), copper (Cu) and mercury (Hg) in brackish water cladoceran *Diaphanosoma celebensis*: survival rate, fecundity and lifespan. As an oxidative stress marker, modulation of superoxide dismutase (SOD) activity was also analyzed in response to these heavy metals. As results, heavy metals adversely affect survival of *D. celebensis*. Based on the acute toxicity test, the 48-h LC₅₀ values were determined as followings; 65.3 mg/L (95% CL 55.36~75.33 mg/L) for Cd, 5.68 mg/L (95% CL 4.89~6.52 mg/L) for Cu, and 0.59 mg/L (95% CL 0.52~0.66 mg/L) for Hg. The order of toxicity was Hg > Cu > Cd. The SOD activity was differently modulated in response to each heavy metal. These findings suggest that heavy metals can induce oxidative stress by producing superoxide radicals in this species, resulting in negative effect on survival, fecundity and lifespan.

P28 Oxidative stress of cadmium and copper in marine ciliate *Euplotes crassus*

Ji-Soo Kim & Young-Mi Lee

Department of Life Science, College of Natural Sciences, Sangmyung University, Seoul 110-743, Republic of Korea

Cadmium (Cd) and copper (Cu) could induce the production of reactive oxygen species (ROS) and cause toxic effects in organisms. In this study, we identified and characterized of antioxidant enzymes (Cu/Zn SOD and Mn SOD) and heat shock proteins (HSP70) in marine ciliate *Euplotes crassus*. We also investigated transcriptional modulation of such genes using real-time RT-PCR and measured the activity of SOD after exposure to Cd and Cu. As results, Cd and Cu induce alteration of gene expression and SOD activity. These findings suggest that Cd and Cu can induce oxidative stress in *E. crassus*. This study would be helpful to understand molecular mechanisms of Cd and Cu-induced oxidative stress in *E. crassus*. 
P29 Role of ACN9 gene in the pathogenesis of chronic obstructive pulmonary disease

Jeeyoung Kim1,2, Hye-Ryeon Heo1,2, Seok-Ho Hong1,2 & Woo Jin Kim1,2

1Department of Internal Medicine, School of Medicine, Kangwon National University, Chunchon 24341, Republic of Korea
2Environmental Health Center, Kangwon National University Hospital, Chunchon 24289, Republic of Korea

ACN9 plays an essential role in the assembly of succinate dehydrogenase (SDH) and glyconeogenesis that is located in the mitochondrial inter-membrane space. Our previous results showed that ACN9 (chromosome 7q21) is a potential candidate gene for COPD and identified significant interaction with smoking based on genetic studies. However, it has not studied yet the role of ACN9 on the inflammatory response that is a key pathogenic factor for the above COPD. Here, we demonstrate that the cadmium (Cd) induced glycolytic switch and inflammatory response is significantly attenuated in ACN9 silencing bronchial epithelial cells (BEAS-2B). We firstly checked the anatomical distribution of ACN9 mRNA by in situ hybridization. Interestingly ACN9 mRNA localizes in lymphoid and bronchial epithelial cells of human lung tissues. In response to Cd, ACN9 silencing BEAS-2B cells do not produce excess succinate, or PDH (pyruvate dehydrogenase), a key regulator of mitochondrial activity. We further attested the effect of ACN9 on intracellular mechanism to Cd induce pro-inflammatory cytokines in BEAS-2B cells. Consequently, ACN9 silencing significantly increased the expression of pro-inflammatory cytokines in mRNA and translational level when BEAS-2B cells were co-treated with Cd via NF-κB pathway. Thus, we suggested that ACN9 is a key molecule of inflammatory response, as a candidate to increase the development of pulmonary diseases.

P30 The effect of umbelliferone on melanogenesis in B16F10 melanoma cells

Yunjung Lee & Eun-Mi Choi

Department of Chemistry, Incheon National University, Incheon 22012, Republic of Korea

We investigated the effect of umbelliferone on melanin synthesis in B16F10 melanoma cells. Melanin, a complex pigment derived from L-tyrosine, is produced by melanocytes, which are located primarily in the skin, hair bulbs, and eyes. Melanin not only determines skin and hair colors, but also plays important functions to protect skin cells from harmful effects of UV radiation. Therefore, stimulation of melanin synthesis can contribute to natural defenses of skin against the harmful effects of UV and also to improvement of disorders associated with hypopigmentation in skin and hair. Umbelliferone (7-hydroxycoumarin) is a bioactive molecule present in edible fruits such as a bitter orange and regarded as the parent compound of the more complex coumarins. Umbelliferone stimulated differentiation of B16F10 cells and also increased melanin content and tyrosinase activity in a dose-dependent manner. Umbelliferone increased the expression of tyrosinase and tyrosinase-related proteins, the enzymes in melanogenesis pathway, and also the expression of microphthalmia-associated transcription factor (MITF), the transcription factor known to stimulate malanogenic genes. Our results suggest that umbelliferone can be used for the treatment of hypopigmentation-related disorders by inducing the expression of melanogenic genes via MITF stimulation.
Gene expression profiling of human placenta cell line (JEG3) exposed to particulate matter (PM2.5)

Woong Kim1,4, Mi-Kyung Song2, Yoon cho1, Jung-hee Lim1, Myung Chan Gye3 & Jae-Chun Ryu1,5,*

1Cellular and Molecular Toxicology Laboratory, Korea Institute of Science & Technology P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeaehab-dong 53212, Republic of Korea
3Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea
4Department of Life Science, College of Natural Sciences, Hangyang University, Seoul 133-791, Republic of Korea

Atmospheric particulate matter (PM) with a diameter less than or equal to 2.5 µm (PM2.5) is a common cause of several respiratory diseases. Recent studies have shown that PM2.5 can affect not only the respiratory system but also the immune system, CNS, and cardiovascular system. In particular, several epidemiological studies have reported that PM2.5 is connected with female reproductive disorders such as miscarriages, preterm births and unhealthy birth outcomes. In the present study, in order to evaluate adverse health effects of PM2.5 on the female reproductive system, we used gene expression profiling and gene ontology (GO) analysis of human placenta cell line (JEG3) to identify gene expression changes after exposed to two different PM2.5 collected from ambient air and underground parking lot. Once completed, we identified 1,021 commonly expressed genes involved in immune responses, cell-cell signaling, the regulation of apoptosis and the regulation of programmed cell death—which are known to induce adverse health effects. In addition, we identified genes related with progesterone synthesis and cytokine-tykocyte receptor interaction. We suggest that these genes might play roles in PM2.5-induced female reproductive disorders and can help elucidate the adverse health effects mechanism of PM2.5 exposure.

Keywords: PM2.5, RNA-sequencing, cytotoxicity, JEG3, gene ontology

Acknowledgement: This subject is supported by KIST Program to Ryu, J.-C. of the Republic of Korea (2E26260).

Gene expression profiles on a human breast cancer cell line (MCF7) and human vascular endothelial cell line (EA.hy926) after two different PM2.5 exposures

Woong Kim1,4, Mi-Kyung Song2, Yoon cho1, Jung-hee Lim1, Myung Chan Gye3 & Jae-Chun Ryu1,5,*

1Cellular and Molecular Toxicology Laboratory, Korea Institute of Science & Technology P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeaehab-dong 53212, Republic of Korea
3Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea
4Department of Life Science, College of Natural Sciences, Hangyang University, Seoul 133-791, Republic of Korea

A number of studies have shown associations between exposure to fine-particulate air pollution and increased mortality, particularly from respiratory disease, but fewer studies have examined the association between exposure to fine-particulate air pollution and other diseases such as metabolic disease, cardiovascular disease, mental illness and non-respiratory organ cancers. Also, hardly any have mentioned the regional, varied effects of particulate matter (PM). We collected particulate matter 2.5 (PM2.5) samples from two different sites (ambient air and an underground parking lot) and conducted an MTT assay to find the regional, varied effects of PM2.5. After the MTT assay, we chose two cell lines. One showed high cytotoxicity to PM2.5 collected from the ambient air (MCF7), the other showed high cytotoxicity to PM2.5 collected from the underground parking lot. Then, we conducted RNA-seq for gene expression profiling and gene ontology (GO) analysis. MCF7 exposed to ambient PM2.5 shows differently expressed genes involved in regulation of proliferation, immune response, cell-cell signaling etc. Meanwhile, EA.hy926 exposed to underground parking lot PM2.5 shows differently expressed genes involved in cell adhesion, biological adhesion and intracellular signaling cascade. These results may help elucidate the regional, varied effects of PM2.5 and associations among several diseases.

Keywords: PM2.5, RNA-sequencing, EA.hy926, MCF7, gene ontology

Acknowledgement: This subject is supported by KIST Program to Ryu, J.-C. of the Republic of Korea (2E26260).
Transcriptome profile analysis of the in vitro aldehydes exposure system and non-small cell lung cancer (NSCLC) related to pulmonary toxicity

Yoon Cho1,3, Mi-Kyung Song2, Woong Kim1, Jung-hee Lim1, Tae Sung Kim1 & Jae-Chun Ryu1,4,*

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST) P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea
3School of Life Sciences and Biotechnology, Korea University, Anam-Dong, Seoungbuk-Gu, Seoul 136-701, Republic of Korea
4Human and Environmental Toxicology, University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea

Low-molecular-weight saturated aliphatic aldehydes (LSAAs) are categorized as volatile organic compounds (VOCs), which are common air pollutants and could induce the diverse adverse human health effects. In particular, an increased risk of pulmonary adverse effect has been linked to exposure to environmental chemicals including VOCs associated with environmental lung diseases such as non-small cell lung cancer (NSCLC). Here, we investigated the critical biomarkers of seven aldehydes (propanal, butanal, pentanal, hexanal, heptanal, octanal and nonanal) associated NSCLC based on transcriptome analysis. First, we investigated the mRNA expression of seven aldehydes-exposed to A549 cell and NSCLC tissues. Following mRNA expression profiling, we performed the integrated analysis of transcriptome profiling data using in vitro system and NSCLC tissues. These core biomarkers of aldehydes associated with NSCLC, environmental lung disease, provide a valuable correlation parameter of exposure to aldehydes and environmental disease associated with pulmonary toxicity. Further validation studies are necessary to develop the implication of such biomarkers for risk assessments.

Keywords: low-molecular-weight saturated aliphatic aldehydes (LSAAs), non-small cell lung cancer (NSCLC), transcriptome, pulmonary toxicity

Acknowledgement: This study was supported by the Korea Research Foundation grants from Korea Ministry of Environment as “The Eco-Innovation Project (412-111-010),” and “KIST Program” to Ryu, J.-C. of the Republic of Korea. The biospecimens for this study were provided by the Korea University Guro Hospital of Biobank.

DNA methylation-based biomarkers of saturated aliphatic aldehydes associated with pulmonary toxicity: the in vitro system and primary NSCLC tissue

Yoon Cho1,3, Mi-Kyung Song2, Woong Kim1, Jung-hee Lim1, Tae Sung Kim1 & Jae-Chun Ryu1,4,*

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST) P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea
3School of Life Sciences and Biotechnology, Korea University, Anam-Dong, Seoungbuk-Gu, Seoul 136-701, Republic of Korea
4Human and Environmental Toxicology, University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea

Epigenetics is essential for a wide range of biological processes including regulation of gene expression, normal development and cellular differentiation. All of epigenetic mechanisms play an important role in the pathogenesis of environmental diseases and cancers. As a result, there has been a steady increase the DNA methyleome studies investigating the effect of human health risk factors including environmental chemicals and in relation to disease. Therefore, DNA methylation based biomarkers are also rapidly developing. Here, we present the integrative epigenetic biomarkers of aldehydes, common air pollutants, and primary non-small cell lung cancer (NSCLC) tissues using DNA methyleome analysis. We investigated the epigenome-wide DNA methyleome analyses in aldehydes-exposed A549 lung adenocarcinoma cells and primary NSCLC tissues to identify the relationship of exposure to aldehydes and risk of environmental pulmonary disease such as NSCLC. These core biomarkers underlying the linkages between aldehydes and environmental lung disease provide the important insights into the toxicological mechanisms and potential diagnosis of related lung diseases exposure to aldehydes.

Keywords: low-molecular-weight saturated aliphatic aldehydes (LSAAs), DNA methylation, non-small cell lung cancer (NSCLC), epigenetic biomarker

Acknowledgement: This study was supported by the Korea Research Foundation grants from Korea Ministry of Environment as “The Eco-Innovation Project (412-111-010),” and “KIST Program” to Ryu, J.-C. of the Republic of Korea. The biospecimens for this study were provided by the Korea University Guro Hospital of Biobank.
**P35** Identification of microRNA (miRNA) biomarkers for low-molecular-weight saturated aliphatic aldehydes exposure and non-small cell lung cancer (NSCLC)

Yoon Cho1,3, Mi-Kyung Song2, Woong Kim1, Jung-hee Lim1, Tae Sung Kim3 & Jae-Chun Ryu1,4,*

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST) P.O. Box 131, Cheongryang, Seoul 130-650, Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea
3School of Life Sciences and Biotechnology, Korea University, Anam-Dong, Seongbuk-Gu, Seoul 136-701, Republic of Korea
4Human and Environmental Toxicology, University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea

Among the diverse environmental factors, air pollutants revealed the greatest environmental risk to human health. Although LSAAs are a well-known major indoor air pollutant classified as volatile organic compounds (VOCs), the health risk assessment studies of its epigenetic effects are insufficient. Here, we aimed to investigate whether exposure to low-molecular-weight saturated aliphatic aldehydes had potential adverse impacts on human respiratory system in regard to environmental lung disease including non-small cell lung cancer (NSCLC) based on microRNA microarray analysis. Using microarray analysis, we identified seven aldehydes (propanal, butanal, pentanal, hexanal, heptanal, octanal and nonanal)-characterized miRNA and primary human NSCLC tissues (adenocarcinoma, squamous cell carcinoma and large cell carcinoma)-specific miRNAs. By integrating the analysis of the in vitro and NSCLC tissues’ miRNA expression profiles, we identified the critical biomarkers reflecting the associations between environmental chemical/aldehydes exposure and pulmonary diseases such as NSCLC. Our findings provide insight into the adverse effects of aldehydes on pulmonary toxicity and possibility of pathogenesis of lung diseases. These results also suggest the miRNA signatures in aldehydes-induced pulmonary toxicity mechanisms reflect a potential diagnosis of aldehyde-induced environmental pulmonary diseases.

**Keywords:** microRNA, low-molecular-weight saturated aliphatic aldehydes (LSAAs), non-small cell lung cancer (NSCLC), epigenetics

Acknowledgement: This study was supported by the Korea Research Foundation grants from Korea Ministry of Environment (grant numbers 2014001650003) as “The Converging Technology” and “KIST Program” to Ryu, J.-C. of the Republic of Korea.

---

**P36** Gene expression profiles of exosomal and cellular miRNA from human promyelocytic leukemia cells (HL-60) exposed to xylene

Jung-hee Lim1,3, Yoon Cho1, Woong Kim1, Sung Ok Han3 & Jae-Chun Ryu1,4,*

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST), Republic of Korea
2Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea
3Department of Biotechnology, Korea University, Seoul 131-701, Republic of Korea

Exosomes, small extracellular vesicles released by many kinds of cells, are associated with a variety of biological processes. These vesicles are gaining attention in toxicological and pathological research because they have great value as a new tool for disease prognosis and therapy. Xylene, the most ubiquitous chemical in industry, according to Korea’s Ministry of Environment. Although xylene is very useful as a solvent, the mechanisms underlying its toxicity are not understood. In this study, a microarray analysis identified 59 miRNAs, and qRT-PCR validated 5 miRNAs, that were differentially expressed in the HL-60 cell line exposed to xylene and exosomes from the cells. A total of 2,245 putative target genes of the 5 miRNAs were classified according to the miRWalk 2.0 database. The Kyoto Encyclopedia of Genes and Genomes analysis of the putative target genes showed a correlation with biological processes such as MAPK signaling pathways, pathways in cancer, insulin signaling pathways, and neurotrophin signaling pathways. In conclusion, this study suggests the value of exosomes as diagnostic biomarkers of toxicity. Moreover, it describes miRNA expression profiles altered by xylene and related toxicity affected by significantly expressed target genes.

**Keywords:** exosome, xylene, miRNA, target gene, HL-60, microarray

Acknowledgement: This work was supported by the Korea Research Foundation grants from Korea Ministry of Environment (grant numbers 2014001650003) as “The Converging Technology” and “KIST Program” to Ryu, J.-C. of the Republic of Korea.
**P37** Differentially expressed microRNA and mRNA profiles in HL-60 human promyelocytic leukemia Cells and exosomes under toluene exposure

Jung-hee Lim1,2, Mi-Kyung Song2, Yoon Cho1, Woong Kim1, Sung Ok Han1 & Jae-Chun Ryu1,4,5

1Center for Environment, Health and Welfare Research, Cellular and Molecular Toxicology Laboratory, Korea Institute of Science and Technology (KIST), Republic of Korea
2National Center for Efficacy Evaluation for Respiratory Disease Product, Jeonbuk Department of Inhalation Research, Korea Institute of Toxicology, 30 Baehak1-gil, Jeongeup, Jeollabuk-do 53212, Republic of Korea
3Department of Pharmacology and Toxicology, Human and Environmental Toxicology, Korea University of Science and Technology, Gajeong-Ro 217, Yuseong-gu, Daejeon 305-350, Republic of Korea
4Department of Biotechnology, Korea University, Seoul 131-701, Republic of Korea

Toluene (TOL) is a major indoor air contaminant that causes adverse human health effects. Although toluene is a prevalent pollutant, its mechanisms of toxicity are largely unknown. In recent years, exosomes have attracted great interest in the field of toxicology and pathology. In this study, we aimed to identify toluene-sensitive miRNAs and to characterize the relationships between miRNAs and the expression of target genes involved in toluene-induced toxicity using HL-60 human promyelocytic leukemia cells and exosomes from the cells. Microarray analysis identified 54 miRNAs that were differentially expressed in the exosomes and cytosols of a HL-60 cell line exposed to toluene. Of these 54 differentially expressed miRNAs, 4 (hsa-miR-1290, hsa-miR-718, hsa-miR-3663-3p, and hsa-miR-320c) were validated by qRT-PCR. Integrated analysis of miRNA and mRNA expression profiles identified 8 miRNA-mRNA correlations. By performing a CTD analysis of the putative target genes, we found 8 toluene-induced genes related to diverse disease categories such as nervous system disease, cancer, and respiratory tract disease. In conclusion, our data demonstrated that miRNA-mRNA network provides insight and understanding in regard to identifying toxicological mechanisms caused by environmental pollutants in an in vitro model. Furthermore, it suggests the value of exosomes as diagnostic biomarkers for toxicants.

**Keywords:** exosome, toluene, miRNA-mRNA network, HL-60, microarray, CTD analysis

Acknowledgement: This work was supported by the Korea Research Foundation grants from Korea Ministry of Environment (grant numbers 2014001650003) as “The Converging Technology” and “KIST Program” to Ryu, J.-C. of the Republic of Korea.

**P38** Evaluation of nutrient bioextraction capacity by shellfish aquaculture in Korea

Ye-Ho Kang, Da-Eun Kim, Min-Jeong Kim, Jin-Hee Park & Jang K. Kim

Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea

Pacific oyster (Crassostrea gigas) and Manila clam (Venerupis philippinarum) are known to have a great capacity to remove nutrients from the ecosystem. In Korea, Pacific oysters are cultivated mostly in the southeast of the country, Gyeongnam province. Over 260,000 tons of pacific oysters were harvested during August, 2015 through July, 2016. Manila clams are mostly produced in Chungnam province (West Sea of Korea), and its annual production during the same period was approximately 14,000 tons. In this study, we evaluated the nutrient bioextraction capacity of these shellfish species in different seasons and different locations in Korea. Crassostrea gigas was collected from Tae An and Seo San, Chungnam in January and March, 2016, and from Tong Young, Gyeongnam, monthly from February to July, 2016. Venerupis philippinarum was collected from Tae An and Seo San in January and March, 2016. After the residue on the oyster and clam shells were removed, the samples were dried and then ground into powder for tissue nitrogen analysis. Both species did not show any seasonal variations in terms of the tissue nitrogen content. The oysters from Tong Young had on average 0.9% of tissue nitrogen content, while the tissue nitrogen content of the oysters from Tae An and Seo San was 0.42% and 0.47%, on average, respectively. This result suggests that V. philippinarum had a higher nitrogen removal capacity per unit weight than C. gigas. However, considering the production of shellfish in Korea, Pacific oysters removed over 1,300 tons of nitrogen during August, 2015 through July, 2016, while Manila clams removed 270 tons of nitrogen. These results suggest that Pacific oyster and Manila clam farming provides ecosystem services by efficiently removing nutrients from the coastal environments.
Widespread environmental contaminants halogenated aromatic hydrocarbons (HAHs), including polychlorinated dibenzo-p-dioxins, furans and biphenyls, are one of great threats to wild animals in Arctic region. The aryl hydrocarbon receptor (AHR) is a key transcription factor involved in broad spectrum of toxicities in vertebrates by regulation of multiple target genes including cytochrome P450. Recent studies of AHR revealed this protein plays important role in carcinogenesis, regulation of cell cycle, T-cell differentiation and immune system via endogenous ligands such as tryptophan derivate. The apex predator in the Arctic, polar bear (Ursus maritimus), is a vulnerable species from exposure to HAHs through the food web. Several studies have indicated large species differences in AHR-mediated responses in mammals. Hence, the functional characterization of polar bear AHR signaling is of interest, as this would help to unveil the susceptibility of AHR to HAHs, and further to assess the risks. In the present study, we initially isolated AHR from polar bear cDNA. The clone encodes 793 amino acids including basic-helix-loop-helix (bHLH) and Per-Amt-Sim (PAS) domains. Seven key amino acid residues (293T, 295H, 259F, 326Y, 329I, 355F and 385A) of the ligand binding domain (LBD) in polar bear AHR (pbAHR) were conserved, which are critical sites for determining the sensitivity to TCDD were conserved as C57BL/6 mouse AHR. And we conducted pbAHR dependent reporter-gene assay using mouse CYP1A1 promoter for assessment of predicted TCDD energy of dioxin like compounds (DLCs). The results showed different trend-line and R² among each four models. Also polychlorinated biphenyls (PCBs) are separated from trend-line of Polychlorinated dibenzodioxins and dibenzofurans (PCDDs/PCDFs). And in case of natural ligands, we suppose that they would have different trend-line of predicted docking energy according to their structural congeners.
**P41 Effect of salinity on the growth of Gracilaria vermiculophylla and Ulva prolifera**

Beomjoon Son¹, Hailong Wu¹, Taejun Han¹,², Hojun Lee¹, Jihae Park¹,², Soyeon Choi², Je-Woo Jung¹, Sojin Jang¹, Mi Seon Park⁶, Young-Dae Kim⁶, Byung-Hwa Min⁶ & Jang K. Kim¹

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
³College of Life and Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 22012, Republic of Korea
⁴Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
⁵Department of Cosmetic Science & Management, Incheon University, Yeonsu-gu, Incheon 22012, Republic of Korea
⁶Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam 46083, Republic of Korea

Gracilaria and Ulva are known as nutrient scrubbers and used for bioremediation in integrated multi-trophic aquaculture and nutrient bioextraction systems. We tested the growth of *Gracilaria vermiculophylla* and *Ulva prolifera* in four different salinity conditions (20, 30, 40 and 50 psu) to determine the optimal environmental conditions for nutrient bioremediation. Both species were cultivated at 20°C, 12:12 light:dark photoperiod and 100 μmol photons·m⁻²·s⁻¹ for 15 days. The culture medium was changed every 2 or 3 days. The growth rate was determined every 5 days. The growth rate of *G. vermiculophylla* and *U. prolifera* ranged from 12.71 to 24.51% d⁻¹ and 20.29 to 36.33% d⁻¹, respectively. For both species, the maximum growth rate was observed at 20 psu and the growth rate decreased with increasing salinity. The rapid growth capability of these two species in this study confirmed that *Gracilaria vermiculophylla* and *Ulva prolifera* are good seaweed species to be utilized in the IMTA and nutrient bioextraction systems. In addition, the rapid growth capacity at a wide range of salinity conditions suggests these algae can be used in a land based IMTA system, where the salinity is maintained low, 20 psu or high, > 40 psu.

**P42 Nutrient bioextraction of the sea cucumber, Apostichopus japonicus in an integrated multi-trophic aquaculture (IMTA) system**

Haram Jung¹, Hailong Wu¹, Taejun Han¹,², Hojun Lee¹, Jihae Park¹,², Soyeon Choi², Je-Woo Jung¹, Sojin Jang¹, Mi Seon Park⁶, Young-Dae Kim⁶, Byung-Hwa Min⁶ & Jang K. Kim¹

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
³College of Life and Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 22012, Republic of Korea
⁴Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
⁵Department of Cosmetic Science & Management, Incheon University, Yeonsu-gu, Incheon 22012, Republic of Korea
⁶Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam 46083, Republic of Korea

The wastes from fish farms have created serious environmental problems. Particulate organic matters (POMs) from fish farms elevate the levels of sulphides and phaeopigments in sediments. The accumulation of POMs in the sediments has caused increased mortality of cultured animals. Sea cucumbers have been suggested as a good candidate for bioremediation for large POMs in integrated multi-trophic aquaculture (IMTA) systems. The monthly growth rate and nutrient removal ability of the sea cucumber *Apostichopus japonicus* were analyzed from May to September, 2016 in the IMTA system in Tongyeong, Gyeongnam, Korea. Ten thousand sea cucumbers were placed in the IMTA system and additional 10,000 sea cucumbers were released at a nearby fish farm (control). The maximum growth rate was 6.21% d⁻¹ in both IMTA and control sites in July. However, the sea cucumbers showed negative growth during the month of August when the water temperature reached 30°C (-1.73 (IMTA) and -2.17% d⁻¹ (control), respectively). The tissue nitrogen content of sea cucumbers was on average 6.45% at IMTA and 6.53% at the control site. Assuming 100% survival, the total nitrogen removal by the sea cucumbers in July was 2.30 kgN·d⁻¹ and 3.16 kgN·d⁻¹ at the IMTA and control sites, respectively, in July. The sea cucumbers appeared to release nitrogen into the ecosystem in August but started to remove POMs again from September. The estimate of nitrogen removal in September was 1.04 kg N at the IMTA site and 2.02 kg N at the control site This result indicates that an introduction of the deposit feeder, *A. Japonicus* to fish farms or IMTA systems may efficiently remove POM during the temperate seasons.
**P43 Reversible phase transfer of highly stabilized gold nanorods between organic and aqueous solutions**

Sundo Jeong & Myoung-Hwan Park*

Department of Chemistry, Sahmyook University, Seoul 01795, Republic of Korea

Interest in rod-shaped metallic nanoparticles such as gold nanorods (GNRs) stems from their anisotropic physical properties that are size- and shape-dependent and sensitive to environment for therapeutic and diagnostic agents for decades. The most common method to synthesis GNRs is performed in aqueous solution with a bilayer of the shape-directing surfactant cetyltrimethylammonium bromide (CTAB). However, the CTAB bilayer non-covalently coated onto GNRs is toxic to biological cells and dynamically unstable. In this research, the robust formation of GNRs in aqueous media is achieved initially by exchanging CTAB with (11-Mercaptoundecyl)-N,N,N-trimethylammonium (TMA) ligands which are more biocompatible than CTAB. To further expand their functionality and potential use, an additional step for phase transfer from water to hexane was performed through electrostatic assembly of positively charged TMA ions with negative oleate ions, enabling to be organic-soluble. Interestingly, the electrostatic assembly between the TMA and oleate ions can be easily disrupted by HCl treatment that removes the oleate ions onto GNRs to return the positively charged TMA-GNRs or by ligand-exchanging with 11-mercaptoundecanoic acid (MUA) to achieve the negatively charged MUA-GNRs in which both GNRs are soluble in aqueous media again. These behaviors in phase transfer and chemical and physical properties were analyzed using transmission electron microscope, FT-IR, thermogravimetric analysis, zeta-potential, and UV-vis spectroscopy.

**P44 Fabrication of highly photoluminescent quantum dot-polymer composite micropatterned surface using thiol-ene chemistry**

Min-Chul Jo, Chung-Hyeon Kim & Myoung-Hwan Park*

Department of Chemistry, Sahmyook University, Seoul 01795, Republic of Korea

The patterning of quantum dot (QD)-polymer nanocomposites with the unique optical and electrical properties into large area with an organized array is of great importance for various applications with photonic and optoelectronic devices. Here, we have fabricated a patterned QD-polymer composite with high photoluminescence (PL) using a thiol-ene reaction and imprinting technology. In our system, the positive charge onto QDs enhance dispersion interaction between QDs and the allylic groups on the positive charge enables QDs to chemically and strongly bind to a polymer matrix. The phenomenon was confirmed using two control QDs; neutral QDs (QD-TOH), and positive QDs without allylic groups (QD-TTMA). This synergetic effect of the charge repulsion and chemical binding in our system provides high PL with robustness. Additionally, the PL intensity shows a linear relationship with the content of QDs in a polymer matrix, indicating that the system is able to control easily a light power as a light-emitting source. These QD-polymer composites that are well-dispersed and stably fixed in a polymer matrix might provide the potential to enhance PL quantum yields in various systems with photonic and optoelectronic devices.
**P45 Growth and nutrient bioextraction of Gracilaria vermiculophylla, Gracilaria lemaneiformis and Ulva prolifera in response to different salinities and nitrogen sources**

Hailong Wu1, Jang K. Kim1, Taejun Han1,2, Hojun Lee1, Jihae Park3,4, Soyeon Choi5, Je-Woo Jung5, Sojin Jang5, Mi Seon Park5, Young-Dae Kim5, Byung-Hwa Min6 & Peimin He7

1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
3College of Life Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 22012, Republic of Korea
4Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea
5Department of Cosmetic Science & Management, Incheon National University, Yeonsu-gu, Incheon 22012, Republic of Korea
6Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam 46083, Republic of Korea
7College of Life and Fisheries, Shanghai Ocean University, Shanghai, China

Seaweed aquaculture has been suggested as a good tool for bioremediation in the coastal waters. The growth and bioremediation capacities of Gracilaria vermiculophylla, Ulva prolifera and two different strains of Gracilaria lemaneiformis were tested in different salinity conditions from 5 psu to 50 psu and three combinations of NO3⁻:NH4⁺: 300:0, 150:150 and 0 μM:300 μM, respectively. For the salinity experiments, the maximum growth rates of G. vermiculophylla, U. prolifera, G. lemaneiformis (Chinese strain) and G. lemaneiformis (Korean strain) were 24.51% d⁻¹ (20 psu), 36.33% d⁻¹ (20 psu), 15.06% d⁻¹ (30 psu) and 7.67% d⁻¹ (30 psu), respectively. G. vermiculophylla and U. prolifera were tolerant to high salinity and even had 9.88 and 20.29% d⁻¹ of growth rate at 50 psu. The nitrogen removal of G. lemaneiformis (Chinese) and G. lemaneiformis (Korean) was highest at 30 psu, which was 0.61 mgN·gDW⁻¹·d⁻¹ and 0.54 mgN·gDW⁻¹·d⁻¹, respectively. For the nutrient experiment, the maximum growth rates were 18.79% d⁻¹ at 0:300, NO3⁻:NH4⁺ for G. lemaneiformis (Chinese), 10.96% d⁻¹ at 150:150, NO3⁻:NH4⁺ for G. lemaneiformis (Korean) and 29.59% d⁻¹ at 0:300, NO3⁻:NH4⁺ for U. prolifera, respectively. These results suggest that all tested species grew rapidly and showed a good capability of nutrient removal, making these species as good extractive organisms in an Integrated Multi-Trophic Aquaculture system and an urbanized coastal environment.

**P46 Nutrient bioextraction by Year-round Seaweed aquaculture in Jiangsu coasts, China**

Hailong Wu1,2, Jang K. Kim1, Peimin He2, Weiping Dai3, Yongdong Zhou4 & Xinming Yang5

1Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
2College of Life and Fisheries, Shanghai Ocean University, Shanghai, China
3Laver Association of Jiangsu Province, Nantong, Jiangsu Province, China
4Yancheng Hairui Food Company, Dafeng, Jiangsu Province, China
5Jiangsu Xianzhiyuan Aquatic Food Company, Rudong, Jiangsu Province, China

Areas of marine eutrophication and harmful algal blooms in offshore and coastal areas have increased in recent years. It was suggested that Pyropia yezoensis aquaculture help reduce marine eutrophication in Jiangsu Province, China.59 kt (dry weight) of P. yezoensis from 30 kha farms in Jiangsu province was harvested in the 2012-2013 growing season (Nov.-Apr.). Approximately, 88 kg·ha⁻¹ of nitrogen, 3 kg·ha⁻¹ of phosphorus and 534 kg·ha⁻¹ of carbon, respectively, were removed from the ecosystem. During the warm season after the Pyropia was harvested, however, green tide was occured due to the excess nutrients. Thus, two warm temperate species, Pyropia haitanensis (Aug.-Nov.) and Gracilaria lemaneiformis (Apr.-Aug.) were introduced to Jiangsu coasts. Pyropia haitanensis removed 96 kg·N·ha⁻¹, 8.7 kg·P·ha⁻¹ and 607.5 kg·C·ha⁻¹, respectively, while G. lemaneiformis removed 111 kg·N·ha⁻¹, 1 kg·P·ha⁻¹ and 1336 kg·C·ha⁻¹, respectively. These results suggests that year round seaweed aquaculture by alternating three species in Jiangsu Province can effectively remove nutrients and help improve the water quality.
**P47 Periphytic diatom community as a biomonitoring tool for assessing the ecological health of Korean waterbodies**

Lalit Kumar Pandey1,2, Jihae Park1,3,4, Lyu Jie1,3, Soyeon Choi1,3, Hojun Lee1,2, & Taejun Han2

1Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
2Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
3Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
4Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea

In the present study, the ecological status of 16 sites belonging to four major rivers of Korea impacted with industrial and sewage effluents was assessed after examining their residing periphytic diatom assemblages. Principal component analysis characterizes Dalseo, Keumho, Soyo and Daejeon sites as severely contaminated sites while rest 12 sites were found to be clean. The four contaminated sites showed lower cell density, species richness, Shannon index with the dominance of adnate and small size diatoms in the community. Furthermore, these sites also had diatoms of unhealthy, dead frustules and pioneer life forms. Increase of lipid bodies in terms of number, size and percent biovolume contribution and deformities in diatom frustules was a general phenomenon found in severely contaminated sites. Overall, both traditional and recently developed periphytic diatom community parameters were found effective in assessing the ecological status of streams and rivers of Korea under chronic exposure to industrial and sewage effluents.

**P48 Rapid response of the aquatic macrophyte Spirodela polyrhiza after short time exposure to toxicants**

Soyeon Choi1,2, Jihae Park1,2,3, Youn-Jung Kim4, & Taejun Han4

1Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea
2Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
3Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
4Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea

The rapid response of the aquatic macrophyte, *Spirodela polyrhiza*, was studied by examining chlorophyll fluorescence using a Junior-PAM (Pulse Amplitude Modulated). *S. polyrhiza* plants were exposed to two different type of toxicant (antimony and 1,4-dioxane) less than 1 hr and maximal fluorescence of light-adapted plants was measured every 20 min. In response to varying concentrations of 0, 0.045, 0.09, 0.36 and 0.72 mg L\(^{-1}\) of antimony, values of Fm' showed 790, 810, 855, 925 and 932, respectively. Fm' values were found to exhibit 832, 938, 970, 989, 1078, and 1302 after exposure to 1,4-dioxane with varying concentrations of 0, 0.12, 0.24, 0.48, 0.96, and 1.72 mg L\(^{-1}\), respectively. With the national drinking water standards of antimony and 1, 4-D being 0.18 mg L\(^{-1}\) and 0.48 mg L\(^{-1}\) in 1 h in mind, the present results revealed that there was a clear increase in Fm' by 10.4% and by 18.9% after exposure to antimony and 1, 4-D for 1 h, respectively as compared with the controls. The use of Chl a-fluorescence (particularly, Fm') may be a useful biomonitor to assess toxicity in drinking waters within 1 h.
P49 Effects of heavy metals on frond area and re-growth of roots in *Spirodela polyrhiza*

Mirae Kim¹, Jihae Park²,³,⁴, Jang K. Kim¹, Soyeon Choi²,⁴, Hojun Lee¹,⁴, Ki Jun Yang¹ & Taejun Han¹

¹Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
²Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
³Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
⁴Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea

Macrophytes belonging to Lemnaceae have been used successfully as a model system for aquatic toxicology, and the present study aimed to evaluate root re-growth of *Spirodela polyrhiza* L. as a suitable endpoint for testing metal pollution. *S. polyrhiza* were exposed to different metals (Ag, Cd, Cr, Cu and Hg) and their toxicities were assessed by measuring the size of fronds and length of re-grown roots. Our results show that there were significant difference in sensitivity of both fronds and roots to the five metals tested, with Ag being the most toxic (EC₅₀ = 13.2-31.6 µg·L⁻¹), and Cu being the least toxic (EC₅₀ = 222.9-462.8 µg·L⁻¹). Direct comparisons of metal sensitivity of two endpoints revealed that frond area were less sensitive to Cr, Cd and Cu than root. Root bioassay differs from internationally standardized methods in that it is completed in 72 h, the required volume of test solutions is only 3 mL, non-axenic plants are used and plants can be obtained from turion, dormant state, anytime. Our results showed that this method is a simple, rapid, cost-effective, sensitive and precise to assess the toxic risks of metals and has practical application for monitoring industrial waste waters where metals are common constituents.

P50 A comparison of nutrient uptake capacity of *Gracilariopsis lemaneiformis* and *Ulva australis* in an integrated multi-trophic aquaculture (IMTA) system

Hojun Lee¹, Jihae Park²,³, Soyeon Choi², Juseon Lee³, Hailong Wu¹, Eun A Seo¹, Je-Woo Jung¹, So Jin Jang¹, Mi Seon Park⁶, Young-Dae Kim⁸, Byung-Hwa Min⁵, Young-Hyun Do⁶, Taejun Han¹ & Jang K. Kim¹

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²College of Life and Sciences and Bioengineering, Incheon National University, 119, Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
³Department of Cosmetic Science & Management, Incheon University, 119 Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
⁴Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea
⁵National Institute of Fisheries Science, 361, Yeong-un-ri, Sanyang-eup, Tongyeong-si, Gyeongsangnam-do 53085, Republic of Korea
⁶Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea

*Gracilariopsis* and *Ulva* species are excellent candidates for bioremediation in an integrated multi-trophic aquaculture (IMTA) system. This study examined the tissue nitrogen content of *G. lemaneiformis* and *U. australis* collected from an open water IMTA site at Tongyeong, Gyeongnam, and two other locations at Tongyeong (Dara harbor and Tongyeong bridge) without a finfish farm nearby in June and July, 2016. *U. australis* collected from the IMTA site showed the higher tissue nitrogen content (2.60%) than the same species collected from Dara harbor (1.20%). *G. lemaneiformis* from IMTA also showed higher tissue nitrogen content (2.18%) than the same species from Tongyeong bridge (1.45%). This result indicates that *G. lemaneiformis* and *U. australis* can effectively store nitrogen in tissue and may be used in an IMTA system (open water or land-based) as a bioremediator to remove inorganic nutrients from the fed aquaculture component.
P51 Effect of salinity on the chlorophyll fluorescence of *Gracilariopsis lemaneiformis* (Gracilariales, Rhodophyta)

Hojun Lee¹, Taejun Han¹,² & Jang K. Kim¹,*

¹Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
²Ghent University Global Campus, Songdo, Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea

The effects of salinity on *Gracilariopsis lemaneiformis* (Gracilariales, Rhodophyta) was studied by examining chlorophyll fluorescence using an Imaging-PAM (Pulse Amplitude Modulated). *Gracilariopsis lemaneiformis* were cultured at 5, 10, 15 and 30 psu of VSE medium for 7 days and various photosynthetic parameters were measured directly. The photosynthetic efficiency of *G. lemaneiformis* was measured as the ratio of variable to maximum quantum yield (Fv/Fm) as well as maximum electron transport rate (ETR max). Values of ETR max were minimal (14.96) and maximal (30.13) in the samples grown under 5 psu and 30 psu, respectively. In the case of Fv/Fm values, no significant difference was noted between the different salinity treatments except for 5 psu. These results indicate that *G. lemaneiformis* had similar capacity for light capture and use the light energy at salinities higher than 5 psu, but maximal photosynthetic production at 30 psu.

P52 Comparative sensitivity of different life stages of *Spirodela polyrhiza* exposed to paraquat

Ki Jun Yang¹, Jihae Park²,³,⁴, Jang K. Kim¹, Soyeon Choi²,⁴, Hojun Lee¹,⁴, Miraie Kim¹ & Taejun Han¹

¹Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
²Division of Life Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea
³Lab of Plant Growth Analysis, Ghent University Global Campus, Yeonsu-gu, Incheon, Republic of Korea
⁴Institute of Green Environmental Research Center, Yeonsu-gu, Incheon, Republic of Korea

To determine the toxic effects of paraquat on the aquatic plant *Spirodela polyrhiza*, EC₅₀ and CV in each life stage of *S. polyrhiza* (3 days old, 4 weeks old and mature plants; 8 weeks old) were measured. Chlorophyll a fluorescence measurement techniques were used to investigate the effects of herbicides on the photosynthetic efficiency of *S. polyrhiza*. The effective quantum yield of PSII was measured by Fv/Fm after 3 days of exposure to the toxicant. The toxicity rank based on EC₅₀ was as follows: 3 days old (0.757 µg L⁻¹) > 4 weeks old (1.411 µg L⁻¹) > 8 weeks old (2.291 µg L⁻¹). On the other hand, EC₅₀ values of root length exposed to paraquat were 0.722 (0.645–0.788), 2.140 (1.368–3.061) and 5.533 (3.654–10.293) µg L⁻¹, respectively. 3 days-old *S. polyrhiza* plants were found to be most sensitive to paraquat. Chl a fluorescence may be one of the most sensitive parameter and may provide useful information for the toxicity risk assessment of residual herbicides in the aquatic ecosystem.
Nutrient bioextraction by seaweed aquaculture in Korea

Je-Woo Jung, Sojin Jang, Euna Seo, Hailong Wu, Hojun Lee, Jihae Park, Soyeon Choi, Juseon Lee, Mi Seon Park, Young-Dae Kim, Byung-Hwa Min, Taejun Han, & Jang K. Kim

Department of Marine Science, Incheon National University, Incheon 22012, Republic of Korea
College of Life and Sciences and Bioengineering, Incheon National University, 119, Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea
Department of Cosmetic Science & Management, Incheon University, 119 Academy-ro, Yeonsu-gu, Incheon 22012, Republic of Korea
Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong 46083, Republic of Korea
Ghent University Global Campus, Songdo Munwha-ro, Yeonsu-gu, Incheon 21985, Republic of Korea

Seaweed aquaculture performs as a promising nutrient management tool in the coastal environment by removing nutrients from the aquatic environment. In this study, we evaluated the bioextraction capacity of seaweed aquaculture in Korea. Seaweed species including Undaria pinnatifida, Saccharina japonica, and Pyropia yezoensis were collected from five seaweed farms in Korea (Kijang, Busan; Dangmok and Jangyong-ri, Wando, and Yeosu, Jeonnam; Seosan, Chungnam) during the harvest season (March-April, 2016). These three species occupy more than 97% of total seaweed production in Korea (Undaria, 283,707 ton; Saccharina, 372,311 ton; and Pyropia, 397,841 ton). The tissue carbon contents of these seaweeds were 24.28-30.52% (Undaria), 20.04-25.43% (Saccharina), and 34.84% (Pyropia), respectively. The average tissue nitrogen contents were 2.18-2.82% (Undaria), 1.97-2.33% (Saccharina), and 5.87% (Pyropia), respectively. Based on the tissue carbon and nitrogen contents along with the production information, it was estimated that approximately 40,000 tons of carbon and 5,000 tons of nitrogen were removed by seaweed aquaculture in Korea during 2013-2014 growing season. This result suggests that seaweed aquaculture can efficiently remove nutrients and help improve the water quality in the marine environments.
**P55** Toxicogenomic analysis for elucidating the lead-induced response under low-level exposure in rat liver in terms of repair activity

Hyun Soo Kim, Sang Min Lee, Yeo Jin Kim, Won Hee Jang & Young Rok Seo

Institute of Environmental Medicine for Green Chemistry, Department of Life Science, Dongguk University Biomedical Campus, 32, Dongguk-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do 10326, Republic of Korea

Lead (Pb) is widely used in consumer products as an alloy and pigment despite its well-known serious toxic effects. Pb absorbed through the gastrointestinal and respiratory system flows through the bloodstream and accumulates in the brain, bone and liver. Especially, the liver is well known as an important organ for detoxification, and a number of prior studies have confirmed the alteration of diverse biological mechanisms caused by long-term Pb exposure in the liver. In this study, we investigated the genotoxic potential of Pb on nuclear DNA and repair capacity using comet and AP endonuclease activity assay, respectively in rat liver tissue at long-term and low-level exposure. Significant extent of DNA break damages and the impairments of enzymatic repair activities were observed in the Pb exposed group, in comparison to the control group. In addition, using integrative toxicogenomic approach we comprehensively analyzed the Pb-induced gene alteration in genome-wide scale and DNA excision repair-focused biological networks using microarray and pathway analysis, respectively. Based on integrative approach, we suggest that genotoxic effects of low-level Pb exposure are, in part, involved in the enhancement of DNA strand break and impairment of repair activity, with complex molecular signaling pathways. Our study provides perspective on novel biomarker responsible for Pb-induced hepatotoxicity at long-term and low-dose exposure, which would be useful for further development of gene-targeted therapeutic strategies and/or natural chemo-preventive agents for effective reduction of the Pb toxicity in both occupational and environmental perspectives. The exact mechanism of genotoxicity in liver exposed to low-level Pb will be further warranted.

**P56** Removal of mercury by using the mixture of silver nanoparticles and nanowires

Mu Lei & Sung Ik Yang*

Department of Applied Chemistry, Kyung Hee University, Yongin 446-701, Republic of Korea

Hg\(^{2+}\) is one of the most important toxic metal ions, because of its wide use in electrical equipment, catalysts, and paints, after which it is released into the environment. In this work, we have synthesized the Ag nanostructures and characterized the removal properties of Hg\(^{2+}\) from aqueous solution. Field emission scanning electron microscopy (FESEM), X-ray diffraction (XRD), and energy dispersive spectroscopy (EDX) have been used to characterize the prepared silver nanostructures. The optical property of the as-prepared product was measured by ultraviolet-visible (UV-vis) spectroscopy. TGA/SDT (Thermal Analyzer) confirmed the weight loss and the stability of sample with the change of temperature. Mercury analyzer using EPA 1631 method was used to measure the concentration of mercury ions and removal efficiency was determined to be more than 95%.

**Keywords:** mercury removal, adsorption, silver nanostructures

Acknowledgement: This subject is supported by Korea Ministry of Environment as an “Environmental Health R&D Program.” (2013001350008).
**P57 Characterization of indoor airborne fungi in public facilities**

**Dong-Jin Kang, Ji-Yeon Lee, Eun-Min Cho* & Sung Ik Yang**

*Department of Applied Chemistry, Kyung Hee University, Yongin 446-701, Republic of Korea*

Indoor environments play important roles in human health. Airborne fungi are known as representative bioaerosol in indoor environment. It causes asthma, rhinitis, sinusitis, atopy, pneumonia, sick building syndrome etc. Especially, the relationship between indoor airborne fungi and respiratory disease was reported by several research workers. When children in the level of immunity are exposed by indoor airborne fungi, they easily get asthma. Thus, monitoring the risk of exposure to allergenic fungi and the development of preventive measures to safeguard public health, requires methods that can accurately identify airborne fungi and the method could be easily followed. Therefore, importance about indoor biological harmful factor is increasing, and characterization of these species is absolutely necessary. In this study, we have investigated the distribution of indoor airborne fungi in kindergarten and postpartum care centers using PCR analysis with primers designed from the internal transcribed spacer (ITS) regions.

Acknowledgement: This research was supported by Korea Ministry of Environment as an "Environmental Health R&D Program." (20130013500008) and NanoMaterial Technology Development Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science, ICT and Future Planning (NRF-2016M3A7B4909776).

**P58 The effects of silver nanoparticles and silver ions on airborne fungi**

**Ji-Yeon Lee, Hye Ji Jang, Seung Kyun Shin, Eun-Min Cho* & Sung Ik Yang**

*Department of Applied Chemistry, Kyung Hee University, Yongin 446-701, Republic of Korea*

Nanotechnology is gaining tremendous revolution in the present century due to its capability of modulating metals into their nanosize, which drastically changes the physicochemical properties of metals, for instance, high surface area, high reactivity, tunable pore size. However, the commercial applications of the nanoparticles have been developed rapidly by a lack of toxicology data. In particular, silver nanoparticles (AgNPs) have gained antimicrobial properties. Due to the properties, AgNPs are have been used in numerous commercial products. Therefore, they may pose a risk for humans and the environment. In this study, the toxicity of AgNPs and silver ions on fungi, *Fusarium oxysporum, Beauveria bassiana* and *Lecanicillium psalliota*, were evaluated. We have synthesized silver nanoparticles using sodium citrate as reducing agent, and three fungi were isolated from indoor air of public facilities. Physico-chemical properties of AgNPs are shown by dynamic light scattering (DLS), Zeta-potential, and transmission electron microscope (TEM).

Acknowledgement: This research was supported by NanoMaterial Technology Development Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Science, ICT and Future Planning (NRF-2016M3A7B4909776) and the Basic Science Research Program under The National Research Foundation of Korea (NRF) funded by the Ministry of Education (NRF-2013R1A1A2062438).
Expression profiles of Th2-type chemokine genes for atopic dermatitis by the *Pyropia yezoensis* extract in HaCaT cells

Yuna Ha¹, Do Yeon Seo², Taejun Han¹² & Youn-Jung Kim¹²,*,

¹Department of Cosmetic Science & Management, Graduate School, Incheon National University, Incheon, Republic of Korea
²Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea

Atopic dermatitis (AD) is pruritic inflammatory skin disease that is observed frequently in children and even in adults. Its pathogenesis has been reported by genetic background, environmental factor, immunologic abnormalities, or skin barrier dysfunction. However, it is not clear. In immunologically, chronic AD patients have increased IL-5, IL-12, and interferon-gamma mRNA-expression levels. These show that AD is Th-2 type immune response. Furthermore, AD causes the skin barrier dysfunction. *Pyropia yezoensis* is a marine red algae, which has various bioactive materials, such as MAA (mycosporin-like amino acid). This extract is known to possess anti-aging activity against UV-induced skin cell damages and antioxidant. In this study, the analysis of thymus and activation-regulated chemokine (TARC/CCL17) and macrophage-derived chemokine (MDC/CCL22) gene expression level was performed to examine effects of the *Pyropia yezoensis* extract on the Th2-type chemokines. HaCaT cells incubated with interferon-gamma (10 ng/mL) in the presence or absence of *Pyropia yezoensis* extract 40 µg/mL, 200 µg/mL, and 1000 µg/mL, respectively. Responses of Th2-type chemokine genes were depends on the concentration of extract. In conclusion, this research indicated that the anti-atopic activity of *Pyropia yezoensis* extract was appeared on the cellular and molecular levels. Through further study, the precise mechanism will be elucidated by analyzing of the inflammation induction in this cell model.

Effects of the emulsifying agent on the safety of nanoparticles in sunscreens

Ga-Young Seo¹, Ji Hyun Lee², Jin Hyeok Kim², Jung Been Shim², Hyun Joon Hong², Kim Eunsung² & Youn-Jung Kim¹²,*,

¹Department of Cosmetic Science and Management, Graduate School, Incheon National University, Incheon, Republic of Korea
²Incheon Academy of Science and Arts, Incheon, Republic of Korea
³Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea

The ways for screening the ultraviolet light has been used with chemical and mineral methods. Titanium dioxide (TiO₂), zinc oxide (ZnO), or both nanoparticles are used as a mineral sunscreen. Emulsifying agents commonly used in sunscreen are compounds including isopropyl alcohol, acidic buffer, alkali or alkali metal carbonate. These additives can be affected the penetration of nanoparticles into the skin cells or the cellular responses by physico-chemical interaction with both compounds. In this study, to evaluate the effects of some additives on the toxicity of nanoparticles (TiO₂ or ZnO) composing of the sunscreen, we conducted MTT assay to human keratinocytes, HaCaT cell line. Three additives for comparison study were selected to cyclopentasiloxane and jojoba ester commonly used in sunscreen and lecithin known to have less toxicity. First, from the results of the cytotoxicity of nanoparticles on HaCaT cell, TiO₂ was almost no toxicity, while ZnO treated group and both nanoparticles treated group were increased the cytotoxicity dependent to concentration. As a result by additives, lecithin is less cytotoxic than cyclopentasiloxane and jojoba ester, and when using lecithin as the emulsifier showed a tendency to decrease the toxicity. Therefore, our result suggests that the lecithin is safer emulsifier than cyclopentasiloxane and jojoba ester in sunscreen including nanoparticles.
Transcriptional profile of *Pyropia yezoensis* extracts in HaCaT cell

Young-Jin Lee¹, Do Yeon Seo¹, Taejun Han¹,² & Youn-Jung Kim¹,²

¹Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea
²Department of Cosmetic Science & Management, Graduate School, Incheon National University, Incheon, Republic of Korea

*Porphyra yezoensis* that includes many bioactive compounds, such as porphyra-334 or shinorine is promising candidate for useful cosmetic resources. Extracts from this red algae are able to have anti-aging activity against UV-induced skin cell damages and antioxidant or antiproliferative activities in cancer cells. And also, MeOH extract from *P. yezoensis* did not induced the cytotoxicity in human keratinocyte, HaCaT cell line. So, we would elucidate the mechanisms of action of *P. yezoensis* extract in skin cell through investigation of the transcriptional change of the HaCaT cell whole genome. Using Affymetrix Human Primeview array, we compared global gene expression profiles of HaCaT cells treated with 200 µg/mL and 1,000 µg/mL of *P. yezoensis* extract with the profile of control cells. It found that 755 up-regulated genes and 544 down-regulated genes were changed by high concentration of *P. yezoensis* extract and 182 up-regulated genes and 286 down-regulated genes by low concentration. Gene Ontology analysis showed that up-expressed transcripts by both concentrations of *P. yezoensis* extract were mainly implicated in cell cycle, response to DNA damage stress and microtubule cytoskeleton organization. And also, a broad spectrum of genes associated with immune response, epidermis development, defense response, cell adhesion and keratinocyte differentiation were down-regulated. Especially, distinctive expression pattern of some keratin genes was represented. Collectively, our results provide evidence that *P. yezoensis* extract can protect against skin-aging stress, such as oxidative stress or the inflammatory responses by transcriptional regulation.

Analysis of human plasma protein expression by toluene, ethylbenzene and xylene exposure using antibody array

Sungwoo Seo¹, Do Yeon Seo¹, Jae-Chun Ryu², Seung-Yong Hwang³ & Youn-Jung Kim¹,⁴,*

¹Department of Marine Sciences, Incheon National University, Incheon, Republic of Korea
²Cellular and Molecular Toxicology Laboratory, Center for Integrated Risk research, Korea Institute of Science & Technology, Seoul, Republic of Korea
³Department of Biochemistry, Hanyang University, Sangrok-gu, Ansan, Gyeonggi-do, Republic of Korea
⁴Department of Cosmetic Science & Management, Graduate School, Incheon National University, Incheon, Republic of Korea

Long term exposure to trace amount of volatile organic compounds (VOCs) is associated with various diseases, such as respiratory system and central nervous system disorders. Current biomonitoring methods using urinary biomarkers have been known to time-consuming and technically challenging. So, the identification of more precise and specific biomarkers is necessary, for this purpose, we investigated plasma proteins from workers exposed to toluene, ethylbenzene, and xylene using antibody array. The expression profiles of protein were different between each VOCs exposed and unexposed groups. Commonly expressed proteins by three VOCs were 16 proteins and these proteins are associated with cell proliferation, regulation of body fluidic levels, lymphocyte activation, peptidyl tyrosine phosphorylation, and etc. Among these proteins, PF4 protein was up-regulated and CD40 and IL-23p19 protein were down-regulated. And functional study on differentially expressed proteins by each VOCs was represented that biological processes including regulation of apoptosis, phosphorylation and cell migration were similar in three VOCs exposed groups. So, proteins related to these function are expected to function as biomarkers for monitoring of exposure to VOCs. Further research is required to confirm the specificity and reliability of these protein biomarkers on many of VOCs exposed workers.
**P63** Association of phthalate exposures with oxidative stress markers in prenatal and postnatal environments

Jin Hee Kim\(^1\), Jangwoo Lee\(^2\), Hyo-Bang Moon\(^3\), Jeongim Park\(^4\), Kyungho Choi\(^5\), Sung Koo Kim\(^6\) & Sungkyoon Kim\(^7\)

1Department of Integrative Bioscience & Biotechnology, Sejong University, Republic of Korea  
2Department of Environmental Health, Seoul National University, Republic of Korea  
3Department of Marine Sciences and Convergent Technology, Hanyang University, Republic of Korea  
4College of Natural Sciences, Soonchunhyang University  
5College of Medicine, Hallym University, Republic of Korea

Several studies suggested potential links of phthalates to oxidative stress markers. Limited evidence has been available for the relations between diethylhexyl phthalate (DEHP) and oxidative stress markers in prenatal and postnatal environment. Urines were collected from a total of 287 mother-baby pairs repeatedly at specific time points. We measured urinary levels of two DEHP metabolites, mono-(2-ethyl-5-hydroxyhexyl) phthalate (MEHHP) and mono-(2-ethyl-5-oxohexyl) phthalate (MEOHP), and two oxidative stress markers, free cortisol and 8-hydroxy-2'-deoxyguanosine (8-OHdG) and then estimated the relations between DEHP metabolites and oxidative stress markers using mixed effect model after adjustment for sex of infant, urine collection time, and smoking status of mother. We also calculated the risk for increase of oxidative stress markers by DEHP metabolites using GLIMMIX model after adjustment for smoking status of mother with sex of infant and urine collection time as random effects. DEHP exposure was associated with increase of oxidative stress markers (free cortisol, \(\beta = 0.22, p < 0.0001\), and 8-OHdG, \(\beta = 0.23, p < 0.0001\)). Risk for increase of oxidative stress markers by DEHP exposure was found to be 1.99 for free cortisol (OR = 1.99, \(p = 0.0019\)) and 1.60 for 8-OHdG (OR = 1.60, \(p = 0.0327\)). Our findings suggest that DEHP exposure may induce oxidative stress in prenatal and postnatal environments.

**P64** A comparison of nutrient bioextraction capacity of Pacific oysters and blue mussels in an integrated multi-trophic aquaculture (IMTA) system

Sojin Jang\(^1\), Hailong Wu\(^1\), Taejun Han\(^1\), Hojun Lee\(^1\), Jihae Park\(^3,4\), Soyeon Choi\(^5\), Je-Woo Jung\(^1\), Mi Seon Park\(^6\), Young-Dae Kim\(^6\), Byung-Hwa Min\(^7\) & Jang K. Kim\(^1\)

1Department of Marine Science, Incheon National University, Yeonsu-gu, Incheon, Republic of Korea  
2Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea  
3College of Life and Sciences and Bioengineering, Incheon National University, Yeonsu-gu, Incheon 22012, Republic of Korea  
4Department of Plant Biotechnology and Bioinformatics, Ghent University Global Campus, Yeonsu-gu, Incheon 21985, Republic of Korea  
5Department of Cosmetic Science & Management, Incheon University, Yeonsu-gu, Incheon 22012, Republic of Korea  
6Southeast Sea Fisheries Research Institute, National Institute of Fisheries Science, Tongyeong, Gyeongnam, 46083, Republic of Korea

Oysters and mussels efficiently filter suspended particulate organic matters (POMs) and are considered to be good extractive organisms in integrated multi-trophic aquaculture (IMTA) and nutrient bioextraction systems. Here, we evaluated the bioremediation ability of Pacific oysters and blue mussels in the IMTA system in Tongyeong, Gyeongnam, Korea. The growth rate of oysters was approximately 5.70% \(d^{-1}\) during the months of May and June. The growth rate was then decreased to 2.97% \(d^{-1}\) in July. The average tissue nitrogen contents of oysters and mussels were 0.84 and 2.14%, respectively. The nitrogen removal of oysters increased mgN·gDW\(^{-1}\)·d\(^{-1}\) during the months of June and July. From May to July, 2016, oysters and mussels removed over 730 and 970 kg·ha\(^{-1}\) of nitrogen, respectively from the IMTA system. Our results indicate that mussels have a high nutrient bioextraction capacity than oysters.
Species-specific characteristics and variability of carbon acquisition strategies on coastal macroalgae: implications for ocean acidification

Ju-Hyoung Kim

Faculty of Marine Applied Biosciences, Kunsan National University, Gunsan, Republic of Korea

Coastal macroalgal habitat have important roles in the shallow water systems with anthropogenic CO₂ regulations. There are many concern about dynamics of inorganic carbon species in the seawater along the ocean acidity increased consistently, thus many research is more focused on algal ecophysiology in response to ocean acidification. Among ecophysiological studies, evaluation of carbon concentrating mechanisms (CCMs) has been considered as important to forecast the responses of marine macroalgae to ocean acidification, but data are still insufficient. This study was conducted with estimation of CO₂ and HCO₃⁻ use strategies of 9 macroalgal species using photosynthesis measurement. Photosynthesis of various macroalgal species showed wide range of apparent half-saturation constant for CO₂ and HCO₃⁻. Notably, photosynthesis of Ulva pertusa and Prionitis cornea are undersaturated under ambient HCO₃⁻ concentration, thus these species will be positively affected by ocean acidification due to elevated HCO₃⁻. Also, most species have higher values of apparent half-saturation constant for CO₂, and this indicate that they could derive benefit for CO₂ utilization under elevated CO₂. Understanding these species-specific carbon use strategies might allow us to forecast ecophysiological changes in macroalgal communities in a high CO₂ world.

Selection of peptides for detection, neutralizing of botulinum toxin type E by phage display

Ga-Young Park, Se Hee Lee, Gna Ahn, Eunji Lee, Yang-Hoon Kim, & Ji-Young Ahn*

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea

Botulism is a serious paralytic disease caused by Botulinum neurotoxin (BoNT) in human and animals. BoNT is known as one of powerful neurotoxin produced by Clostridium botulinum. BoNT is classified into type A to G. Especially, Botulinum neurotoxin type E (BoNT/E) causes a food-borne botulism in human. In this study, peptides that bind to BoNT/E were obtained by random phage display technique. Phage library having target-specific peptide is selected by panning procedure. The panning of phage display consists of binding, washing, elution and amplification. BoNT/E-specific phage candidates were obtained through 4 rounds of selection including negative selection. 2 peptides were finally selected through binding activity test. Affinity of BoNT/E-specific phage candidates was measured by dot-blotting. For the future work, we will confirm blocking of BoNT-E toxicity of BoNT/E-specific peptide by cytotoxicity test. Our peptide can utilize to develop BoNT/E detection and neutralization.

Acknowledgement: This work was supported by “CRP for Agriculture Science & Technology Development (PJ010530)” Rural Development Administration, Republic of Korea.
The detection of *Rosellinia necatrix* caused pear white root rot based on loop-mediated isothermal amplification

Se Hee Lee & Ji-Young Ahn*

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea
Fax: +82-(43)-263-2301 E-mail address: jyahn@chungbuk.ac.kr

*Rosellinia necatrix* is fungal plant pathogen caused white root rot. Symptoms of the disease are early defoliation, stop of developing new growth, stem dieback and so on. Because the fungal pathogen has broad host range and can survive at soil over 4~5 years, the serious economic loss has been causing on farms. However, there were no methods for distinct prevention of the fungal pathogen-infection. Loop-mediated isothermal amplification method is nucleic acid amplification method. It can amplify target in isothermal without the need to change temperature by using 2~3 pairs of specific primer set and bst polymerase. Also, it has very high sensitivity and applicability about various targets. Therefore, it is gaining a greater spotlight as convenient, sensitive and quick diagnosis method of infectious diseases. However, there were no methods for distinct prevention of the fungal pathogen-infection. So, we designed detection methods of *R. necatrix* for early diagnosis based on LAMP methods. First of all, LAMP primers were then specifically designed from the sequence information. LAMP experimental condition such as temperature and time of reaction, concentration and ratio of primer was optimized by systematic experiments. It was performed to compare LAMP amplification efficiency with conventional PCR and Real-time PCR.

Acknowledgement: This work was carried out with the support of "Cooperative Research Program for Agriculture Science & Technology Development (Project title: Development of diagnostic method for major tree fruit diseases and Biological control, Project No: PJ01191701)" Rural Development Administration, Republic of Korea.

Identification of LAMP condition to amplify dsDNA template for detection of *Rosellinia necatrix* scaffold

Se Hee Lee & Ji-Young Ahn*

Department of Microbiology, Chungbuk National University, Cheong-Ju, Republic of Korea
Fax: +82-(43)-263-2301 E-mail address: jyahn@chungbuk.ac.kr

Loop mediated isothermal amplification (LAMP) is nucleic acid amplification method. It can amplify target in isothermal without the need to change temperature by using 2~3 pairs of specific primer set and bst polymerase. Also, it has very high sensitivity and applicability about various targets. Therefore, it is gaining a greater spotlight as convenient, sensitive and quick diagnosis method of infectious diseases. Detection methods of pathogens based on molecular biology are northern blotting, dot blotting by using specific probe, PCR and real-time PCR. Because the methods require much expensive equipment and complex procedure, development of enhanced methods, which are applicable in field is now essential. Thus, we studied simple detection method of pathogens on the basis of LAMP method. At first, we specifically designed 2~3 pairs primer sets from the dsDNA template sequence information. LAMP condition such as temperature and time of reaction, concentration and ratio of primer was optimized by systematic experiments. It was performed to compare LAMP amplification efficiency with conventional PCR and real-time PCR.

Acknowledgement: This work was carried out with the support of "Cooperative Research Program for Agriculture Science & Technology Development (Project title: Development of diagnostic method for major tree fruit diseases and Biological control, Project No: PJ01191701)" Rural Development Administration, Republic of Korea.
Induction of thioredoxin reductase 1 by crotonaldehyde as an adaptive mechanism in human umbilical vein endothelial cells

Hong Duck Yun¹, Seung Eun Lee², Hye Rim Park¹ & Yong Seek Park²,*

¹Department of Biomedical Science, Graduate School, Kyung Hee University, Seoul, Republic of Korea
²Department of Microbiology, School of Medicine, Kyung Hee University, Seoul, Republic of Korea

Cigarette smoke has been implicated as risk factors for vascular diseases. Crotonaldehyde, one of the major compounds of cigarette smoke, is a highly reactive alpha, beta-unsaturated aldehyde and a product of endogenous lipid peroxidation. Thioredoxin reductase (TrxR) is predominant in modulating the intracellular redox homeostasis. In this study, we showed that TrxR1 induction in response to low concentration of crotonaldehyde and evaluated the signaling pathways involved in human umbilical vein endothelial cells (HUVECs). Also, inhibition of TrxR1 activity significantly increased the death rate of crotonaldehyde-exposed cells. In brief, these results demonstrate that the activation of TrxR1-p38 MAPK-Nrf2 axis defines a new mechanism for the adaptive response to crotonaldehyde in human endothelial cells.

Expression profiling of microRNA in crotonaldehyde-stimulated human endothelial cells

Hye Rim Park¹, Seung Eun Lee², Hong Duck Yun¹ & Yong Seek Park²,*

¹Department of Biomedical Science, Graduate School, Kyung Hee University, Seoul, Republic of Korea
²Department of Microbiology, School of Medicine, Kyung Hee University, Seoul, Republic of Korea

α,β-unsaturated aldehyde is toxic compounds that is found in combustion of tobacco, wood and produced endogenously by lipid peroxidation. Crotonaldehyde (CRA) is one of the reactive aldehydes. It makes DNA adducts inducing reactive oxygen species (ROS) production, and increase apoptotic cell death via regulating intracellular calcium and p53 signaling pathway, which causes endothelial dysfunction and cardiovascular diseases. Micro RNAs (miRNAs) are non-coding RNAs and controls gene expression through repressing of target mRNAs. miRNA regulates many cellular function including apoptosis, development, and proliferation. Toxicant such as CRA exposure changes miRNA expression causing cellular stress, and can affect many vascular disease. In this study, we demonstrate that analysis of miRNAs in CRA stimulated human umbilical endothelial cells (HUVECs). We found 162 miRNAs were differentially expressed in CRA-treated endothelial cells and performed anti-correlations between miRNAs and mRNAs. The Gene Ontology (GO) enrichment analysis on specifically expressed miRNAs indicated significant enrichment in biological functions. Our findings support the view that CRA-treated changes in gene expression make for the improvement of cardiovascular diseases.
**P71** Integrative cross-species analysis on insulin resistance expression profile in white adipose tissues

Junghyun Jung¹, Gowoon Kim², Sunghyun Chung² & Wonhee Jang¹,*

¹Department of Life sciences, Dongguk University, Seoul 100-713, Republic of Korea
²Department of Pharmacology and Clinical Pharmacy, College of Pharmacy, Kyung Hee University, Seoul 130-701, Republic of Korea

Accumulating evidence indicates that insulin resistance (IR) is closely related to white adipose tissue, but the underlying mechanisms of IR pathogenesis are not fully understood. In this study, we conducted a meta-analysis of IR expression microarray datasets by integrating 7 datasets in human subcutaneous adipose tissue, and identified 1413 (842 up- and 571 down-regulated) genes (i.e., meta-signatures). Cross-species analysis using gene set enrichment analysis (GSEA) showed that the meta-signatures were significantly enriched in not only *in vivo* and *in vitro* IR model studies, but pharmacogenomics and gain- and loss-of-function studies for attenuating IR in overall white adipose tissue. Among meta-signatures, 211 drug-signatures (133 up- and 78 down-regulated genes) were identified using microarray datasets of human IR patients treated with thiazolidinedione and IR mouse model treated with metformin, and expression levels of 195 drug-signatures (92%) were significantly correlated with homeostatic model assessment 2 of insulin resistance and body mass index. Finally, network analysis showed that 19 genes (degree > 9) were identified and confirmed by real-time qPCR. These findings suggest that our results provide a robust genetic markers and potential therapeutic targets of IR.

**P72** A study on relationship between coplanar PCBs and heart diseases via meta-analysis

Kyoungyoung Hah & Wonhee Jang*

Department of Life sciences, Dongguk University, Seoul 100-713, Republic of Korea

Polychlorinated biphenyls (PCBs) had been widely used for transformers and hydraulic fluids, but has been banned from using due to residual toxicity. PCBs can be categorized into two structural group, coplanar and non-coplanar PCBs, depending on the number and position of chlorine. In particular, the coplanar PCBs are known as dioxin-like as well as potent toxicity compounds. In this study, the two types of coplanar PCBs, PCB77 and PCB126, were chosen for data analysis to evaluate their effects on human health. We performed meta-analysis through R GeneMeta/DOSE package, Gene Set Enrichment Analysis (GSEA). The datasets including 45 samples of microarrays contained 359 differentially expressed genes (DEGs) and 117 genes of these DEGs were associated with muscular diseases. The important feature of coplanar PCBs referred to as dioxin-like is caused by binding to aryl hydrocarbon receptor (AhR). Although studies involved in PCBs and heart diseases as well as AhR have been ongoing for many years, this is the first meta-analysis showing the correlation between coplanar PCBs and muscular disease thereby heart diseases. We show that meta-analysis data which support the hypothesis that coplanar PCBs can generate human heart diseases related to AhR.
Exploring the association between single nucleotide polymorphisms and risk of Korean serous ovarian cancer at stage IIIc through genomic approach

Yeo Jin Kim¹, Hyun Soo Kim¹, Woong Shick Ahn², Jee Young Kwon³ & Young Rok Seo¹

¹Department of Life Science, Institute of Environmental Medicine for Green Chemistry, Dongguk University Biomedical Campus, Goyang-si, Gyeonggi-do, Republic of Korea
²Department of Obstetrics and Gynecology, College of Medicine, The Catholic University of Korea, Seoul, Republic of Korea
³The Jackson Laboratory for Genomic Medicine, Farmington, USA

Globally, ovarian cancer is responsible for approximately 125,000 deaths each year. Identifying the genetic contributions to ovarian cancer will lead to advances in diagnosis and therapy. Here we analyzed SNPs through genotyping in Korean serous ovarian cancer patients at stage IIIc for the purpose of applying a pathway analysis-based approach using candidate loci. The results of statistical analysis based on the Korean HapMap showed that a total of 759 SNPs had significant differences in ovarian cancer. Our biological pathway analysis included the comparison of all SNPs with SNPs of serous ovarian cancer patients in The Cancer Genome Atlas (TCGA) to identify the molecular pathway in Korean serous ovarian cancer. The results suggest that genetic alterations associated with these signaling pathways might contribute to the discovery of unique biomarkers for diagnostic predictor of Korean serous ovarian cancer at stage IIIc.

Exploring the potential biomarker of cadmium in Daphnia magna through comparative network analysis using BLAST

Hyo Jeong Kim¹,†, Jun Hyuek Yang¹,†, Sang Min Lee¹, Yeo Jin Kim¹, Bo-Mi Kim² & Young Rok Seo¹

¹Institute of Environmental Medicine for Green Chemistry, Department of Life Science, Dongguk University Biomedical Campus, 32, Dongguk-ro, Ilsandong-gu, Goyang-si, Gyeonggi-do, 10326, Republic of Korea
²Unit of Polar Genomics, Korea Polar Research Institute, Incheon 21990, Republic of Korea
†Co-first authors

Exposure to cadmium is gradually increased and its toxicity can be fatal to organisms in aquatic environment. Daphnia magna (D. magna), a type of water flea, inhabits in water and is recommended by OECD guideline as aquatic model to test toxicity of chemicals. Through acute immobilization test, we observed a mobility change of D. magna caused by cadmium chloride exposure. The EC₅₀ value of cadmium chloride was 14.5 ppb. Using D. magna exposed to cadmium chloride at EC₅₀ Concentration, we conducted microarray analysis to investigate differential gene expression and found 247 up- and 146 down-regulated genes. We performed BLAST analysis to identify and understand the meaning of the microarray data in comparative genomics. Comparing common proteins in some species, potential biomarkers and functions are discovered through pathway analysis. Based on differential gene expression of cadmium-treated D. magna, potential biomarkers are identified. Additionally, they are investigated by functional network of mammals including human through comparative genomic analysis. By discovering these potential biomarkers, it is possible to improve prediction of cadmium exposure in aquatic environment.
**P75 Comparative genotoxicity investigation in HepG2 human hepatoma cells using comet and gamma-H2AX assays**

Hyo Jeong Kim1,2, Yeo Jin Kim1,2, Preeyaporn Koedrith1,3, Hyun Soo Kim1, Wook Jun Yu4, Jong Choon Kim5 & Young Rok Seo1,2

1Institute of Environmental Medicine for Green Chemistry, Dongguk University Biomi Campus, Gyeonggi-do, Republic of Korea
2Department of Life Science, Dongguk University Biomi Campus, Gyeonggi-do, Republic of Korea
3Faculty of Environment and Resource Studies, Mahidol University, NakhonPathom, Thailand
4Korea Institute of Toxicology, Daejeon, Republic of Korea
5College of Veterinary Medicine, Chonnam National University, Gwangju, Republic of Korea

As public interest in safety has increased the toxicity evaluation of chemicals become more important. In this study, the DNA-damaging effect of genotoxicants was examined in HepG2 cell line originated from human hepatocellular carcinoma by widely used genotoxicity assays: the comet assay and gamma-H2AX immunostaining. Four different direct/indirect genotoxicants were tested in dose-/time-dependent manner. The comet assay and the gamma-H2AX immunostaining enables detection of DNA damages in the form of DNA strand breaks with different sensitivity. Therefore, the combination of comet assay and gamma-H2AX immunostaining will be complementary tool for evaluation of various forms and degree of DNA damage. Our result also suggested that HepG2 cells could be a suitable model for assessing the genotoxicity of various mutagens and for determining the lowest genotoxic concentration. Further analysis using a larger number of chemicals is warranted to determine the sensitivity and the specificity of HepG2 with in vitro genotoxicity test.

**P76 Environmental health-risk assessment of volatile organic compounds exposure using integrated analysis**

Ji Young Hong1, So-Yeon Yu2, Gi Won Kim2, Ha Jeong Song1, Kwang Ho Lee*, Sang Wook Son3 & Seung Yong Hwang1,2,*

1Department of Bio-Nanotechnology, Hanyang University, Sangnok-gu, Ansan, Gyeonggi-do, Republic of Korea
2Department of Molecular & Life Science, Hanyang University, Sangnok-gu, Ansan, Gyeonggi-do, Republic of Korea
3Department of Dermatology, Korea University Medical Center, Seoul, Republic of Korea

With the increasing advancement of industries, environmental pollution has become conspicuous on a global scale. At this point, the requirements of the variety of systems for an early risk assessment and studies of the environmental problems for the making of such systems have been proceeding around the world. In recent decades, a number of studies have sought to evaluate the environmental risk of toxicants such as VOCs, and a variety of techniques like the microarray have been correspondingly employed; however, a dearth of the studies that evaluate the effects of such toxins with the use of an in vivo analysis still exists. For this study, the three toxicants TOL, EBZ, and XYL were selected from among the VOCs, and the mRNA-expression levels with methylation-expression levels were compared with those of the control samples to ensure reliability and to check the effects of the epigenetics. First, the mRNA-expression levels for each chemical were analyzed, so the 275 mRNAs in the TOL exposure, the 485 mRNAs in the EBZ exposure, and the 141 mRNAs in the XYL exposure were obtained as results. With these genes, the attainment of the candidate biomarkers of the 66 genes in the TOL exposure, the 148 genes in the EBZ exposure, and 43 genes in the XYL exposure was achieved with a methylation analysis. These biomarkers confirmed that the sample group was divided well into the exposed group and the control group in classification analysis. This integrated data-analysis approach and the selected biomarkers could represent a promising way to study the environmental risk assessment of VOCs.
Toxicology and Environmental Health Sciences (ToxEHS): Toxicology and Environmental Health Sciences (ToxEHS) is owned and published by The Korean Society of Environmental Risk Assessment and Health Science (KoEHS). The Journal is published four times a year in printed and electronic forms. The editorial policies are rooted in the responsibility of the editor, the associate editors, and the editorial board under the general authority of the Publications Committee and the Council.

Scope of Journal: Toxicology and Environmental Health Sciences publishes original Research Articles, Rapid Communications, and Mini Reviews. The Journal is intended to provide a venue for presenting and discussing fundamental and applied research advances relevant to the issues of local/global environments, human/animal health, and occupational safety. In particular, manuscripts with interdisciplinary approaches to solve current local/global environmental issues related with above topics are welcomed; such as cutting-edge applications in basic principles of physics, chemistry and biology, which could contribute significantly with new (or which could advance the understanding) understandings in the predictions, measurements, and assessments of the consequential effects of toxic hazardous harmful chemicals in the environment. The Journal also provides a forum for professionals in academia, industry, and government involved in the use, protection, and management of the chemicals in environment for the enhancement of human health and occupational safety. Lastly, the journal focuses on the applications of sciences and technologies in environmental decision-making, regulations, and management, and the development of science-based solutions of local/global issues of environment, health, and safety.

Publication Ethics

Manuscripts submitted for publication must contain a statement to the effect that all human studies have been approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments. It should also be stated clearly in the text that all persons gave their informed consent prior to their inclusion in the study. Details that might disclose the identity of the subjects under study should be omitted.

The editors reserve the right to reject manuscripts that do not comply with the above-mentioned requirements. The author will be held responsible for false statements or failure to fulfill the above-mentioned requirements. Experiments causing pain or discomfort to animals must be performed according to the guidelines of the International Association for the Study of Pain as published in Pain 1983; 16:109-110. In accordance with these guidelines, authors performing such experiments must justify explicitly that the procedures used are scientifically necessary and that the minimum possible pain or stress has been imposed on the animals. For all animal studies which extend beyond a first hypothesis generation, a sample size calculation should be provided. Authors should also indicate whether the experimental work was reviewed by an ethics committee or its equivalent.

Other ethical considerations should be in keeping with the most recent guidelines of the International Committee of Medical Journal Editors (www.icmje.org). In addition, a statement must be provided as part of a covering letter, signed by all authors, which approves the manuscript for publication, states that the manuscript has not been published in part or as a whole elsewhere and indicates source(s) of funding and absence of any possible conflicts of interest.

Clinical trials should be presented in accordance with the revised CONSORT statement as published in several leading journals (e.g. http://www.biomedcentral.com/1471-2288/1/2). As outlined in this statement, a patient flow chart should be included in all clinical trials submitted for publication.

Instructions for Authors

Types of papers: Three types of manuscripts are accepted, rapid communication, full-length research articles and minireviews. Authors are urged to keep the length of manuscripts below four printed pages for the rapid communications (12 typed pages of manuscript in double spacing including figures and tables), and eight printed pages for research articles and minireviews (24 typed pages of manuscript in double spacing including figures and tables). All minireviews are published through invitation only with suggested subjects by the
ToxEHS Editor.

**Language of paper:** All manuscripts should be written in English. Authors, who are unsure of proper English usage, should have their manuscripts checked by someone with English proficiency (or native English speaker). **Manuscripts may be editorially rejected, without review, on the basis of poor English or lack of conformity to the standards set forth in these Instructions.** All manuscripts submitted for publications will be screened for English by the professional English editor in ToxEHS.

**Publication charges:**
Authors are required to pay page charges of US$20 (₩20,000) (based on the number of typeset pages, including illustrations, in the article). Authors, whose research was supported by grants, special funds (including departmental and institutional), or contracts (including governmental) or whose research was done as part of their official duties (government or corporate, etc.), are required to pay page charges. In recognition of the different economic conditions and professional needs among authors, publication charges may be waived if deemed appropriate by the editorial board. Authors may apply for a waiver of the charges at the time of submission.

**Color charges:** Authors will be assessed US$100 (₩100,000) for each page containing color figure(s). Color figures can generally be reproduced in acceptable quality in black and white, if authors are unwilling or unable to pay for color charges.

**Copyright:** To maintain and protect the Society’s ownership and rights, and to continue to afford scientists with opportunities to publish in high-quality journals, the corresponding author must sign a copyright transfer agreement to The Korean Society of Environmental Risk Assessment and Health Science on behalf of all the authors on acceptance.

**Materials availability:** By publishing in the journal, the authors are obligated to honor any reasonable request by qualified investigators for unique propagative materials, such as cell lines, hybridomas, and DNA clones, which are described in the paper. Authors must disclose any restrictions on the availability of materials or information upon submission of the manuscript.

**Review process:** All manuscripts are considered to be confidential and are reviewed by the editors, members of the editorial board, or qualified ad hoc reviewers. All manuscripts submitted to ToxEHS are reviewed critically, and it is the responsibility of the editors, the associate editors, and editorial board to determine the suitability for the publication. After receipt of a manuscript by the editor, it is sent to an associate editor, who usually assigns it to a member of the editorial board. The board member then makes a definitive recommendation for the acceptance, revision, or rejection based on the scientific merit and technical quality of the reported study. Referees may be consulted when additional expertise is required. All board members and referees who review a manuscript remain unknown to the authors. Every manuscript is treated by the reviewers as a privileged communication.

**Manuscript submission:** All submitted manuscripts should contain original research, which has not been published previously and is not under consideration for publication elsewhere. Submit a digital file including high quality graphics prepared in appropriate formats. A cover letter must be included, indicating the address, telephone and fax numbers, and e-mail address of the corresponding author. The preferred format is Microsoft Word; however, other formats such as WordPerfect and Acrobat PDF are also acceptable. Manuscripts and other materials will not be returned unless specifically requested. Send manuscript and correspondence to:

**Editors-in-Chief Toxicology and Environmental Health Sciences (ToxEHS)**
The Korean Society of Environmental Risk Assessment and Health Science (KoEHS)  
E-mail: toxehs@gmail.com  
Editors-in-Chief: Ryu, Jae-Chun & Ahn, Ji-Young  
Technical Manager: Kim, Youn-Jung & Lee, Se Hee  
Online submission: http://www.springer.com/13530

**Preparation of manuscript:** Authors should format rapid communications, research articles or minireviews using ToxEHS’s Microsoft Word template. The style tags in the template should be deleted before submission. Contributions should be double-spaced and written in English (spellings as in the Oxford English Dictionary). Contributions should be organized in the sequence: title, author list, text, methods, references, acknowledgements, tables, figure legends, and Supplementary Information line (if any). When providing word counts for the editors, authors need only to state the number of words in the text (and, separately, methods and total figure legends). Title, acknowledgement and other matter do not need to be included in the word count. Full-length papers and minireviews should be no more than 8 typeset pages of ToxEHS. An uninterrupted page of text contains about 300 words. A typical papers and reviews contain about 3,000 words of text and, additionally, five small display items (figures and/or tables) with brief legends. When submitting new or revised manuscripts, authors should state in a cover letter to the editor their rough
estimate of the length of their paper in terms of number of pages of ToxEHS and fill out the format checklist. Longer papers are sometimes allowed but only if explicitly suggested by the editor. Authors of contributions that significantly exceed the limits stated here or specified by the editor will have to shorten their papers before acceptance, inevitably delaying publication.

Title: Titles do not exceed 90 characters (including spaces), and do not normally include numbers, acronyms, abbreviations or punctuation. Title should clearly and concisely reflect the emphasis and content of the paper. They should include sufficient detail for indexing purposes but be general enough for readers outside the field to appreciate what the paper is about. Please provide “running title” of paper with less than 50 words.

Author list: ToxEHS prefers authors to be listed without details of relative status, but instead to specify the contribution made by their coauthors in the acknowledgements. ToxEHS strongly encourages coauthors to specify their contributions in this way. If authors regard it as essential to indicate that two or more coauthors are equal in status, they may be identified by a symbol with the caption ‘these authors contributed equally to the work’ immediately under the address list. Present addresses appear immediately below the author list; all other essential author-related explanation is in the acknowledgements.

Text: Abstract, Introduction, Results and Discussion:

Abstract: Abstract must be a single paragraph that summarizes the main findings of the paper in 150 words or fewer. A short list of keywords up to 10 should be included immediately after the abstract as index words. These words or phrases are used for indexing or searching services. Because the abstract will be published separately by abstracting services, it must be complete and understandable without reference to the text.

Introduction: Introduction should be as concise as possible, without subheadings. The introduction should present the purpose of the studies reported and their relationship to earlier work in the field. It should allow the readers to understand and evaluate the results of the present study without referring to previous publications on the topic.

Results and Discussion: Results and Discussion may be combined and may be organized into subheadings.

Methods: If brief (less than 200 words in total), they can be included in the text at an appropriate place. Otherwise, they should be described at the end of the text in a ‘Methods’ section, subdivided by short, bold headings referring to methods used. Descriptions of methods already published should be avoided; a reference number can be provided to save space, with the new addition or variation briefly stated. This whole section should not exceed 800 words and should ideally be shorter. If more space is required for Methods, the editor may suggest use of online-only supplementary information for this purpose after submission and after receiving referees’ reports. Supplementary material is also peer-reviewed.

References (Nature style): References are each numbered, ordered sequentially as they appear in text, methods, tables, figure legends. When cited in the text, reference numbers are superscript, not in brackets unless they are likely to be confused with a superscript number. The maximum number of references, strictly enforced, is 50 for full-length articles. Only one publication can be listed for each number. Only articles that have been published or submitted to a named publication should be in the reference list; papers in preparation should be mentioned in the text with a list of authors (or initials if any of the authors are coauthors of the present contribution). Published conference abstracts, numbered patents and preprints on recognized servers may be included in reference lists.

Please follow the style below in the published edition of ToxEHS in preparing reference lists.

- Authors should be included in reference lists unless there are more than five, in which case only the first author should be given, followed by ‘et al.’.

- Authors should be listed surname first, followed by a comma and initials of given names.

- Titles of articles cited in reference lists should be in upright, not italic text; the first word of the title is capitalized, the title written exactly as it appears in the work cited, ending with a full stop. Book titles are italic with all main words capitalized. Journal titles are italic and abbreviated according to common usage.

- Volume numbers are bold. The publisher and city of publication are required for books cited. (Refer to published papers in ToxEHS for details.)

- References to web-only journals should give authors, article title and journal name above, followed by url in full - or doi if known - and the year of publication in parentheses.

- References to websites should give authors if known, title of cited page, url in full, and year of posting in parentheses.
Examples:

Reference to a journal publication
Jones, R. B., Gordus, A., Krall, J. A. & MacBeath, G. A quantitative protein interaction network for the ErbB receptors using protein microarrays. Nature **439**, 168-174 (2006).

Reference to a book
McKusick, V. A. in Mendelian Inheritance in Man 12th Edn (John Hopkins University Press, Baltimore, 1998).

Reference to a chapter in an edited book
Bruce, M. E., Fraser, H., McBride, P. A., Scott, J. R. & Dickinson, A. G. in Prion Diseases of Humans and Animals (eds Prusiner, S. B., Collinge, J., Powell, J. & Anderton, B.) 497-508 (Ellis Horwood, New York, London, 1992).

Reference to a website
Global Effluent Guidelines, www.levistrauss.com/Downloads/GEG2007.pdf (2007).

Acknowledgements: Acknowledgements are brief and follow the reference list. Authors are encouraged to include a statement to specify the contributions of each coauthor. Acknowledgements contain grant or contribution numbers, but do not contain thanks to anonymous referees and editors, or effusive comments.

Tables: Table should each be presented on a separate page, portrait (not landscape) orientation, and upright on the page, not sideways. Tables have a short, one-line title in bold text. Upright roman (not bold or italic) type of the same size as the rest of the text is used. The body of the table should not contain horizontal or vertical rules; these will be added by ToxEHS when necessary after the paper has been accepted for publication. Tables should be as small as possible. Bear in mind the size of a ToxEHS page as a limiting factor when compiling a table and ensure it will reduce appropriately. Symbols and abbreviations are defined immediately below the table, followed by essential descriptive material as briefly as possible, all in double-spaced text. The preferred format for regular tables is Microsoft Word; however, WordPerfect and Acrobat PDF are also acceptable. Note that a straight Excel file is not currently an acceptable format. Excel files must be either embedded in a Word or WordPerfect document or converted to PDF before being uploaded.

Figure legends: Figure legends should be listed one after the other, as part of the text document, separate from the figure files. Please, do not write a legend below each figure. Each figure legend should begin with a brief title for the whole figure and continue with a short description of each panel and the symbols used. For contributions with methods section, legends should not contain any details of methods, or exceed 100 words (fewer than 500 words in total for the whole paper). In contributions without methods sections, legends should be fewer than 300 words (800 words or fewer in total for the whole paper).
This journal was supported by the Korean Federation of Science and Technology Societies (KOFST) Grant funded by the Korean Government.

Toxicology and Environmental Health Sciences

Publisher: Ryu, Jae-Chun
Editors-in-Chief: Ryu, Jae-Chun, Ahn, Ji-Young
Technical manager: Kim, Youn-Jung, Lee, Se-Hee

Published by

Korean Society of Environmental Risk Assessment and Health Science
Department of Marine Sciences,
Incheon National University,
119 Academy-ro, Yeonsu-gu, Incheon, Korea
Tel: +82-32-835-8861, 4564
Fax: +82-32-835-0806
Web site: http://www.ehs.or.kr/

Printed by

Junghaeng-Sa
#303, 48, Nangye-ro 28-gil, Dongdaemun-gu,
Seoul 02586, Korea
Tel: +82-2-2232-3281~2
Fax: +82-2-2232-5874
E-mail: s3213@korea.com
Web site: http://www.junghaengsa.co.kr/

Distribution by
Springer (http://www.springer.com/13530)
