

동식물 생물공학 (Animal and Plant Cell Biotechnology)

- P0401** LED Based Real-time Survival Bioassays for Nematode Research
Chaitany Jayprakash RAORANE, Jintae LEE
School of Chemical Engineering, Yeungnam University, Gyeongsan, Korea
- P0402** Human Olfactory Receptor Response Pattern to Indole
Eunjin KANG¹, Tai Hyun PARK^{1,2}
¹Interdisciplinary Program for Bioengineering, Seoul National University, Seoul, Korea, ²School of Chemical & Biological Engineering, Institute of Chemical Processes, Seoul National University, Seoul, Korea
- P0403** BMP11 Regulates Thermogenesis in Adipocytes
HUONG GIANG PHAM, SULAGNA MUKHERJEE, JONG WON YUN
Department of Biotechnology, Daegu University, College of Engineering Gyeongsan, Korea
- P0404** Development of Cell Culture Process for the Production of Recombinant Human Interferon-beta
Hyanghee CHO, Sulki LEE, Jae Myung JEONG, Duk Jae OH
Department of Integrative Bioscience & Biotechnology, Sejong University, Seoul, Korea
- P0405** Random Mutagenesis of Micro-algae, *Haematococcus pluvialis*, Using Gamma Ray Irradiation
Hye Won YOO, Yun Hwan PARK, Yoon-E CHOI
Environmental Science & Ecological Engineering, Korea University, Seoul, Korea
- P0406** Electrical Stimulation Enhances Osteogenic Differentiation in Mesenchymal Stem Cell
Hyeyeon MOON, Dongjoo KIM, Soonjo KWON
Department of biological Engineering, Inha University, Incheon, Korea
- P0407** Hypoxia-enhanced Production of Mesenchymal Stem Cells in Microcarrier Based Suspension Culture
Hyoungki KIM, Soonjo KWON
Department of biological Engineering, Inha University, Incheon, Korea
- P0408** Application of TFF(Tangential Flow Filtration) Perfusion System Using a HF(Hollow Fiber) for rCHO Cell Cultures
Hyunwoo KIM, Duk Jae OH
Department of Integrative Bioscience & Biotechnology, Sejong University, Seoul, Korea
- P0409** LongR³IGF-1 and Lysophosphatidic Acid as Growth Factors in CHO Cell Serum-Free Medium
Jeonghwan KIM, Duk Jae OH
Department of Integrative Bioscience & Biotechnology, Sejong University, Seoul, Korea

- P0410** Reconstruction of Liver-Kidney Interaction in Hypoxia Condition on Microfluidic Device
Jongkwon PARK, Soonjo KWON
 Department of Biological Engineering, Inha University, Incheon, Korea
- P0411** Hypergravity Enhances Natural Killer Cell-Mediated Cytotoxicity against Breast Cancer Cells
Minseon LEE, Dongjoo KIM, Soonjo KWON
 Department of biological Engineering, Inha University, Incheon, Korea
- P0412** Anti-inflammatory Effect of Rhodiola Rosea Callus Extract Response to the Particulate Matter Stress
Miyoung LEE¹, Kyungmin LEE¹, Gil-Yong LEE¹, Eunsoo KANG¹, Hee Won CHO¹, YoonHwan CHOI¹, Cheol Seung JEONG², Kee Yoeup PAEK²
¹R&D center, Kolon Life science, Seoul, Korea, ²Wellgreen, Cheongju, Korea
- P0413** Development of Microcarrier Cell Culture Process for Adherent Cells in a Single-Use Bioreactor System, CEL-BIC™
SEOHYUN PARK, DUK JAE OH
 Department of Integrative Bioscience & Biotechnology, Sejong University, Seoul, Korea
- P0414** Physical and Biological Evaluation of a Newly Developed Single-use Multi-bioreactor Cell Culture System
Seunghyun WANG¹, Beomseok PARK¹, Donghoon KIM², Doohyun KIM³, Duk Jae OH¹
¹Department of Integrative Bioscience & Biotechnology, Sejong University, Seoul, Korea, ²SPL Life Sciences Co., Ltd, Pocheon, Korea, ³E-cell Co., Ltd, Anyang, Korea
- P0415** Development of Hyperosmotic Resistant Recombinant Cell Lines Using Aldose Reductase Gene
Soo Ah JEONG, Jung Eun HEO, Duk Jae OH
 Department of Integrative Bioscience & Biotechnology, Sejong University, Seoul, Korea
- P0416** Roles of Colony Stimulating Factor in Obesity
Sulagna MUKHERJEE, Jong Won YUN
 Department of Biotechnology, Daegu University, Gyeongsan, Korea
- P0417** An Optimized Strategy for Efficient Multiple Targeted Integration with CRISPR/Cas9-mediated Homology-Directed Repair Pathway in CHO cells
Sung Wook SHIN¹, Jae Seong LEE^{1,2}
¹Department of Molecular Science and Technology, Ajou University, Suwon, Korea, ²Department of Applied Chemistry and Biological Engineering, Ajou University, Suwon, Korea
- P0418** A Novel Approach to Prove Relationship Between Light Source and Production of Microalgal Biomass in CC406 Using a Microstructure-based Culture Platform and Arduino
Yun Hwan PARK¹, Hye Won YOO¹, Jae Won PARK², Yoon-E CHOI¹
¹Environmental Science & Ecological Engineering, Korea University, Seoul, Korea, ²Department of Electrical and Electronic Engineering, Southern University of Science and Technology, Shenzhen, China

- P0419** Beneficial Effects of Alginate Hydrogel with Chitosan on Plant Growth
Hyeonseok KIM, Yongsang YOON, Su-Bin HWANG, Yeongje KIM, Hyewon SONG,
Mi-Kyeong JANG
Department of Polymer Science and Engineering, Suncheon National University, Suncheon, Korea
- P0420** Evaluation of Replacement Ratio of Mixed Organic Compound Fertilizer for Basal Application of Inorganic Fertilizers in Lettuce Cultivation at the Plastic Film House Soil
Myung-Sook KIM, Seong-Jin PARK, Seong-Heon KIM, Hyun-Young HWANG, Jae-Eun RIM, Kyoung Ah RYU
Division of Soil and Fertilizer, National Institute of Agricultural Sciences, Rural Development Administration, Wanju, Korea
- P0421** Functional Characterization of a Rice Thioredoxin M Isoform and Its Interaction Proteins
Seong-Cheol PARK¹, Yongjae LEE², Jung Ro LEE³, Mi-Kyeong JANG¹
¹Department of Polymer Science and Engineering, Suncheon National University, Suncheon, Korea,
²Department of Nutrition and Food Science, Texas A&M University, College Station, TX, USA,
³Department of Biochemistry and Biophysics, Texas A&M University, College Station, TX, USA
- P0422** Anti-apoptotic Effects of 30Kc19-30Kc6 Against Anoikis for Mesenchymal Stem Cell Therapies
Yeong Kyu PARK¹, Tai Hyun PARK^{1,2}
¹Interdisciplinary Program for Bioengineering, Seoul National University, Seoul, Korea, ²The School of Chemical and Biological Engineering, Institute of Chemical Processes, Seoul National University, Seoul, Korea

시스템 생물공학 및 합성생물학 (Systems Biotechnology and Synthetic Biology)

- P0501** Implementing Tug of War Strategy to Optimize 3,4-Dihydroxybutyric Acid Production from D-Xylose via Dahms Pathway in *Escherichia coli*
Angelo BAÑARES¹, Kris Niño VALDEHUESA¹, Teklebrahan WELDEMHRET¹, Grace NISOLA¹, Won-Keun LEE², Wook-Jin CHUNG¹
¹Department of Energy Science and Technology (DEST), Energy and Environment Fusion Technology Center (E2FTC), Myongji University, Yongin, Korea, ²Division of Bioscience and Bioinformatics, Myongji University, Yongin, Korea
- P0502** Genome-scale Evaluation of Core One-carbon Metabolism in Gamma-proteobacterial Methanotrophs Grown on Methane and Methanol
Anh Duc NGUYEN¹, JoonYoung PARK², In Yeub HWANG¹, Richard HAMILTON³, Marina G. KALYUZHNYAYA³, Donghyuk KIM², Eun Yeol LEE¹
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- P0503** Heterologous Expression of FK506 Biosynthetic Gene Clusters (BGCs) through TAR Direct Cloning in *Streptomyces coelicolor*
Boncheol GU, Min-Kyu OH
 Department of Chemical & Biological Engineering, Korea University, Seoul, Korea
- P0504** Towards Engineering an Orthogonal Protein Translation Initiation System
Byeong Sung LEE¹, Woon Jong CHOI¹, Sang Woo LEE¹, Byoung Joon KO², Tae Hyeon YOO^{1,3}
¹Department of Molecular Science and Technology, Ajou University, Suwon, Korea, ²New Drug Development Center, Osong Medical Innovative Foundation, Cheongju, Korea, ³Department of Applied Chemistry and Biological Engineering, Ajou University, Suwon, Korea
- P0505** Optimal Metabolic Flux Rebalancing for Efficient Production of 3-Hydroxypropionic Acid from Glycerol in *Escherichia coli*
Chae Won KANG¹, Hyun Gyu LIM¹, Myung Hyun NOH¹, Sunghoon PARK², Gyoo Yeol JUNG^{1,3}
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- P0506** Sensitive One-step Detection of Pathogen-derived RNAs
Chang Ha WOO¹, Sungho JANG², Giyoung SHIN¹, Gyoo Yeol JUNG^{1,2}, Jeong Wook LEE^{1,2}
¹School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology, Pohang, Korea, ²Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea
- P0507** Microbial Production of Tryptophan Derivatives in *Escherichia coli*
Da Ae GWON¹, Joo Yeon SEOK², Gyoo Yeol JUNG^{1,2}, Jeong Wook LEE^{1,2}
¹Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea, ²School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology, Pohang, Korea
- P0508** Strategy for Improvement of Catabolic Pathway in *Pseudomonas putida* KT2440 to Increase Production of 4-Hydroxyvalerate from Levulinic Acid
Daegeun CHA¹, Sung Kuk LEE^{1,2}
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- P0509** Improvement of 5-aminolevulinic Acid Production in *Escherichia coli* via Elaborate Flux Re-distribution of Glyoxylate Shunt
Daeyeol YE¹, Hyun Gyu LIM¹, Myung Hyun NOH¹, Dongyeop BAEK¹, Sunghoon PARK², Sang Woo SEO³, Gyoo Yeol JUNG^{1,4}
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- P0510** Improvement of Itaconate Production in *Escherichia coli* Using Acetate as a Substrate
Daeyeol YE¹, Hyun Gyu LIM¹, Myung Hyun NOH¹, Gyoo Yeol JUNG^{1,2}
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- P0511** Genomic and Metabolic Analysis of Engineered Xylose Metabolism in *Corynebacterium glutamicum*
Dong Hyun LEE¹, YooJin LEE¹, Seung Soo LEE¹, Donghyuk KIM², Han Min WOO¹
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- P0512** Genetic Mutator Device to Accelerate Adaptive Laboratory Evolution
Donghyeon KIM, Sungho JANG, Gyoo Yeol JUNG, Jeong Wook LEE
Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea
- P0513** Carbon Analysis of Heterotrophic and Photoautotrophic Production of Isoprenoids in Metabolically-engineered Microorganisms
Doohyun KANG, Sung Cheon KO, Han Min WOO
Department of Food Science and Biotechnology, Sungkyunkwan University (SKKU), Suwon, Korea
- P0514** Comparative Genomic Analysis Reveals an Evolutionary Trace in the Genome of *Erwinia pyrifoliae*, a Black Shoot Blight Pathogen
GYU Min LEE¹, Seyoung KO², Donghyuk KIM^{1,2}, Chang-Sik OH³
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P0515 [Showcase Poster]

Effective Detection of Hazardous Compounds with Biosensor Mixture and 3D Printed Remote Monitoring Device

Haseong KIM^{1,2}, Eugene RHA¹, Soo-Jin KIM¹, Wonjae SEONG^{1,2}, Hyewon LEE¹, Seung-goo LEE^{1,2}

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P0516 Organophosphorus Pesticide Biosensor Construction Using Bio-part Library

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P0517 Metabolic Engineering of an Oleaginous Bacterium for the Production of Fatty Acid and Fuels

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P0518 Metabolic Engineering Using Synthetic Small Regulatory RNAs for Overproduction of Tyrosine and Cadaverine in *Escherichia coli*

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P0519 Metabolic Engineering of *Escherichia coli* for Renewable Production of 1,3-Diaminopropane: C3 Linear Chain Diamine

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P0520 Microbial Production of 4,5 and 6-carbon Lactams via Novel Metabolic Engineering

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- P0521** Efficient Expression of Functional Peptides Using Repeated Sequence in *Escherichia coli*
Hye Min SONG, Si Jae PARK
Division of Chemical Engineering and Materials Science, Ewha Womans University, Seoul, Korea
- P0522** Squalene Production in Engineered *Corynebacterium glutamicum* Using Coryne-CRISPRi
Hyeonbae LIM, Jaehyun PARK, Hye Jeong CHO, Han Min WOO
Department of Food Science and Biotechnology, Sungkyunkwan University (SKKU), Suwon, Korea
- P0523** Using Production-base Selection Evolved Alkane Degradation Protein for High Production of Azelaic Acid Ester from Esterified Nonanoic Acid
Hyun wook JUNG¹, Yong Joo LEE¹, Sathesh-Prabu CHANDRAN², Sung Kuk LEE^{1,2}
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- P0524** Two Step ChIP-exo Peak Calling Convolutional Neural Network
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- P0525** Reconstruction of Pan-regulons for Fur Uncovers the Conservation of Its Transcriptional Gene Regulatory Network in the *Escherichia coli*
Ina BANG¹, Ye GAO², Gayoung NAM¹, Sang Woo SEO³, Eun Yeol LEE⁴, Bernhard O. PALSSON², Donghyuk KIM¹
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- P0526** Application of Polyketide Synthase-based Malonyl-CoA Biosensor for Production of Natural Compounds in Bacteria
Dongsoo YANG^{1,2}, Won Jun KIM^{1,2}, Seung Min YOO^{1,3}, Jong Hyun CHOI⁴, Shin Hee HA¹, Mun Hee LEE^{1,2}, Yae Seul PARK¹, Sang Yup LEE^{1,2,3,5}
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- P0527** Systematic Scheme for the Creation of Gene-Transcript-Protein-Reaction Associations in Human Metabolism
 Jae Yong RYU, Hyun Uk KIM, Yae Seul PARK, Sang Yup LEE
 Metabolic and Biomolecular Engineering National Research Laboratory, Systems Metabolic Engineering and Systems Healthcare Laboratory, Dept. of CBE (BK21 Plus Program), KAIST, Daejeon, Korea
- P0528** Top-notch Production of Astaxanthin Through Metabolic Engineering in *Escherichia coli*
 Seon Young PARK, Robert M. BINKLEY, Won Jun KIM, Mun Hee LEE, Yae Seul PARK, Sang Yup LEE
 Metabolic and Biomolecular Engineering National Research Laboratory, Dept. of Chemical and Biomolecular Engineering (BK21 Plus Program), KAIST, Daejeon, Korea
- P0529** Utilizing Scaffold Engineering of Synthetic sRNAs for Wide-range Gene Expression
 Minhoo NOH¹, Seung Min YOO^{2,3}, Dongsoo YANG^{1,4}, Yae Seul PARK¹, Sang Yup LEE^{1,3,4}
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- P0530** Pan-genome Analysis with Newly Isolated *Mycobacterium avium* subsp. *paratuberculosis* Highlights Unique Genomic Features of Its Subgroups
Jaewon LIM¹, Hong-Tae PARK², Gyumin LEE³, Hyun-Eui PARK², Han Sang YOO², Donghyuk KIM^{1,3}
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- P0531** Scaffold Engineering of Synthetic sRNAs for Diversity and Versatility of Gene Repression
Jinho YEOM¹, Jong Seong PARK¹, Minhoo NOH², Dongsoo YANG², Sang Yup LEE², Seung Min YOO¹
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P0532 Metabolic Engineering of *Escherichia coli* Strains for One-Step Production of Aromatic Polyester from Glucose

Jung Eun YANG¹, Si Jae PARK², Won Jun KIM¹, Hyeong Jun KIM³, Bumjoon J. KIM³, Hyuk LEE⁴, Jihoon SHIN⁵, Damla HUC CETOGULLARI¹, Sang Yup LEE^{1,6,7}

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P0533 Engineered *Escherichia coli* Strain for Efficient Production of Ethylene Glycol from Xylose

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P0534 Efficient Production of 2-Pyrone-4,6-dicarboxylic Acid from Glucose by Metabolically Engineered *Escherichia coli*

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P0535 Engineering *Escherichia coli* for the Biosynthesis of Terephthalic Acid from p-Xylene

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P0536 FadR Based Biosensor for Monitoring Cell to Cell Variation of Fatty Acid Biosynthesis in *Yarrowia lipolytica*

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P0537 Characterization of Embden-Meyerhof-Parnas Pathway Distrupted *Escherichia coli* Mutant

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P0538 In silico Analysis of Interaction Between PgCYPs and Herbicides and Salicylic Acid

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P0539 Interpretation of Inverted Retina Using Coded Application

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P0540 Enhanced Production of L-tyrosine in *Escherichia coli* by Fine-tuning of Metabolic Pathway through 5'-UTR Design

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P0541 Development of Metabolic Engineered *Pseudomonas Putida* Strain for Simultaneous Utilization of Glucose and Xylose

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P0542 Production of Polyhydroxyalkanoates from Sugarcane Molasses by Recombinant *Ralstonia eutropha* Strains

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P0543 Metabolic Engineering of *Escherichia coli* for High-level Production of Poly(2-hydroxyisovalerate-co-lactate)

Seong Jin PARK¹, Jung Eun YANG¹, Je Woong KIM¹, Young Hoon OH², So Young CHOI¹, Hyuk LEE³, A-Reum PARK³, Jihoon SHIN², Si Jae PARK⁴, Sang Yup LEE¹

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P0544 Metabolic Engineering of *Escherichia coli* for One-step Biosynthesis of Aromatic Polyesters from Glucose

Seong Jin PARK¹, Jung Eun YANG¹, Si Jae PARK², Won Jun KIM¹, Hyeong Jun KIM¹, Bumjoon J. KIM¹, Hyuk LEE³, Jihoon SHIN⁴, Sang Yup LEE¹

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P0545 Development of Metabolically Engineered *Escherichia coli* for One-step Biosynthesis of Poly(lactate-co-glycolate) from Carbohydrates

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P0546 Biosynthesis of 3-hydroxypropionic acid and Malonic Acid through Beta-alanine Route by Recombinant *Escherichia coli*

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P0547 Coding Sequence-independent, Tunable Gene Expression Toolbox for Bacteria Engineering

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P0548 Genomic and Phenotypic Characterization of a Lytic Bacteriophage CF1 Infecting the Multi-drug Resistant Bacterium *Citrobacter freundii*

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- P0549** RNA Toehold Switch Sensor for On-site Detection of MERS-coronavirus
Soan PARK, Jeong Wook LEE
 Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea
- P0550** Metabolic Construction of Secondary Alcohol Production in *Eubacterium limosum* KIST612
Soyoung OH, Minseok CHA, Byeongchan KANG, In Seop CHANG
 School of Earth Sciences and Environmental Engineering, Gwangju Institute of Science and Technology (GIST), Gwangju, Korea
- P0551** Metabolic Engineering of *Pseudomonas denitrificans* for the 1,3-propanediol Production from Glycerol
Suman LAMA¹, Shengfang ZHOU^{1,2}, Sunghoon PARK^{1,3}
¹School of Energy and Chemical Engineering, UNIST, Ulsan, Korea, ²School of Life Sciences, Jiangsu Normal University, Xuzhou, China, ³School of Chemical and Biomolecular Engineering, Pusan National University, Busan, Korea
- P0552** Development of a Genome Editing Tool for *Pseudomonas putida*
Sunho CHO¹, Daegeun CHA¹, SungKuk LEE^{1,2}
¹School of Life Sciences, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Korea, ²School of Energy & Chemical Engineering, Ulsan National Institute of Science and Technology(UNIST), Ulsan, Korea
- P0553** Transcriptomics Studies of a Less-characterized Transcription Factor Responsible for 3-HP Tolerance Shed Light on General and Novel Acid Tolerance Mechanisms
Thuan PHU NGUYEN-VO^{1,2}, Seyoung KO¹, Jung Rae KIM², Donghyuk KIM¹, Sunghoon PARK^{1,2}
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- P0554** Acetate as a Potential Feedstock for Production of 3-hydroxypropionic Acid
Yeonhee KIM, Suman LAMA, Dat NGUYEN TUAN, Chaeho IM, Sunghoon PARK
 School of Energy and Chemical Engineering, Ulsan National Institute of Science and Technology, Ulsan, Korea
- P0555** Metabolic Engineering of *Corynebacterium glutamicum* for Extracellular Production of l-cysteine via Plant-derived Alternative Pathway
Young Jin KO, Young-chul JOO, Minhye KIM, Sung Ok HAN
 Department of Biotechnology, Korea University, Seoul, Korea
- P0556** Current Limitation and Future Prospect of The CRISPR-Cas System Understood Through Conversion of Xylose to Glycolate in *Corynebacterium glutamicum*
Yu Been HEO, Seung Soo LEE, Phil KIM, Han Min WOO
 Department of Food Science and Biotechnology, Sungkyunkwan University (SKKU), Suwon, Korea

P0557 DeepEC: a Computational Framework for Prediction of Enzyme Commission Numbers Using Deep Learning Method

Jae Yong RYU^{1,2,3,4}, Changdai GU^{1,5}, Hyun Uk KIM^{3,4,5,6}, Sang Yup LEE^{1,2,3,4,5}

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P0558 A Deep Learning Method for Prediction of Drug-Drug and Drug-Food Interactions

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P0559 Development of Rapid and Multiplex Knockdown Platform in *Escherichia coli* Using Expanded Synthetic sRNA Expression System

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P0560 Systematic Characterization of Liver Cancer Stem Cells

Jae Yong RYU¹, Wonhee HUR², Hyun Uk KIM^{1,3}, Sung Woo HONG², Eun Byul LEE², Changdai GU¹, Sang Yup LEE^{1,3,4}, Seung Kew YOON^{2,5}

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P0561 RecET Recombineering System Can Edit Genomic DNA of *Pseudomonas putida* without Markers

Kyeong Rok CHOI¹, Jae Sung CHO¹, In Jin CHO¹, Dahyeon PARK¹, Sang Yup LEE^{1,2,3}

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P0562 Metabolic Engineering of *Escherichia Coli* for the Production of Ultra-molecular Weight Spider Silk

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P0563 Enhanced Putrescine and L-proline Production in *Escherichia coli* with Systems Metabolic Engineering Using Synthetic Small Regulatory RNA

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P0564 Secretory Heme Production by Metabolically Engineered *Escherichia coli*

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P0565 Construction of a Synthetic Methylophilic *Escherichia coli* Equipped with Reconstructed One-carbon Assimilation Pathways

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P0566 Fermentative Production of Gamma-Butyrolactone in Metabolically Engineered *Mannheimia succiniciproducens*

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- P0567** Bio-based Production of Short Chain Alkanes Using Metabolically Engineered *Escherichia coli*
Yong Jun CHOI¹, Junho BANG^{1,2}, Sang Yup LEE^{1,2,3}
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- P0568** Biosynthesis of Single-and Multi-element Nanoparticles Using Recombinant *Escherichia coli*
Yoojin CHOI¹, Tae Jung PARK², Doh C. LEE³, Junho BANG¹, Sang Yup LEE¹
¹Metabolic and Biomolecular Engineering National Research Laboratory, Department of Chemical and Biomolecular Engineering (BK21 Plus Program), BioProcess Engineering Research Center and Institute for the BioCentury, KAIST, Daejeon, Korea, ²Department of Chemistry, Research Institute for Halal Industrialization Technology, Chung-Ang University, Seoul, Korea, ³Department of Chemical and Biomolecular Engineering (BK21 Plus Program), Korea Advanced Institute of Science and Technology (KAIST), Daejeon, Korea
- P0569** Membrane Engineering of *Mannheimia succiniciproducens* to Produce trans-unsaturated Fatty Acids Improves Succinic Acid Tolerance
Jung Ho AHN, Jong An LEE, Junho BANG, Sang Yup LEE
Metabolic and Biomolecular Engineering National Research Laboratory, Department of Chemical and Biomolecular Engineering, KAIST, Daejeon, Korea
- P0570** Bio-based Homo-succinic Acid Production by Metabolically Engineered *Mannheimia succiniciproducens*
Jung Ho AHN, Jeong Wook LEE, Jongho YI, Tae Yong KIM, Sol CHOI, Hyohak SONG, Moon-Hee LEE, Sang Yup LEE
Metabolic and Biomolecular Engineering National Research Laboratory, Department of Chemical and Biomolecular Engineering, KAIST, Daejeon, Korea
- P0571** Metabolically Engineered Microorganism for Methyl Anthranilate Production, a Grape Flavor Compound
Cindy Pricilia Surya PRABOWO¹, Zi Wei LUO¹, Jae Sung CHO¹, Sang Yup LEE^{1,2}
¹Metabolic and Biomolecular Engineering National Research Laboratory, Department of Chemical and Biomolecular Engineering, KAIST, Daejeon, Korea, ²BioInformatics Research Center, KAIST, Daejeon, Korea
- P0572** 5-Aminovaleric Acid Production by Metabolically Engineered *Corynebacterium glutamicum*
Cindy Pricilia Surya PRABOWO¹, Jae Ho SHIN¹, Sang Yup LEE^{1,2}
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- P0573** Development of CRISPR/Cas9-based Genome Engineering Tool for *Corynebacterium glutamicum*
Cindy Priscilla Surya PRABOWO¹, Jae Sung CHO¹, Kyeong Rok CHO¹, Jae Ho SHIN¹, Dongsoo YANG¹, Sang Yup LEE^{1,2}
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- P0574** High-level L-arginine Production by Metabolically Engineered *Corynebacterium glutamicum*
Cindy Priscilla Surya PRABOWO¹, Seok Hyun PARK¹, Sang Yup LEE^{1,2}
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- P0575** Modular Design of Metabolic Pathway for Production of N-butanol from Glucose-galactose Mixture in *Escherichia coli*
Daeyeong MUN¹, Hyun Gyu LIM¹, Jae Hyung LIM¹, Gyoo Yeol JUNG^{1,2}
¹Department of Chemical Engineering, Pohang University of Science and Technology(POSTECH), Pohang, Korea, ²School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology(POSTECH), Pohang, Korea
- P0576** Controlling Glycolytic Flux for the Design of an Optimal Cell Factory
Daeyeong MUN¹, Jae Hyung LIM¹, Gyoo Yeol JUNG^{1,2}
¹Department of Chemical Engineering, Pohang University of Science and Technology(POSTECH), Pohang, Korea, ²School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology(POSTECH), Pohang, Korea
- P0577** Experimental Promoter Identification of a Representative Food-Borne Pathogen *Salmonella Enterica* Subsp. *Enterica* Serovar Typhimurium LT2 with Near Single Base-Pair Resolution
Hoa THI LE¹, Assiya TAIZHANOVA², Ye GAO^{3,4}, Linh KHANH NONG¹, Joonyoung PARK¹, Eun-Jin LEE⁵, Bernhard O. PALSSON⁴, Donghyuk KIM^{1,6,7}
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- P0578** Effect of Light Intensity on Algicidal Activity of GreenTD
Hyeon-su YANG¹, Seong-Joo HONG¹, Hoon CHO², Choul-Gyun LEE¹
¹National Marine Bioenergy Center, Dept. Of Biological Engineering, Inha University, Incheon, Korea, ²Department of Polymer Science and Engineering, Chosun University, Gwangju, Korea

- P0579** On-chip Screening for High Performing Strains for Chemical Production in Microfluidic Static Droplet Array
JaeSeong HWANG¹, SungHo JANG², SungYeon JANG², SeongGyeong KIM², Gyoo Yeol JUNG^{1,2}
¹School of Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology (POSTECH), Pohang, Korea, ²Department of Chemical Engineering, Pohang University of Science and Technology (POSTECH), Pohang, Korea
- P0580** Development of Riboswitch-based Biosensor for *in vivo* Sensing Naringenin
JaeSeong HWANG¹, SungYeon JANG², SungHo JANG², Gyoo Yeol JUNG^{1,2}
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- P0581** Co-culture ¹³C-MFA to Produce Resveratrol with *Escherichia coli*
Jaeseung HONG, Min-kyu OH
Department of Chemical & Biological Engineering, Korea University, Seoul, Korea
- P0582** Comparative Genomic and Phenotypic Analysis of Newly Isolated Lytic *Klebsiella pneumoniae* Bacteriophages, KP1 and KP12
Linh Khanh NONG¹, Youngju KIM², Hyunil KIM², Donghyuk KIM¹
¹School of Energy and Chemical Engineering, Ulsan National Institute of Science and Technology (UNIST), Ulsan, Korea, ²Optipharm Inc., Cheongju, Korea
- P0583** Enhanced Production of Tyrosine from Acetate in *Escherichia coli* by Engineering of Glyoxylate Cycle
Minjae KIM¹, Myung Hyun NOH¹, Hyun Gyu LIM¹, Chae Won KANG¹, Dae-Kyun IM², Min-Kyu OH², Gyoo Yeol JUNG¹
¹Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea, ²Department of Chemical and Biological Engineering, Korea University, Seoul, Korea
- P0584** Promoter Systems for *Pseudomonas putida* KT2440
Sathesh-Prabu CHANDRAN¹, Sung Kuk LEE^{1,2}
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- P0585** Antibiotic-free Biochemical Production Using α -Glutamate Auxotrophic *Escherichia coli*
Seong Keun KIM¹, Seung-Gyun WOO^{1,2}, Taehyun KIM^{1,2}, Hyewon LEE¹, Seung-Goo LEE^{1,2}, Dae-Hee LEE^{1,2}
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P0586 Constructing High Free Fatty Acids Producing Strain by Introducing Combinatorial Metabolic Engineering

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바이오산업 (바이오의약부문) (Bioindustry / Biomedical Engineering)

P0601 New Hydroxylated Rhamnolipids from the Marine-Derived Actinomycete *Actinoalloteichus hymeniacidonis*

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P0602 Chitosan/Oleamide Electrospun Nanofiber with Enhanced Electrospinning Processibility and Antibacterial Activity

Eunjoon MOON, Eungsu KANG, Yoo Seong CHOI

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P0603 Molecular Mechanism on the Dermal Papilla Cell-Specific Proliferation of Vimentin Protein

Hun Taek JUNG¹, Soo-Jin ANN², Chan PARK¹, Young Ju LEE¹, Jun KANG¹, Ho Jun LEE¹, You Jin NAM¹, Ji Hyung CHUNG¹

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P0604 Native-like Osteochondral Scaffold with Gradual Structural and Physical Properties

Jinyoung YUN, Hyung Joon CHA

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P0605 Development of a Fluorescent scFv-Type Antibody for Simple and Rapid Detection of Tumor Necrosis Factor-Alpha

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- P0606** A New Detection System for Theophylline Utilizing Redox Reaction of Silver Ions Bound to the Abasic Site in the Double-Stranded DNA
Jun Ki AHN, Sang Mo LEE, Ki Soo PARK, Byoung Yeon WON, Hyun Gyu PARK
Department of Chemical and Biomolecular Engineering, KAIST, Daejeon, Korea
- P0607** Development of Novel Yeast-derived Dengue Vaccine Based on Recombinant Immunoglobulin in *Saccharomyces cerevisiae*
Kum-Kang SO¹, Satabdi ACHARYA², Jyotiranjana BAL³, Jeeseun CHUN¹, Dae-Hyuk KIM^{1,2}
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- P0608** Development of AAV Variants by Directed Evolution for Enhanced Gene Delivery in Glial Cells
Mira CHO, Seung-Hyun KIM, Jae-Hyung JANG
Department of Chemical and Biomolecular Engineering, Yonsei University, Seoul, Korea
- P0609** Blooming *Microcystis aeruginosa* Extracted Microcystins Exert Anti adipogenic and Antilipogenic Effects by Suppressing the mRNA Expression Level of the Associated Signaling Molecules
Muhammad Imran KHAN¹, Hyo Jin SEO¹, Nam Jun CHO¹, Jong Deog KIM^{1,2}
¹Department of Biotechnology, Chonnam National University, Yeosu, Korea, ²Research center on Anti-Obesity and Health Care, Chonnam National University, Yeosu, Korea
- P0610** Theasaponin E1 Decrease A β Peptides Level in APP-N2a Cells by Activating and Enhancing Activities of the A β Degrading Enzymes α -secretase and Nephilysin
Muhammad Imran KHAN¹, Jin Hyuk SHIN¹, Jong Deog KIM^{1,2}
¹Department of Biotechnology, Chonnam National University, Yeosu, Korea, ²Research center on Anti-Obesity and Health Care, Chonnam National University, Yeosu, Korea
- P0611** Neuroprotective Effects of Green Tea Seed Isolated Saponin by Inhibition of A β peptides Production due to Anti-acetylcholinesterase Activity and Downregulation of BACE1 and Presenilin-1 & 2
Muhammad Imran KHAN¹, Jin Hyuk SHIN¹, Jong Deog KIM^{1,2}
¹Department of Biotechnology, Chonnam National University, Yeosu, Korea, ²Research center on Anti-Obesity and Health Care, Chonnam National University, Yeosu, Korea
- P0612** Green Tea Seed Isolated Saponins Exert Strong Antibiotics Effects and Effectively Inhibit Zoonosis Causing Salmonella Serovars *In vitro* and *In vivo*
Muhammad Imran KHAN¹, Jun Soo BAEK¹, Sang Byuk PARK¹, Jong Deog KIM^{1,2}
¹Department of Biotechnology, Chonnam National University, Yeosu, Korea, ²Research Center on Anti-Obesity and Health Care, Chonnam National University, Yeosu, Korea

- P0613** Anthocyanins Cyanidin3-glucoside, Delphinidin3-glucoside and Pelargonidin 3-glucoside Imposed Synergistic Inhibitory Effects to Adipogenesis and Lipogenesis via Downregulation of the Related Signaling Pathways
Muhammad Imran KHAN¹, Tai Sun SHIN^{2,4}, Min Yong KIM^{3,4}, Jong Deog KIM^{1,4}
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- P0614** Development of Efficient Yeast-based Oral Vaccine Candidates Using Co1 Ligand Against Foot-and-mouth Disease (FMD) Virus of Cattle
Satabdi ACHARYA¹, Kum-Kang SO², Jyotiranjana BAL³, Jeessun CHUN², Dae-Hyuk KIM^{1,2}
¹Department of Bioactive Material Sciences, Chonbuk National University, Jeonju, Korea, ²Institute for Molecular Biology and Genetics, Chonbuk National University, Jeonju, Korea, ³NanoBio-Chemistry Laboratory, Chung-Ang University, Seoul, Korea
- P0615** Carbon Dots Based Fluorescence Biosensor for Detection of L-DOPA
Seok Won PARK, Yun Kyung JUNG
 School of Biomedical Engineering, Inje university, Gimhae, Korea
- P0616** [Review] Light-activated Adhesive Protein with Various Biomedical Applications
Seung Hyeon HWANG, Hyung Joon CHA
 Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea
- P0617** Intervertebral Disc Replaceable Biocompatible Hydrogel with Mussel Adhesive Protein Incorporated with an Insect Resilin Modif
Seung Kyeum CHO, Hyung Joon CHA
 Division Interdisciplinary Bioscience and Bioengineering, Pohang University of Science and Technology, Pohang, Korea
- P0618** Conductive and Self-healed Adhesive Hydrogel by Fe³⁺-triggered Co-polymerization of Mussel Adhesive Protein and Pyrrole
Tae Yoon PARK, Hyung Joon CHA
 Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea
- P0619** Mussel Foot Protein Mimic Mucoadhesive Dual-crosslinked Hydrogel for Stomach Ulcer Beelding
Woohyung PARK, Jaeyun LEE, Hyung joon CHA
 Department of Chemical Engineering, Pohang University of Science and Technology, Pohang, Korea
- P0620** [Showcase Poster]
 Fabrication of Microneedle Array Sensor to Detect Microplastics
Yejin KIM, Hyeeyeon HUR, Pilwoo LEE, Yoonjae KIM, Jongmin YANG, Dhanashri DESAI, Hyunho LEE
 Department of Chemical Engineering, Myongji University, Yongin, Korea

P0621 [Showcase Poster]

Nano-textured Micro Patterning on Intraocular Lens to Suppress Posterior Capsular Opacification by Regulating Lens Epithelial Cells Migration

Youngmin SEO¹, Kyungwoo LEE^{1,2}, Byoung Chan CHOI³, Choun-Ki JOO⁴, Hojeong JEON^{1,5}

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P0622 Construction of Multiplexed Amino Acid Chip by Using *Escherichia coli* Auxotrophs

ByungJo YU, Jiyeon JANG, Inseung JANG, Sungjin LEE, Yihyang KIM, Yerin HONG
Intelligent Sustainable Materials R&D group, Korea Institute of Industrial Technology(KITECH), Cheonan, Korea

P0623 Effect of ATPase Inhibitor Factor1 on the Tight Junction Proteins in Human Epidermal Keratinocytes

Chan PARK, Young Ju LEE, Hun Taek JUNG, Jun KANG, Ho Jun LEE, Jin Myeong SEO, You Jin NAM, Ji Hyung CHUNG

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P0624 Effects of PTP Sigma on Glial Scar Formation in Spinal Cord Injury Model

Dohhee KIM

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P0625 Anti-Inflammatory Metabolites from the Deep-sea Sediment-derived Fungus *Cystobasidium laryngis*

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P0626 Designing Drug Delivery Platform to Overcome Limitations of TRAIL Therapeutics

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P0627 Development of Cellulose Nanocrystal Complex with Zinc-DNA Cluster for Gene Delivery

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P0628 Inhibitory Effect of *Hypochaeris radicata* on Matrix Metalloproteinases-2 and -9 Activities

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- P0629** Effect of the *Erigeron annuus* Extracts on Inhibition of Matrix Metalloproteinases in HT-1080 Cells
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- P0630** The Application of Host-Guest Chemistry between Homocysteine and Cucurbit[7]uril
Se-Ho PARK^{1,2}, Jae-Yeul LEE^{1,2}, Seun-Ah YANG³, Hee-Joon KIM¹, Kwang-Hwan JHEE¹
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- P0631** Development of a Seed Coating Agent Using Natural Materials
SongGyeong YUN, HaeSeon KIM, JungHee WOO, NyunHo PARK
 Marine Industry Research institute for East sea rim (MIRE), Uljin, Korea
- P0632** Tunichrome Mimicked Chitosan-gallic Acid Conjugates for Tissue Adhesives and Hemostasis
Suyoung LEE¹, Naresh D SANANDIYA^{1,2}, Sangchul RHO^{2,3}, Hoik LEE⁴, Ick Soo KIM⁴, Dong Soo HWANG^{1,2}
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- P0633** Antimicrobial Activity and Dye Uptake Enhancement by Chitosan Treatment of Seaweed Dye
Youjin SEO, SunYoung PARK, HaeSeon KIM, NyunHo PARK, JungHee WOO
 Marine Industry Research Institute for East sea rim(MIRE), Uljin, Korea
- P0634** *Brevibacillus antibioticus* sp. nov., with Antibacterial Activity, Isolated from Soil in the Nakdong River
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- P0635** Synergistic Effect of Electromagnetic Fields and Nanomagnetic Particles on Osteogenesis in Saos-2 Cells
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바이오산업 (식품부문) (Bioindustry / Food Biotechnology)

- P0701** Fed-batch Cultivation of *Euglena gracilis* with the Addition of the Extracellular Polymeric Substances Derived from Marine Bacterium, *Pseudoalteromonas* sp. MEBiC 03485
Da Hee KIM, Jee Young KIM, Jeong-Joo OH, Min Seo JEON, Yoon-E CHOI
Division of Environmental Science & Ecological Engineering, Korea University, Seoul, Korea
- P0702** Comparative Analysis of Nutritional Components of Domestic and Foreign Sweet Potato Varieties
Da-Song KIM¹, Moon-Hee CHOI^{1,2}, Hyun-Jae SHIN¹
¹Department of Chemical Engineering, Graduate School of Chosun University, Gwangju, Korea, ²Institute of Engineering and Technology of Chosun University, Gwangju, Korea
- P0703** Potential of the 1,4-Dihydroxy-2-Naphthoic Acid Producing from *Weissella paramesenteroides* as *Protacetia brevitaris* Fermenter
EunShin JU¹, JeongA KIM¹, JungChul PARK², SunMee HONG¹
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- P0704** Type II Toxin-antitoxin Systems in *Methanothermobacter thermoautotrophicus*
Hae-Gang IM^{1,2}, Won-Ho CHOI¹, Jung-Ho PARK¹
¹Bio-Evaluation Center, Korea Research Institute of Bioscience and Biotechnology, Cheongju, Korea, ²Department of Food Science & Technology, Chungnam National University, Daejeon, Korea
- P0705** Protective Role of *Rhodiola sachalinensis* Extracts Fermented with *Bovista plumbea* against Oxidative Stress in Nonmalignant Human Prostate Epithelial Cells
Hyun-Ji PARK¹, Won-Yeoung CHOI², So-Hee AHN², Mi-Jin KWON³, Gye Won LEE^{1,2}, Young Ho CHO^{1,2}
¹Department of Medical Engineering & Science, Konyang University, Daejeon, Korea, ²Department of Pharmaceutics and Biotechnology, Konyang University, Daejeon, Korea, ³R&D center, PSA Co., Daejeon, Korea
- P0706** Development of Rice Beer with Enhanced Anti-oxidant Property
Kyungmin LIM, Suyeon LEE, Heeyoung PARK, Soo Rin KIM
School of Food Science and Biotechnology, Kyungpook National University, Daegu, Korea
- P0707** Enhancing the Production of Long-chain Polyunsaturated Fatty Acids (LC-PUFAs) in *Nannochloropsis salina* by Overexpressing the Heterologous and Endogenous Fatty Acid Elongase Genes
Mohammad Rifqi GHIFFARY^{1,2}, SeungJib JEON², Hyun Uk KIM², Yong Keun CHANG^{1,2}
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- P0708** Adequacy of Anti-obesity Effects of *Barley sprout*
Ye Seul PARK¹, Gun He NAM¹, Kyung Jo JO¹, Hye Won KAWK¹, Myeong Jin KIM¹, Hee Sun JIN¹, Sang Yung KIM², Young Min KIM¹
¹Department of Biological Sciences and Biotechnology, College of Life Science and Nano Technology, Hannam University, Daejeon, Korea, ²Department of Food Science & Bio Technology, Shinansan University, Ansan, Korea
- P0709** Optimization and Development of SPH-IPN Sustained-release Tablets Containing Sarpogrylate Hydrochloride
Hyun Sang JANG¹, So jeong BOO², Su Hwan LEE², Yoo Bin KIM², Eun Seo KIM², Hyeong Sik JEONG¹, Young Ho CHO^{1,2}, Gye Won LEE^{1,2}
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- P0710** Optimization and Development of SPH-IPN Gastric Retention Tablets Containing Metformin Hydrochloride
Hyun Sang JANG¹, Ji Won PAK², Se hee LEE², Chae Jeong KIM², Eun Seo KIM², Yoo Bin KIM², Hyeong Sik JEONG¹, Young Ho CHO^{1,2}, Gye Won LEE^{1,2}
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- P0711** Isolation and Characterization of *Streptomyces* sp. NIBRBAC000003276 Exhibiting Antibacterial Activity from Coastal Sand Dune
Da Som KIM, Won Jae CHI
 Biological and Genetic Resources Assessment Division, National Institute of Biological Resources, Incheon, Korea
- P0712** Isolation and Characterization of *Streptomyces* sp. NIBRBAC000498585 Exhibiting Antibacterial Activity from Soil
Da Som KIM, Won Jae CHI
 Biological and Genetic Resources Assessment Division, National Institute of Biological Resources, Incheon, Korea
- P0713** Anti-Bacterial and Anti-inflammatory Effects of *Elaeagnus umbellata* Leaf Extract
Ha-Rin KANG, Jong-Kang JUNG, Seun-Ah YANG
 Department of Food Science and Technology, Keimyung University, Daegu, Korea
- P0714** Optimization of Sustained Release Tablets of Loxoprofen Using Response Surface Method
Hyeong Sik JEONG¹, Hye Ri KIM², Seong Ju HONG², Yun Ho OH², Hyun Sang JANG², Young Ho CHO^{1,2}, Gye Won LEE^{1,2}
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- P0715** Development and Optimization of Immediate Release Tablets by Improving the Properties of Natural Products
Hyeong Sik JEONG¹, Hyun Sang JANG¹, Ye Rim SONG², A Hyun KIM², I Jeong SHIN², Young Ho CHO^{1,2}, Gye Won LEE^{1,2}
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- P0716** Development of the Dual Release Tablet of Sapogrelate HCL and Optimization Based on QBD
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¹Department of Medical Engineering & Science, Konyang University, Daejeon, Korea, ²Department of Pharmaceutics & Biotechnology, Konyang University, Daejeon, Korea
- P0717** Protective Effects of *Zizania latifolia* Extract in *t*-BHP-Induced HepG2 and AAPH-Induced LLC-PK1 Cells
Hyeon-Ji KIM¹, Se-Ho PARK^{2,3}, Seun-Ah YANG¹
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- P0718** Synthesis and Characterizations of Alginate Hydrogels Using Microdispenser-based Bio 3D Printing
Hyung Sun YOON, Kyungjik YANG, Young Hoon ROH
Department of Biotechnology, Yonsei University, Seoul, Korea
- P0719** Risk Assessment of Carbofuran, Carbamate pesticide, Using *Pseudokirchneriella subcapitata* and *Daphnia magna*
IN-TAEK PARK, SEONG-JUN KIM
Department of Environment and Energy Engineering, Chonnam National University, Gwangju, Korea
- P0720** Monitoring of Ginseng Seedling Cultivation Environment Using IoT Technology
Jae-Hoon HAN¹, Seong Bean PARK², Seung Yoon SEO¹, Min Jung SONG¹, Yong Chan PARK², Sang-Kyu JUNG¹
¹Bio. & Chemical Engineering, Hongik University, Sejong, Korea, ²Research Laboratory, ECONNBIZ CO., LTD., Sejong, Korea
- P0721** Anti-inflammation Effect on Skin of *Zizania latifolia* Extract in Mast Cells and Keratinocytes
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- P0722** The GAD Genes and GABA Production from *Protaetia brevitarsis*'s MSG Using *Lactobacillus plantarum* Isolated from Deep Sea Water
JeongA KIM¹, EunShin JU¹, JungChul PARK², SunMee HONG¹
¹Department Research and Development, Marine Industry Research institute for East sea rim, Uljin, Korea, ²Agricultural Company Corporation, DongUiBoGum, Yeongcheon, Korea
- P0723** Characteristics of Flavor Compound Production by Stress-tolerant *Zygosaccharomyces rouxii* Isolated from Fermented Foods
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¹Division of Food Biotechnology and Biosystems Engineering, Kangwon National University, Chuncheon, Korea, ²Department of Life Science, Chung-Ang University, Seoul, Korea
- P0724** Effects of Extraction Conditions on Antioxidant Activity and Major Compound Contents of *Elaeagnus umbellata* Leaves Extracts
Jong-Kang JUNG, Ha-Rin KANG, Seun-Ah YANG
 Department of Food Science and Technology, Keimyung University, Daegu, Korea
- P0725** Production of Succinic Acid by Metabolically Engineered *Mannheimia succiniciproducens* Using Formic Acid as a Secondary Substrate
Jung Ho AHN, Junho BANG, Won Jun KIM, Sang Yup LEE
 Metabolic and Biomolecular Engineering National Research Laboratory, Department of Chemical and Biomolecular Engineering, KAIST, Daejeon, Korea
- P0726** The Skin Improvement Effect of Korean Cabbage Core Extracts
Kwang-Hwan JHEE¹, Won Ho LEE¹, Se-Ho PARK^{1,2}, Jae-Yeul LEE^{1,2}, Seun-Ah YANG³, Daesuk BANG⁴
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- P0727** Development of Thermo-responsive Gelatin-Alginate Hybrid Hydrogel for Controlled Release of Meat Flavor
Young Min KIM, Kyungsene LEE, Young Hoon ROH
 Department of Biotechnology, Yonsei University, Seoul, Korea
- P0728** Isolation of *Hanseniaspora opuntiae* with High Ethanol Production Yield from *Senecio sruentus*
Young-Eun DO, Jeong-Ah YOON, Se-Young KWUN, Myoung-Dong KIM
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- P0729** Enhanced production of poly(γ -glutamic acid) by *Bacillus* sp. FBL-2
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