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**Kodithuwakku Kankanange Indika Upali Arunakumara, Buddhi Charana Walpola, Min-Ho Yoon. Aluminum toxicity and tolerance mechanism in cereals and legumes — A review. J. Korean Soc. Appl. Biol. Chem. 56(1):1-9**

Aluminum (Al), the third most abundant element overall, after silicon and oxygen, is found virtually in all food, air, soil and water. Under acidic conditions, Al is solubilized into [Al(H2O)6]3+, which is highly toxic to many plant species. Present paper reviewed Al toxicity and tolerance mechanism in agricultural plants with special reference to cereals and legumes. Even at micromolar concentrations, cell division in the root tip meristem in sensitive plants is quickly inhibited by Al3+. Expressing the species-dependent manner of response, growth enhancement at low concentrations of Al3+ is also reported from some plants such as soybean. Plasma membrane can be identified as the primary target of Al toxicity, where production of higher reactive oxygen species and higher fatty acid peroxidation has been observed due to alteration of plasma membrane integrity. Though, toxicity and the mechanisms attributed to Al-resistance are extremely complex phenomena, exclusion is widely accepted as the key mechanism involved in detoxifying Al3+. Exudation of chelating ligands, formation of pH barrier at the rhizosphere or at root apoplasm, cell wall immobilization, selective permeability of the plasma membrane, and Al efflux have been proposed as the possible mechanisms for Al exclusion. Al-induced exudation in cereals and legumes is dominated by citrate, malate, and oxalate in varying degrees depending on the species and/or cultivar. Apart from sensitive cultivars, moderately tolerant or tolerant cultivars can also be distinguished from various kinds of cereals and legumes. However, reliable techniques for screening such resistant genotypes have not been developed for any economically important crops.

**Yen San Chan, Mashitah Mat Don. Optimization of process variables for the synthesis of silver nanoparticles by *Pycnoporus sanguineus* using statistical experimental design. J. Korean Soc. Appl. Biol. Chem. 56(1):11-20**

Sequential optimization strategy based on statistical experimental design and one-factor-at-a-time (OFAT) method were employed to optimize the process parameters for the enhancement of silver nanoparticles (AgNPs) production through biological synthesis using *Pycnoporus sanguineus*. Based on the OFAT method, three significant components influencing the size of AgNPs produced were identified as AgNO3 concentration, incubation temperature, and agitation speed. The optimum values of these process parameter for the synthesis of AgNPs were determined using response surface methodology (RSM) based on Box-Behnken design. The validity of the model developed was verified, and the statistical analysis showed that the optimum operating conditions were 0.001 M of AgNO3, 38°C, and 200 rpm with the smallest AgNPs produced at 14.86 nm. The disc diffusion method also suggested that AgNPs produced using optimum conditions have higher antimicrobial activity compared to the unoptimized AgNPs. The present study developed a robust operating condition for the production of AgNPs by *P. sanguineus*, which was 8.6-fold smaller than that obtained from un-optimized conditions.

**Hyon Jin Park, Yang Do Choi, Sang Ik Song, Hawk-Bin Kwon, Nam Iee Oh, Jong-Joo Cheong. Overexpression of the 3′(2′),5′-bisphosphate nucleotidase gene *AtAHL* confers enhanced resistance to *Pectobacterium carotovorum* in *Arabidopsis.* J. Korean Soc. Appl. Biol. Chem. 56(1):21-26**

The Arabidopsis AtAHL gene encodes a 3′(2′),5′-bisphosphate nucleotidase that catalyzes the conversion of adenosine 3′,5′-bisphosphate (PAP) into adenosine monophosphate and inorganic phosphate. We have generated transgenic Arabidopsis overexpressing this gene under control of the cauliflower mosaic virus 35S (CaMV 35S) promoter. Transgenic lines integrating a single copy of the insert DNA and constitutively expressing the AtAHL gene were selected. The transgenic lines of Arabidopsis plants exhibited enhanced resistance to Pectobacterium carotovorum subsp. carotovorum. In general, plant defense responses and sulfur metabolism are linked through jasmonic acid signaling. The expression of sulfur-related defense genes is known to be induced via a jasmonate-mediated signaling pathway. In this work, we observed that the expression of AtAHL was also induced by jasmonate treatment in Arabidopsis. Our data suggest that PAP catabolic activity enhanced by the jasmonate signaling pathway contributes to the rapid flux of the sulfur activation pathway, accelerates the incorporation of activated sulfur into sulfur-containing defense molecules such as defensins, thionins, and glucosinolates, and thereby increases defense resistance in plants.

**Yeon Jong Koo, Eun Sil Yoon, Jun Sung Seo, Ju-Kon Kim, Yang Do Choi. Characterization of a methyl jasmonate specific esterase in arabidopsis. J. Korean Soc. Appl. Biol. Chem. 56(1):27-33**

Methyl jasmonate (MeJA)-specific methyl esterase of Arabidopsis (AtMJE) was identified and characterized. AtMJE has high substrate specificity to MeJA compared to other related substrates, methyl indole-3-acetate (MeIAA) and methyl salicylate (MeSA). Through enzyme kinetics analysis, we found AtMJE has similar level of substrate affinity to JA carboxyl methyltransferase (AtJMT). However, AtMJE has 10 times lower catalytic efficiency than AtJMT at low substrate concentrations. AtMJE gene expression was suppressed for 2 h after MeJA treatment, even though its expression recovered and was induced to maximum level within 8 h after treatment. AtMJE overexpressing plants (AtMJEox) showed enhanced MeJA methyl esterase activity demonstrating esterase activity of AtMJE in vivo. AtMJEox plants responded differentially to JA and MeJA in root growth. MeJA in the media could be a source for more JA production in AtMJEox plants, which resulted in root growth inhibition. In contrast, AtMJEox plants grown on JA containing media showed similar root growth inhibition as wild-type. These results show that AtMJE functions in altering JA/MeJA ratios in Arabidopsis and increased JA, because the conversion of MeJA to JA enhances JA responsive gene expression.

**Moonhyuk Kwon, Bok-Kyu Shin, Jaekyoung Lee, Jaehong Han, Soo-Un Kim. Characterization of *Burkholderia glumae* BGR1 4-hydroxy-3-methylbut-2-enyl diphosphate reductase (HDR), the terminal enzyme in 2-*C*-methyl-d-erythritol 4-phosphate (MEP) pathway. J. Korean Soc. Appl. Biol. Chem. 56(1):35-40**

4-Hydroxy-3-methylbut-2-enyl diphosphate reductase (HDR) is the ultimate enzyme in 2-C-methyl-D-erythritol 4-phosphate (MEP) pathway converting (E)-4-hydroxy-3-methylbut-2-enyl pyrophosphate (HMBPP) into isopentenyl diphosphate (IPP) and dimethylallyl diphosphate (DMAPP). Burkholderia glumae, a Gram-negative rice-pathogenic bacterium, harbors 2 hdr genes and lacks isopentenyl diphosphate isomerase (idi). Both HDR enzymes could complement E. coli hdr deletion mutant (DYTL1). Both of the recombinant HDR proteins, BgHDR1 and BgHDR2, catalyzed reduction of HMBPP into IPP and DMAPP at a ratio of 2:1, in contrast to 5:1 ratio of other bacterial HDRs so far characterized. The kcat and Km values of BgHDR1 and BgHDR2 were 187.0 min−1 and 6.0 μM and 66.6 min−1 and 21.2 μM, respectively. Physiological significance of the kinetic properties was discussed.

**Yeong-Bae Yun, Seong-Wan Park, Jae-Soon Cha, Young-Kee Kim. Biological characterization of various strains of *Pseudomonas tolaasii* that causes brown blotch disease. J. Korean Soc. Appl. Biol. Chem. 56(1):41-45**

Brown blotch disease of cultivated mushrooms is caused by Pseudomonas tolaasii, which secretes the bacterial toxin, tolaasin. Tolaasin is a peptide toxin that causes pore formation in the plasma membrane of mushroom cells. Forty-two strains of pathogenic bacteria causing brown blotch or similar diseases were isolated from mushrooms showing disease symptoms. To characterize these bacteria, the genes of 16S rRNA were sequenced and analyzed. Thirty-three strains were identified as five different species of Pseudomonas. Of these, 23 were identified as P. tolaasii and named as P1-type pathogens. Because the strains identified as P. tolaasii were major pathogens that cause the brown blotch disease, phylogenetic analyses of these pathogens were conducted by the neighbor-joining method. These strains comprised three phylogenetic subtypes, P1α (6 strains), P1β (16 strains), and P1γ (1 strain). Biological characterizations of the isolated bacteria were performed and confirmed that all three subtypes were able to cause the disease by forming blotches on the surface of the mushroom tissue. However, hemolytic activities were observed in the P1α and P1γ strains, but not in the P1β strains. These results imply that remarkable diversity exists among the various strains of P. tolaasii, each strain showing distinct biological characters.

**Jong-Hwan Kim, Jong-Su Seo, Joon-Kwan Moon, Jeong-Han Kim. Multi-residue method development of 8 benzoylurea insecticides in mandarin and apple using high performance liquid chromatography and liquid chromatography-tandem mass spectrometry. J. Korean Soc. Appl. Biol. Chem. 56(1):47-54**

Multi-residue method of eight benzoylurea insecticdes (8BUs; diflubenzuron, triflumuron, hexaflumuron, teflubenzuron, novaluron, lufenuron, flufenoxuron, and chlorfluazuron) in apple and mandarin were developed with high performance liquid chromatography and liquid chromatography-tandem Mass spectrometry. Using multiresidue standard solutions, extraction, partition, and clean-up procedures have been established. Extraction with acetone and partition with n-hexane gave reasonable recovery of more than 90%. Clean-up with florisil-glass column using acetone/n-hexane as eluting solvents resulted in good efficiency of higher than 94%. By employing the established analytical method, recovery test of 8BUs in mandarin and apple was conducted to give recovery of 80–110%, which satisfies the Korea Food & Drug Administration criteria. The method limit of quantitation (MLOQ, 0.02 mg/kg) was lower than 1/2 of maximum residue limits of crops. Excellent sensitivity and selectivity were obtained with liquid chromatography tandem mass spectrometry (LC-MS/MS)-Electrospray ionization(-) even in the samples with no clean-up, suggesting LC-MS/MS can be used for the fast multi-residue method of 8 benzoylurea insecticides in mandarin and apple.

**Young-Ok Kim, In-Suk Park, Hyung-Kwoun Kim, Bo-Hye Nam, Hee Jeong Kong, Woo-Jin Kim, Dong-Gyun Kim, Bong-Seok Kim, Young-Ju Jee, Jung-Hun Song, Sang-Jun Lee. *Shewanella* sp. Ke75 esterase with specificity for *p*-nitorphenyl butyrate: Gene cloning and characterization. J. Korean Soc. Appl. Biol. Chem. 56(1):55-62**

A bacterial strain that produces a cold-adapted esterase was isolated from tidal flats and identified as Shewanella sp. Ke75. In the present study, the corresponding gene was cloned using the shotgun method. The amino acid sequence deduced from the nucleotide sequence (957 bp) corresponded to a protein of 318 amino acid residues with a calculated molecular weight of 34875 Da. The esterase showed 68 and 57% identities with the putative esterases of Shewanella amazonensis SB2B and Colwellia psychrerythraea 34H, respectively. The esterase contained a putative leader sequence, as well as the conserved catalytic triad (Ser, His, Asp), consensus pentapeptide GXSXG, and oxyanion hole sequence (HG). The protein Ke75 was produced in both soluble and insoluble forms when Escherichia coli cells harboring the gene were cultured at 30°C. The enzyme showed specificity for C4 (butyrate) as a substrate, with little activity toward the other p-nitrophenyl esters tested. The optimum pH and temperature for enzyme activity were pH 9.0 and 30°C, respectively. Relative activity remained up to 60% even at 5°C with an activation energy of 6.29 kcal/mol, which indicated that it was a cold-adapted enzyme. Enzyme activity was enhanced in the presence of Mn2+ ions, but inhibited by Cd2+, Cu2+, Hg2+, and Zn2+ ions.

**Chang-Geun Song, Moo-Yeol Baik, Byung-Yong Kim. Rheological properties of native maize, waxy maize, and acetylated maize starches, and applications in the development of food products. J. Korean Soc. Appl. Biol. Chem. 56(1):63-68**

Feasibility of using native and modified maize starches in various food systems such as surimi, soup and noodle was investigated. The viscosity of native maize starch (NMS) increased dramatically with an increase in the starch concentration and a decrease in the temperature, whereas that of of waxy maize starch (WMS) showed no significant change. The acetylated maize starch (AMS) had a lower gelatinization temperature and enthalpy than NMS and WMS. NMS had the highest storage modulus (G′) and loss modulus (G″), whereas WMS had the lowest G′ and G″. The G′ values of all of the surimi increased from 55°C, and the G′ of surimi paste with NMS added was greater than that of the surimi mixed with WMS and AMS. The viscosity of soup containing WMS showed a lower increase than with NMS and AMS. Noodles mixed with AMS had the shortest cooking time, indicating that each starch had typical characteristics that could be applied to food manufacturing.

**Jin-Woong Jeong, Kee-Jae Park, Jeong-Ho Lim, Jung-Min Sung. Analysis of hazard on fresh and salted *baechus* (nappa cabbage, *Brassica rapa L. subsp. pekinensis*) in Korea. J. Korean Soc. Appl. Biol. Chem. 56(1):69-76**

Risk factors, such as microorganism, parasite eggs, pesticide residues, and heavy metal in fresh and salted baechus (napa cabbage, Brassica rapa L. subsp. pekinensis) were analyzed once a month from April 2010 to March 2011. Total bacterial population of salted baechu in summer (2.08–5.11 log CFU/g) was higher than that in winter. Also, coliform population in salted baechu during winter decreased by 2 log CFU/g as compared with that in summer. Pesticide residues and parasite eggs were not detected in any salted baechu. Pb was detected at 0.06 ppm in the winter salted baechu, but the lever was lower than the residue tolerance of the Korea food code. The pH of salted baechu during a 1-year period showed the lowest level at 4.76–5.22 in August and then gradually increased. The microbe results showed a high correlation with the pH of the salted baechu.

**Soon-Mi Shim, Seung-Yong Lim. Texture properties and radical scavenging ability of porridge products based on beans, grains, and nuts. J. Korean Soc. Appl. Biol. Chem. 56(1):77-82**

Textural and sensory properties and radical scavenging ability of rice and cereal-based porridges such as beans, nuts, and grains were examined. Textural properties of the porridges, including hardness, adhesiveness, cohesiveness, springiness, and gumminess, were determined using a TA-XT2 texture analyzer. For the sensory evaluation, thirty-five volunteers participated in the randomized incomplete block design. The 1-diphenyl-2-picrylhydrazyl method was carried out to determine the radical scavenging ability of the porridges. Cereal-based porridges added with beans, grains, and nuts appeared to be less hard and sticky than plain rice porridges. Overall sensory acceptabilities for black rice, walnut, and pine-nut porridges were higher than those for plain rice porridges. Pine-nut, walnut, grain porridge such as wild sesame, black rice, and mixed grains provide strong radical-scavenging ability compared to plain rice porridges. Our results suggest that cereal-based porridge prepared with beans, grains, and nuts are nutritious and palatable substitute food for people with chewing difficulty.

**Jae-ho Choi, Cher-won Hwang, Hyung-ki Do, Gi-seok Kwon, Sun-chul Kang. Anti-oxidizing functional effect of polyamine as a bioconversion starter using microbes isolated from fluke babsikhae. J. Korean Soc. Appl. Biol. Chem. 56(1):83-86**

Polyamines are well known as important molecular compounds for many biochemical processes in animals and plants. The function of biogenic polyamine has been especially well studied for its role in the oxidative system and the protection of membranes from peroxidation in cells. We investigated the polyamine contents of fluke babsikhae and isolated polyamineproducing lactic acid bacteria (LAB) to improve the probiotic antioxidative function of the Korean traditional fermented food, fluke babsikhae. In the present study, first we confirmed that fluke babsikhae possesses more antioxidative molecules compared to the other antioxidative vegetable (Korean radish) and ascorbic acid by using the method of peroxide value (POV). Secondly polyamines, which are considered as antioxidative molecules, were detected in fluke babsikhae using thin layer chromatography (TLC) and high performance liquid chromatography (HPLC). In order to improve the probiotic function of fluke babsikhae, LABs were isolated from the fermented food, and these isolated microbes were tentatively identified as Lactobacillus brevis strain bh3 and Lactobacillus sp. using 16S rRNA sequencing. Polyamine was produced from these two strains and also was confirmed to have antioxidative activity. Especially Lactobacillus sp. was shown to produce high amounts of putrescine. Therefore, this strain can be considered as a starter to improve the probiotic function of fluke babsikhae. According to the results, fluke babsikhae will be a good candidate for a healthy functional food and also isolated LAB will be considered as a starter for probiotics by bioconversion.

**Hoon Choi, Joon-Kwan Moon, Jong-Su Seo, Jeong-Han Kim. Establishment of retention index library on gas chromatography-mass spectrometry for nontargeted metabolite profiling approach. J. Korean Soc. Appl. Biol. Chem. 56(1):87-90**

The retention indices of metabolites expected to be in rice have been established with gas chromatography-mass spectrometry (GC-MS) after derivatization. Total 187 metabolites (59 lipids and 128 polar metabolites) including fatty acids, hydrocarbons, alcohols, steroids, sugars, sugar alcohols, organic acids, amino acids, amines, and amides were analyzed using GCMS and their retention indices were calculated. These retention indices are expected to be used for the identification of various metabolites in many types of crops.

**Ji-Yeon Yang, Kyoung-Shik Cho, Nam-Hyun Chung, Chung-Ho Kim, Joo-Won Suh, Hoi-Seon Lee. Constituents of volatile compounds derived from *Melaleuca alternifolia* leaf oil and acaricidal toxicities against house dust mites. J. Korean Soc. Appl. Biol. Chem. 56(1):91-94**

The acaricidal activities of the volatile compounds derived from Melaleuca alternifolia leaf oil were evaluated against house dust mites. Terpinen-4-ol (3.89 and 3.51 μg/cm2) was approximately 2.0 and 1.7 times more active than benzyl benzoate (7.83 and 5.96 μg/cm2). Therefore, terpinen-4-ol could be useful as a natural acaricide.

**Inkyu Hwang, Daewoon Choi, Hyejeong See, Wonyong Kim, In Sik Chung, Dong-Hwa Shon. Beneficial effects of the mixed adjuvant of CpG plus monophosphoryl lipid a in immunization with a recombinant protein vaccine for hepatitis A. J. Korean Soc. Appl. Biol. Chem. 56(1):95-98**

In an effort to develop a new vaccine for hepatitis A, which is mainly transmitted via contaminated foods and water, recombinant virus protein 1 (VP1) of hepatitis A virus was used as an antigen. Several adjuvants in a single or a mixed form, i.e., alum, CpG oligodeoxynucleotide, monophosphoryl lipid A (MPL), alum plus MPL, and CpG plus MPL, were also tested for their immunological properties. When their effects on the production of VP1-specific IgG relative to that of total IgG and the levels of and balance between Th1- and Th2-type cytokine productions were compared, CpG plus MPL was found to have highly beneficial effects, providing a new insight in selection of adjuvant for development of a new vaccine.

**Lingzhu Meng, Seung Hwan Yang, Tae-Jong Kim, Joo-Won Suh. Two base mutations of a putative LacI-family transcriptional regulator, *SCO7554*, reverse the overexpression effect on the antibiotic pigment production in *Streptomyces coelicolor.* J. Korean Soc. Appl. Biol. Chem. 56(1):99-101**

The SCO7554 protein, a putative LacI-family transcriptional regulator, is important in the antibiotic pigment production in Streptomyces coelicolor M130. A single mutation at the 4th amino acid from asparagine to serine reversed the SCO7554 effect on the antibiotic pigment production in an overexpression experiment. Additional mutation at the 276th amino acid from valine to alanine intensified this effect, and the overexpression of the double mutant SCO7554 increased the production of antibiotics, whereas the overexpression of SCO7554 itself decreased the antibiotic productions. This observation suggested the functional importance of the N-terminal region of a putative LacI-family transcriptional regulator, SCO7554 protein, even though it was not located on any known functional domain.

**Joo-Mi Yoon, Bum-Soo Hahn, Tae-Lim Kim, Man-Ho Cho, Seong Hee Bhoo, Tae-Ryong Hahn, Sang-Won Lee. An efficient method for detection of recombinant proteins using a bacteriophytochrome chromophore binding domain from *Deinococcus Radiodurans.* J. Korean Soc. Appl. Biol. Chem. 56(1):103-106**

Bacteriophytochromes are composed of N-terminal region for chromophore binding and C-terminal domain for transmission of a light signal. In this study, the possibility of using the chromophore-binding domain from a Deinococcus radiodurans bacteriophytochrome as a protein tag to enable a rapid and simple detection method for the production of recombinant proteins were evaluated.

**Jinhua Cheng, Ying-Yu Jin, Seung Hwan Yang, Joo-Won Suh. Isolation and characterization of anti-methicillinresistant *Staphylococcus aureus*/vancomycinresistant *Enterococcus* compound from *Streptomyces bungoensis* MJM 2077. J. Korean Soc. Appl. Biol. Chem. 56(1):107-111**

Strain MJM2077 was selected for its strong anti-Methicillin-resistant Staphylococcus aureus/Vancomycin-resistant Enterococcus activity and designated as Streptomyces bungoensis MJM2077 based on the analysis of the 16S rDNA sequence. The active compound, which was very stable under acidic conditions, was purified and identified as echinomycin by NMR and mass spectrometry. This is the first report on the isolation of echinomycin from a S. bungoensis strain, and the development of high-producing strains is in progress.

**Soon Young Shin, Young Han Lee. 3-Hydroxyflavanone induces apoptosis in HeLa cells. J. Korean Soc. Appl. Biol. Chem. 56(1):113-116**

Flavonoids and their derivatives exhibit many biological properties, including anti-inflammatory and antitumor activities. However, the antitumor action of 3′-hydroxyflavanone (3′-HF) is largely unknown. Antitumor efficacy of 3′-HF was assessed using cervical cancer (HeLa) cells. 3′-HF treatment resulted in a reduction in cell proliferation. A flow cytometric analysis demonstrated that 3′-HF deregulated cell cycle progression and triggered apoptosis. 3′-HF also increased the levels of p53 and p21, but decreased the level of cyclin D1. 3′-HF-induced apoptosis was accompanied by poly(ADP-ribose)polymerase cleavage. Together, these data indicate that 3′-HF possesses antitumor activity, which is mediated via the deregulation of cell cycle progression and induction of apoptosis.

**Min-Kyung Lee, Hee-Jung Park, Sung-Ho Kwon, Ye-Jin Jung, Ha-Na Lyu, Do-Gyeong Lee, Na-Young Song, Hong-Keun Choi, Sangkyu Park, Nam-In Baek, Youn-Hyung Lee. Tellimoside, a flavonol glycoside from *Brasenia schreberi*, inhibits the growth of cyanobacterium (*Microcystis aeruginosa* LB 2385). J. Korean Soc. Appl. Biol. Chem. 56(1):117-121**

Principal components of aquatic plants responsible for inhibiting the growth of Microcystis aeruginosa, a blue-green alga (cyanobacterium) were determined. Methanol extracts of Brasenia schreberi showed strong inhibitory activity against the growth of the cyanobacterium. Two purified flavonoids were afforded through repeated column chromatographies. The compounds were determined as quercetin (**1**) and quercetin 3-O-(6″-galloyl)-β-d-glucopyranoside, tellimoside (**2**) by the interpretation of spectroscopic data including NMR, MS, and IR. Compounds **1** and **2** were first isolated from Brasenia schreberi. In addition, compound **2** showed very strong inhibitory activity against the growth of M. Aeruginosa.

**Dongfei Han, Ji-Young Ryu, Hyunji Lee, Hor-Gil Hur. Bacterial biotransformation of phenylpropanoid compounds for producing flavor and fragrance compounds. J. Korean Soc. Appl. Biol. Chem. 56(2):125-133**

Phenylpropanoids are common aromatic compounds synthesized by plants that are often used as starting compounds for the production of various flavor and fragrance compounds. The use of bacterial metabolism as a means to produce valueadded compounds from natural resources has been given much attention as an alternative method to replace conventional chemical syntheses. This review describes bacterial metabolisms of the phenylpropanoid compounds trans-anethole, isoeugenol, and isosafrole to better understand efficient production of natural fragrance and other value-added compounds.

**Mi-Young Baek, Hee-Jung Park, Gi-Min Kim, Dae-Young Lee, Gee-Young Lee, Sun-Ju Moon, Eun-Mi Ahn, Geum-Soog Kim, Myun-Ho Bang, Nam-In Baek. Insecticidal alkaloids from the seeds of *Macleaya cordata* on cotton aphid (*Aphis gossypii*). J. Korean Soc. Appl. Biol. Chem. 56(2):135-140**

Alcohol extracts from the seeds of Macleaya cordata have shown a significant insecticidal effect against the growth of the cotton aphid, Aphis gossypii Glover. In this study, we aimed to isolate the principal component of M. cordata to manifest its insecticidal effect on A. gossypii. The dried seeds of M. cordata were extracted with 80% aqueous methanol (MeOH), and the concentrated extracts were partitioned successively with ethyl acetate (EtOAc), n-butyl alcohol (n-BuOH), and H2O. During the search for an insecticidal compound against the aphids, activityguided fractionation led to the isolation of two alkaloids from an n-BuOH fraction through repeated silica gel column chromatographic separations. Based on NMR, MS, and IR spectroscopic data, the chemical structures of the compounds were determined to be 8-hydroxydihydrochelerythrine (**1**) and 8-methoxydihydrosanguinarine (**2**) This is the first study in which 8-methoxydihydrosanguinarine was isolated from M. cordata. 8-Hydroxydihydrochelerythrine (**1**) and 8-methoxydihydrosanguinarine (**2**) decreased the survival of the cotton aphid by 76.1±7.9 and 73.6±14.6% at 100 ppm, respectively.

**Dong Hun Lee, Jeong-Woo Kang, Yong-Seok Song, Jung-Hee Kim, Man Sub Kim, Yesol Bak, Deok-Kun Oh, Do-Young Yoon. Compound K attenuates lipid accumulation through down-regulation of peroxisome proliferator-activated receptor γ in 3T3-L1 cells. J. Korean Soc. Appl. Biol. Chem. 56(2):141-147**

Compound K (CK) is rare ginsenosides present at low concentrations or absent in ginseng roots. These rare ginsenosides can be produced from the major ginsenosides Rb1, Rb2, and Rd through hydrolysis of sugar moieties. Recently, CK has been found to have anti-diabetic effects through adenosine 5-phosphateactivated protein kinase (AMPK) activation in human hepatoma cells and a stimulatory effect of glucose uptake in 3T3-L1 adipocytes, as well as anti-obesity effect by down regulation of peroxisome proliferator-activated receptor γ (PPARγ) gene expression in 3T3-L1. However, detailed anti-obesity pathway by CK remains unclear. In the present study, the effects of CK produced from Sulfolobus acidocaldarius on PPARγ signaling during adipocyte differentiation in 3T3-L1 cell were examined. Treatment of differentiating 3T3-L1 cells with CK resulted in down-regulation of fatty acid synthase (FAS), a target gene of PPARγ. The modulating effect of CK on expression of genes involved in lipogenesis was abrogated in part by treatment with troglitazone, a PPARγ agonist. CK significantly decreased accumulation of lipid droplets and PPARγ expression induced by troglitazone in 3T3-L1 adipocytes, suggesting that CK downregulates PPARγ expression and its transcriptional activity as well as abrogates PPARγ signaling pathway induced by troglitazone, a PPARγ agonist. These results indicate that CK inhibits 3T3-L1 adipogenic differentiation by inhibiting PPARγ and FAS expressions as well as interferes with PPARγ signaling pathway induced by PPARγ agonist, and may act as an anti-adipogenic ginsenoside for regulating body fat through its effects on differentiation.

**Nayeon Ryoo, Joon-Seob Eom, Hyun-Bi Kim, Bich Thuy Vo, Sang-Won Lee, Tae-Ryong Hahn, Jong-Seong Jeon. Expression and functional analysis of rice plastidic maltose transporter, *OsMEX1.* J. Korean Soc. Appl. Biol. Chem. 56(2):149-155**

In Arabidopsis, maltose is a major product of the transitory starch degradation pathway at night, and its mobilization from the chloroplasts to the cytosol in leaf tissues via a plastidic maltose transporter, AtMEX1, is essential for normal plant growth. However, such a starch utilization pathway has not yet been characterized in rice (Oryza sativa), a monocot model plant. Examination of expression profiles of a rice plastidic maltose transporter, OsMEX1, by real-time polymerase chain reaction showed that it is abundant in the pollen grain-containing stamens of mature flowers. Consistently, high performance liquid chromatography analysis revealed a relatively high maltose content in mature flowers, suggesting that OsMEX1 mainly functions in the tissues. OsMEX1-green fluorescent protein fusion experiment confirmed that OsMEX1 localizes at the chloroplast envelope in both rice and Arabidopsis. Arabidopsis maltose excess1 (mex1) mutant was transformed with OsMEX1 fused to the cauliflower mosaic virus 35S (CaMV35S) promoter. In the resulting transgenic plants, the typical mutant phenotypes of Arabidopsis mex1, such as chlorosis, stunted growth, and maltose and starch deposition at the end of the night, are clearly rescued. This result demonstrates that OsMEX1 functions as a plastidic maltose transporter in Arabidopsis. Our present findings thus suggest that whereas the Arabidopsis MEX1 gene essentially functions in source leaf tissues, its rice counterpart likely has a role in the pollens of mature flowers.

**Jin Young Kim, Yeon-Ki Kim, Young Mee Kim, Seogjae Lee, Sanggyu Park, Baek Hie Nahm, Dong-Sun Lee, Moonjae Cho. Proteasome down-regulation is partly mediated by Slug/Snail2 in hepatocarcinoma cells. J. Korean Soc. Appl. Biol. Chem. 56(2):157-163**

Snail family proteins (Snail1 and Slug/Snail2) are transcription factors that regulate transcription of molecules during epithelial-mesenchymal transition (EMT). Snail1/2 is known to bind to the E-box motif (CANNTG). The proteasome activity is decreased in EMT (Kim et al., 2011), and several E-box motifs are found in the promoters of genes coding for proteasome subunits. We used a new protein-binding microarray to specify the Slug/Snail2 binding sequence. Among 563 9-mer clusters, the motif **CACCTGC** yielded the highest P-value in the Wilcoxon-Mann-Whitney test. Within this motif, the A and T were absolutely required, and CC was preferred, but could be replaced by GG with little effect. In hepatocytes overexpressing Slug/Snail2, the 20S proteasome expression and proteasome activity were decreased partly due to the down-regulation of proteasome subunit beta type 2 (PSMB2) and PSMB3 transcription.

**Lan Hee Kim, Hye-Weon Yu, Yang-Hoon Kim, In S. Kim, Am Jang. Potential of fluorophore labeled aptamers for *Pseudomonas aeruginosa* detection in drinking water. J. Korean Soc. Appl. Biol. Chem. 56(2):165-171**

Pseudomonas aeruginosa has been considered as a representative pathogenic bacteria in drinking water. In order to detect P. aeruginosa, aptamers were utilized in this study. In particular, fluorescein isothiocyannate (FITC) and quantum dot (QD) were used for aptamer labeling. FITC-labeled aptamers showed higher binding capacity with optimal incubation time of 30 min compared to QD-labeled aptamers. However, incubation speed did not have any effect on the binding capacity of FITC-labeled aptamers to bacteria. Aptamer-binding capacity was measured according to varying cell concentrations of 0, 10, 100, and 1000 cells/mL. As a result, the limit of detection, limit of quantification, and limit of linearity of P. aeruginosa were 5.07, 5.64, and 100 cells/mL, respectively. The low detection limit shows the fluorophore-labeled aptamer potential to detect P. aeruginosa labeling in the field.

**Hyun Kim, Seong-Hun Jeong, Dong-Gyu Kam, Hyun-Jun Kim, Soo-Min Choi, Myung Bo Lee, Sang Won Bae, Joo Hoon Lim, Sang-Hyun Lee. Developing a site index model considering soil characteristics for *Pinus thunbergii* stands grown on the west coast of Korea. J. Korean Soc. Appl. Biol. Chem. 56(2):173-180**

Height model of the dominant tree was developed and derived site index curves of Pinus thunbergii, which is the main species of windbreak forests along the west coast of Korea. The site index of a tree is affected by various environmental factors. In the present study, however, the soil characteristics of P. thunbergii stands, which are scattered along the west coast of Korea were used. Eight sites of windbreak forest were investigated from October 2011 to October 2012. The Schumacher polymorphic equation was the most suitable equation to develop a site index model of P. thunbergii stands, and it was the best site index model when Ca-P and fungus were applied to the asymptotic parameter (α). The equation yielded site index curves using the developed model, which is based on trees aged 50 years, considering the soil characteristic factors of P. thunbergii stands in different areas. The site index model and site index curves suggest important growth information, such as windbreak forests, green spaces development, and height growth estimation, which are needed for management of the stands, with consideration of the proposed soil characteristic factors of this study.

**Hyeri Lee, Myoungjoo Riu, Eunhye Kim, Joon-Kwan Moon, Hoon Choi, Jung-A Do, Jae-Ho Oh, Ki-Sung Kwon, Young Deuk Lee, Jeong-Han Kim. A single residue method for the determination of chlorpropham in representative crops using high performance liquid chromatography. J. Korean Soc. Appl. Biol. Chem. 56(2):181-186**

A single residue analytical method was developed for herbicide chlorpropham in various crops. Brown rice, apple, mandarin, Kimchi cabbage, green pepper, potato, and soybean were selected as representative crops, and clean-up system, partition solvent, and extraction solvent were optimized. For high performance liquid chromatography (HPLC), C18 column was used with elution solvents of water and acetonitrile. Limit of quantitation (LOQ) of chlorpropham was 2 ng (S/N >20), and excellent linearity (R2=1.000) was achieved. Method limit of quantitation (MLOQ) was 0.02 mg/kg. For recovery tests, crop samples were macerated and fortified with chlorpropham standard solution at three fortification levels (MLOQ, 10 MLOQ, and 100 MLOQ). And then those were extracted with acetonitrile, concentrated and partitioned with n-hexane. The n-hexane layer was then concentrated, cleaned-up through Florisil® column with ethyl acetate:n-hexane (5:95, v/v) prior to concentration and analysis with HPLC. Good recoveries from 76.8 to 107.9% with coefficients of variation of less than 10% were obtained, regardless of sample type, which satisfies the criteria of Korea Food and Drug Administration. Those results were confirmed with liquid chromatography-mass spectrometry (LC-MS). The method established in this study could be applied to most of crops as an official and general method for the analysis of chlorpropham residue.

**Lei Li, Gui-sheng Zeng, Sheng-lian Luo, Xiao-rong Deng, Qing-ji Xie. Influences of solution pH and redox potential on the bioleaching of LiCoO2 from spent lithium-ion batteries. J. Korean Soc. Appl. Biol. Chem. 56(2):187-192**

The influences of solution pH and redox potential on bioleaching of LiCoO2 from spent lithium-ion batteries using Acidithiobacillus ferrooxidans were investigated. Bioleaching at different initial pH and ferrous ion (Fe2+) concentrations were carried out, and electrochemical behavior of LiCoO2 dissolution was examined to study the effect of solution redox potential on the bioleaching process. The results showed maximum cobalt dissolution at initial pH of 1.5 and initial Fe2+ concentration of 35 g/L, and cobalt dissolution showed only slight relationship with pH of solution. Nonetheless, there was improvement of cobalt dissolution at higher redox potential. The cyclic voltammograms showed that dissolution rates increase when the solution potentials are higher than 0.4 V, and rapid decrease at 1.3 V. The anodic polarization curves indicated that the corrosion, primary passive, and passivation potentials were 0.420, 0.776 and 0.802 V, respectively.

**Myeong Hoon Joo, Ji Yeon Kim. Characteristics of crude oil biodegradation by biosurfactant-producing bacterium *Bacillus subtilis* JK-1. J. Korean Soc. Appl. Biol. Chem. 56(2):193-200**

The production of biosurfactant by Bacillus subtilis JK-1 was investigated under several conditions. In sea water inoculated with 10% (v/v) of seed culture, the surface tension decreased from 75.0 to 38.4 dyne/cm after 12 h of incubation, which was the highest reduction of surface tension (49%) among the conditions tested. Surface tension further decreased to 31.2 dyne/cm when grown in 1% (v/v) B. subtilis JK-1 inoculated into sea water containing 1% (v/v) crude oil. The decrease of surface tension was similar after 24 h in sea water, sea water containing 1% (v/v) crude oil, and sea water containing 10% (v/v) crude oil using a 10% (v/v) B. subtilis JK-1 inoculum. The biosurfactant produced by B. subtilis JK-1 displayed highest emulsification activity on soybean oil and crude oil. Maximum emulsification stability was obtained from hexane (C6). Using crude oil as a substrate, the emulsification activity of the biosurfactant was much greater than those of chemically synthesized surfactants such as Tween 20 and sodium dodecyl sulfate (SDS). In addition, the bacterial biosurfactant possessed the best emulsification stability when hexane (C6), and hexadecane (C16) were utilized as substrates, as compared to Tween 20, Triton X-100, and SDS. The crude oil in the culture broth was degraded by B. subtilis JK-1, and the C1–C29 carbon chain was almost completely degraded during the 48 h incubation. These results suggest that the biosurfactant of B. subtilis JK-1 is an appropriate candidate for bioremediation of crude oil contaminant.

**Su-Yeon Back, Hyun-Ku Kim, Sang-Dong Lim, Gun-Pyo Do, Jeong-Ryong Do. Development of antihypertensive natural seasoning using beef hydrolyzate. J. Korean Soc. Appl. Biol. Chem. 56(2):201-206**

Natural seasoning with antihypertensive effect was developed using beef hydrolyzate. Quality of the natural seasoning product was compared with five concentrations of beef hydrolyzates at 0, 5, 10, 15, and 20%. Optimum conditions of beef hydrolyzate were determined to be Alcalase 2.4 L 1%, beef concentration 5%, and 4 h of hydrolysis. Angiotensin-converting enzyme (ACE) inhibitory activity of beef hydrolyzate was increased by 70.2% as compared to that of control under the same condition. Sensory evaluation results showed that natural seasoning with 15% beef hydrolyzate was acceptable with salty and savory taste. ACE inhibitory activity of the seasoning with 15% beef hydrolyzate was increased by 41.7% compared to control. Amino acid compositions of natural seasoning in 15% beef hydrolyzate were taurine (511.3mg%), glutamine (846.2mg%), glycine (120.6mg%), and ammonia (NH3) (105.7 mg%). Optimal composition of the seasoning product was: 15% beef hydrolyzate mixed with 1.7% red pepper powder, 4.25% crab water extract, 10.2% kelp powder, 1.7% garlic powder, 10.2% anchovy powder, 10.2% short-necked clam powder, 12.75% shrimp powder, 17% beef powder, 12.75% shiitake powder, and 4.25% freeze-dried pollock powder. The seasoning with 15% beef hydrolyzate may have antihypertensive effects with high consumer acceptability.

**Na-Young Choi, Bo-Ram Kim, Young-Min Bae, Sun-Young Lee. Biofilm formation, attachment, and cell hydrophobicity of foodborne pathogens under varied environmental conditions. J. Korean Soc. Appl. Biol. Chem. 56(2):207-220**

Biofilm formation, attachment and cell hydrophobicity of foodborne pathogens, including Listeria monocytogenes, Pseudomonas aeruginosa, and Staphylococcus aureus were investigated under various environmental conditions such as sodium chloride (0.5–7.0%, w/v), glucose (0.25–10.0%, w/v), pH (6.0–6.8), temperature (25 and 37°C), incubation time (24 and 6 h), and nutrients trypic soy broth (TSB) and diluted TSB (1:10). Biofilm formation for 24 h at 25 and 37°C and attachment for 30 min and 6 h on the surface of polystyrene were measured by the crystal violet staining method. Cell hydrophobicity of pathogens for 6 and 24 h at 25 and 37°C was conducted using the modified bacterial adherence to hydrocarbons method (mBATH). Biofilm formation and attachment of pathogens were highly influenced by the addition of glucose and sodium chloride compared to pH. The biofilm of all pathogens formed in TSB was greater than that in diluted TSB. Biofilm formations of S. aureus and P. aeruginosa at 37°C were greater than that at 25°C. However, biofilm formation of L. monocytogenes was not significantly affected by temperature. Levels of L. monocytogenes hydrophobicity were influenced by adding glucose and sodium chloride at 37°C, whereas levels of hydrophobicity for other pathogens were significantly different depending on the glucose condition (p <0.05). The results demonstrate that biofilm formation, attachment, and hydrophobicity of pathogens were affected by environmental conditions such as the addition of glucose and sodium chloride. However, factors affecting biofilm formation and cell hydrophobicity differed depending on the pathogen type.

**Dong Min Kim, Nari Lee, Seung Min Kim, Soo Hyun Chung, Meehye Kim, Sang Bae Han, Hyang Sook Chun. Occurrence of aflatoxin and aflatoxigenic *Aspergillus* species in corn harvested in Korea. J. Korean Soc. Appl. Biol. Chem. 56(2):221-225**

Sixty six corn samples freshly harvested in Korea were analyzed for the occurrence of aflatoxin and aflatoxigenic Aspergillus using chromatographic and multiplex polymerase chain reaction (PCR) methods. Aflatoxin and aflatoxigenic Aspergillus were detected in 13.6% (0.02 to 0.48 μg kg−1) and 3.0% of the corn samples, respectively. Aflatoxigenic Aspergillus isolates and A. flavus KCCM60330 showed high similarity (98–98.8%). These results suggest that occurrence of aflatoxin and aflatoxigenic Aspergillus in corn harvested from Korea is low.

**Hee-Don Choi, Jeong-Jun Han, Ji-Hee Yang, Sang-Hoon Lee, Yun-Sook Kim, Guk-Hoon Chung, Dae-Hyun Hahm. Effect of soy phosphatidylserine supplemented diet on skin wrinkle and moisture *in Vivo* and clinical trial. J. Korean Soc. Appl. Biol. Chem. 56(2):227-235**

Effect of supplementation of phosphatidylserine (PS), enzymatically synthesized from soy lecithin, on skin moisture and wrinkle in animal and human was investigated. Skin moisture content of hairless mice was significantly decreased and skin thickness and wrinkle were significantly increased by UV irradiation, whereas PS-supplemented groups showed reduced wrinkle depth and much less wrinkle area unlike UV control (UV/Con) group. The collagen content in PS-supplemented groups increased compared with that in UV/Con group. A placebo-controlled double-blind intake study of soft capsules containing PS (300 mg/day) was performed on 63 subjects who had normal healthy skin for 12 weeks. Dermatologist’s visual assessment and image analysis of replicas showed that wrinkle near eye was improved by PSsupplementation. Upon measurement of moisture content in the skin, PS supplementation increased the moisture content in the skin. These findings showed that PS supplementation was effective in moisturizing and improving wrinkle of the skin in both animal and human; thus, PS could be used as an effective skin food ingredient.

**Jong-Hwa Park, Yuan-Yuan Fu, In Sik Chung, Tae-Ryong Hahn, Man-Ho Cho. Cytotoxic property of ultraviolet-induced rice phytoalexins to human colon carcinoma HCT-116 cells. J. Korean Soc. Appl. Biol. Chem. 56(2):237-241**

Exposure to ultraviolet (UV) radiation increased the cytotoxic effect of rice leaf extract on human colon carcinoma HCT-116 cells, suggesting that the production of cytotoxic compounds in rice leaves are induced by UV treatment. To identify cytotoxic agents in UV-treated rice leaves, the phenolic compound peaks prominently increased by UV treatment were isolated using reversed phase high performance liquid chromatography (HPLC). The isolated compounds were identified as N-trans-cinnamoyltyramine, N-benzoyltryptamine, and sakuranetin using NMR and mass spectrometric techniques. N-Benzoyltryptamine and sakuranetin were previously reported as rice phytoalexins, and N-trans-cinnamoyltyramine was first isolated from rice. N-Benzoyltryptamine and sakuranetin were found to inhibit the growth of HCT-116 cells with IC50 values of 89.2±4.8 and 68.8±5.2 μg/mL, respectively, indicating that these phytoalexins are cytotoxic agents in the UV-treated rice leaves. These results suggest that rice phytoalexins are potent anti-cancer agents and UV-treated rice leaves are valuable source for therapeutic agents.

**Bong Soo Park, Sung-Il Kim, Hak Soo Seo. AtSIZ1 regulates expression of nitrite reductase but not its activity. J. Korean Soc. Appl. Biol. Chem. 56(2):243-245**

Plant nitrite reductase (NiR) catalyzes the reduction of nitrite to ammonium. We examined if NiR activity is regulated by sumoylation, and found NiR was not sumoylated by E3 small ubiquitin-related modifier ligase AtSIZ1. However, its transcript level decreased in the siz1-2 mutant, indicating that AtSIZ1 does not directly control NiR activity.

**Yasir Anwar, Seong-Yeol Baek, Soo-Hwan Yeo, Heui-Dong Park. Occurrence of *Issatchenkia orientalis* exhibiting inhibitory effects against soybean lipoxygenase in Korean *nuruk.* J. Korean Soc. Appl. Biol. Chem. 56(2):247-250**

Three yeast strains (designated SHA, SHC, and SHD) exhibiting strong inhibitory effects against soybean lipoxygenase were isolated from Korean nuruk and identified as Issatchenkia orientalis. Total 80 yeast isolates from two major Korean nuruk samples were analyzed by polymerase chain reaction-restriction fragment length polymorphism and phylogenetic analysis. The most abundant yeast was identified as Pichia anomala, comprising 47 out of 80 strains, followed by 15 strains of I. orientalis. All 15 I. orientalis strains showed significant inhibitory effects against soybean lipoxygenase, higher than that of Saccahromyces boulardii used as a positive control.

**Jae-Hwan Kim, Eun-Hee Kim, Mi-Chi Yea, Hae-Yeong Kim. Validation of A multiplex PCR detection kit for screening of herbicide-tolerant genes in genetically modified crops. J. Korean Soc. Appl. Biol. Chem. 56(2):251-254**

A multiplex polymerase chain reaction (PCR) detection kit for screening of four herbicide-tolerant genes (cp4 epsps, mepsps, pat, and bar) in genetically modified (GM) crops was developed. The kit was validated by three different laboratories, and the expected targets were specifically observed in 14 different herbicide-tolerant GM events. This method can be effectively and conveniently used to monitor approved and unapproved GM crops containing four herbicide-tolerant genes.

**Hien Thi Thanh Nguyen, Kyoung Su Choi, SeonJoo Park. Genetic diversity and differentiation of a narrowly distributed and endemic species, *Aster spathulifolius* maxim (Asteraceae), revealed with inter simple sequence repeat markers. J. Korean Soc. Appl. Biol. Chem. 56(3):255-262**

Aster spathulifolius Maxim is a narrowly distributed and endemic species occurring in coastal regions of Korea and Japan. The genetic diversity and differentiation of fifteen populations of the species were analyzed in eight-two loci using six Inter Simple Sequence Repeat primers. Total genetic diversity at species level was extremely high (P=98.78%, Hsp=0.333±0.144, I=0.501±0.180), whereas the genetic diversity at population level was relatively low (P=43.74%, Hpop=0.150±0.189, I=0.227±0.274). High genetic differentiation among populations was detected based on genetic differentiation coefficient (Gst=0.549) and analysis of molecular variance (AP=54.06%). These findings together with low gene flow estimates (Nm=0.205) suggest that genetic drift by isolation is the most critical factor for establishing the current genetic structure of the species. The decrease in abundance of A. spathulifolius along with low levels of genetic diversity indicates that conservation strategies are necessary.

**Zongpei Zhao, Priyadharshini Ramachandran, Joon-Ho Choi, Jung-Kul Lee, In-Won Kim. Purification and characterization of a novel β-1,3/1,4-glucanase from *Sistotrema brinkmannii* HQ717718. J. Korean Soc. Appl. Biol. Chem. 56(3):263-270**

A highly efficient extracellular β-1,3/1,4-glucanase was purified from the culture broth of Sistotrema brinkmannii HQ717718. The molecular mass of β-1,3/1,4-glucanase was respectively determined to be 83 and 166 kDa by sodium dodecyl sulfate-polyacrylamide gel electrophoresis and gel filtration chromatography, indicating that the enzyme is a dimer. The optimum activity of β-1,3/1,4-glucanase against Avicel was observed at pH 4.0 and 65°C. Under the same conditions, Vmax, Km, and kcat values for Avicel were 136.5 U · mg−1 of protein, 3.8 mM, and 211 s−1, respectively. Furthermore, the DNA sequence of gene coding the enzyme showed a significant homology with hydrolases from the glycoside hydrolase family 55. Although β-1,3/1,4-glucanases have been purified and characterized from several other sources, S. brinkmannii β-1,3/1,4-glucanase is distinct from other β-1,3/1,4-glucanases due to its high catalytic efficiency toward Avicel and broad substrate specificity.

**Seong Beom Jin, Hyeon Jin Sun, Md Adnan Al Bachchu, Sung Jin Chung, Jongwoo Lee, Song-I Han, Jeong Hun Yun, Kyung Whan Boo, Dongsun Lee, Key Zung Riu, Jae-Hoon Kim. Production of recombinant miraculin protein using transgenic citrus cell suspension culture system. J. Korean Soc. Appl. Biol. Chem. 56(3):271-274**

Miraculin gene containing the N-terminal signal peptide was introduced into navel orange (Citrus sinensis Osb. var. brasiliensis Tanaka) callus cells by Agrobacterum-mediated transformation. Transgenic somatic embryos were screened on the shoot induction medium containing 25 mg hygromycin L−1. Citrus callus cells were reproduced from the green color somatic embryos on the callus reproduction medium. The obtained transgenic cells were cultured in Murashige and Tucker’s liquid medium containing 50 g sucrose L−1 in a shaking incubator. Similar to the native miraculin, the secreted recombinant miraculin protein formed a disulfide-linked dimer and retained taste-modifying activity. The stability of recombinant protein expression was confirmed over nine generations of callus. This production system can be an excellent alternative for producing various recombinant proteins as well as miraculin.

**Ramasamy Rajesh Kumar, Jae Young Cho. *In vitro* bionics of face centered cubic lattice crystal nanoparticles by *Saccharomyces cerevisiae* and its microbicidal screening. J. Korean Soc. Appl. Biol. Chem. 56(3):275-278**

Extracellular synthesis of nanoparticles has received attention due to its more advantageous form of synthesis in large quantities and also easy for downstream processing. In the present investigation, we report in vitro extracellular synthesis of silver nanoparticles (AgNPs) using Saccharomyces cerevisiae with silver nitrate solution. The AgNPs were produced in 72 h of incubation time. The AgNPs formed were further characterized by means of UV-Vis spectrophotometry, Fourier Transform Infra-Red (FTIR), X-Ray Diffraction (XRD), and Scanning Electron Microscope (SEM). The synthesized AgNPs had maximum absorbance at ∼420 nm in the UV-visible region. FTIR bands were observed at 3353.40, 2075.09, 1637.71 and 1397.30 cm−1. XRD patterns of the AgNPs confirmed the formation of face centered cubic (fcc) lattice crystal silver particles. The SEM analysis revealed that the size of the AgNPs were of 30–60 nm. The synthesized AgNPs inhibited the growth of the test microorganisms at the concentration of 100 μL. The present study highlights the possibility of using the common baker’s yeast S. cerevisiae to synthesize AgNPs and as a microbicidal agent.

**Byungsoo Kim, Jiyeon Kim. Optimization of culture conditions for the production of biosurfactant by *Bacillus subtilis* JK-1 using response surface methodology. J. Korean Soc. Appl. Biol. Chem. 56(3):279-287**

Optimization of culture conditions for the production of biosurfactant by Bacillus subtilis JK-1 was carried out using central composite rotatable design (CCRD) of response surface methodology (RSM). The variables selected for optimization of culture conditions were soluble starch, skim milk, KNO3 concentrations, and temperature. Response surface analysis showed that the fitted quadratic model had adequately high R2 value of 0.9882 and low significance probability of <0.0001, which indicated the statistical significance of the model. The optimum levels of each variable were determined to be as follows: 1.550% (w/v) soluble starch, 0.477% (w/v) skim milk, 0.096% (w/v) KNO3 and 37.145°C. Through the statistical analysis, temperature and soluble starch were found to be the most significant factors, whereas skim milk and KNO3 had less effect within the ranges investigated. Our results could be very helpful in the large-scale production of biosurfactant from B. subtilis JK-1.

**Seong Yeong Kim, Ho Lee. Effect of quality characteristics on brown rice produced from paddy rice with different moisture contents. J. Korean Soc. Appl. Biol. Chem. 56(3):289-293**

Relationship between moisture content of paddy rice and quality characteristics of dehusked brown rice was investigated using paddy rice samples with different moisture contents (11, 13, 15, 17, and 19%). General characteristics of brown rice such as yield, normal, immature, damaged, chalky, discolored, and cracked brown rice ratios, hardness, and whiteness were determined. The results showed that brown rice with 15 and 17% moisture contents had relatively higher values for all quality tests compared to those of the other rice samples with the exception of cracked brown rice ratio. The cracked brown rice ratio increased with the increase in moisture content (p <0.05), whereas hardness of the brown rice decreased with the increase in moisture content (p <0.05). These results suggest that paddy rice with 15–17% moisture content produce high quality brown rice.

**Minseon Koo, Ae-Ri Cho, A-Ram Jeong, Hyun Jung Kim, Yong-Ho Park, Hyo-Sun Kwak, In-Gyun Hwang. Antibiotic susceptibility and molecular typing of *Enterococcus faecalis* from retail pork meat products in Korea. J. Korean Soc. Appl. Biol. Chem. 56(3):295-299**

Enterococci have been used as starter cultures and probiotics. They also have been considered as indicator organisms for antibiotic resistance due to their ability to harbor and to easily acquire antibiotic resistance. This study aimed to show the antimicrobial resistance profiles and genotyping of Enterococcus faecalis in retail pork meat products in Korea. Enterococcus spp. were analyzed for 124 collected samples, which included minced pork meat, marinated pork meat with soy sauce or kochujang (fermented hot pepper-soybean paste), and frozen processed pork meat products. The isolates of E. faecalis (n=36) were resistant to tetracycline (58.3%), erythromycin (11.1%), and nitrofurantoin (2.8%). No vancomycin resistant enterococci were observed in the present study. Most of the E. faecalis isolates were sensitive to all antibiotics or resistant to single antibiotics. As a result of the automated repetitive-sequence-based PCR (rep-PCR), which was used as an approach for genotyping enterococci, 7 out of 36 isolates of E. faecalis were assigned to one cluster with a similarity >95%, and all isolates were found to have originated from minced pork meat, suggesting that this clone might circulate in minced pork meat products. Given the importance of antimicrobial resistance of enterococci in food safety as well as in public health, our results on the occurrence, antimicrobial resistance, and genotyping could provide useful information to derive risk management options.

**Ji-Hoon Kang, Ho-Hyun Chun, Nak-Bum Song, Min-Sung Kim, Jiyong Park, Deog-Hwan Oh, Kyung Bin Song. Effects of electron beam and ultraviolet-C irradiation on quality and microbial populations of leafy vegetables during storage. J. Korean Soc. Appl. Biol. Chem. 56(3):301-307**

Effects of ultraviolet-C (UV-C) and electron beam irradiation on the quality and microbial populations of leafy vegetables were compared as a microbial decontamination method. Tatsoi and red chard leaves were treated with UV-C at a dose of 5 kJ/m2 or by electron beam irradiation at doses of 0.5, 1, and 3 kGy. After UV-C or electron beam irradiation treatment, the samples were stored at 4 ± 1°C for 11 days. Populations of total aerobic bacteria in leafy vegetables decreased by 0.8–1.1 log CFU/g after treatment with UV-C irradiation, and those of yeast and molds decreased by 1.0–1.8 log CFU/g. On the contrary, electron beam irradiation at 0.5 or 1 kGy reduced the microbial populations by 2.0–2.5 log CFU/g. Electron beam irradiation at 3 kGy eliminated the microorganisms in the samples. These results suggest that electron beam irradiation at low dose below 3 kGy can be more effective than UV-C treatment for the inactivation of microorganisms in Tatsoi and red chard leaves.

**Ho Hyun Chun, Ji Hoon Kang, Kyung Bin Song. Effects of aqueous chlorine dioxide treatment and cold storage on microbial growth and quality of blueberries. J. Korean Soc. Appl. Biol. Chem. 56(3):309-315**

The effects of postharvest washing treatment and cold storage on the quality of blueberries were examined. The blueberries were treated with water or 100 ppm aqueous chlorine dioxide (ClO2) and stored at 4 or 20°C for 12 days. The aqueous ClO2 treatment reduced the initial populations of total aerobic bacteria and yeast and mold in the blueberries by 1.4–1.5 and 0.8–0.9 log CFU/g, respectively, compared with the control. Total anthocyanin content indicated that the blueberries stored at 4°C maintained their total anthocyanin content better than those stored at 20°C. Regardless of washing treatment, the blueberries stored at 4°C exhibited lower decay and weight loss than those stored at 20°C. These results suggest that a postharvest treatment of aqueous ClO2 and cold storage can be useful for maintaining the quality of blueberries during storage.

**Hui Teng, Won Young Lee. Optimization of microwave-assisted extraction of polyphenols from mulberry fruits (*Morus alba* L.) using response surface methodology. J. Korean Soc. Appl. Biol. Chem. 56(3):317-324**

Polyphenols in mulberry fruit were fast extracted using a microwave-assisted extraction technique, and the effects of process variables including the solvent concentration, irradiation time, microwave power, and solvent consumption upon polyphenol extraction were investigated. Fifteen runs rotatable box-behnken design (RBBD) with three variables and three levels were employed; optimal conditions and maximal yields of the total polyphenol and flavonoid contents were predicted by generating a mathematical polynomial model based on response surface methodology. The estimated optimal conditions were ethanol concentration of 40%, irradiation time of 8 min, and microwave power of 210 W. A verification experiment was carried out at the above mentioned optimal conditions, and no significant differences were observed between the predicted and experimental values, which confirmed that the prediction was valid and application of response surface methodology (RSM) to the extraction of polyphenols and flavonoids from mulberries under microwaveassisted extraction (MAE) process was successful. In addition, specific polyphenols contained in mulberries were identified and quantified using high performance liquid chromatograph.

**Su-Jeong Ha, Yun-Ji Kim, Se-Wook Oh. Effect of high hydrostatic pressure (HHP) treatment on chemical and microbiological properties of *Makgeolli.* J. Korean Soc. Appl. Biol. Chem. 56(3):325-329**

Chemical and microbiological properties of Makgeolli after high hydrostatic pressure (HHP) treatment were investigated to determine the possibility of shelf-life extension. Laboratory prepared Makgeolli was treated with 400MPa for 5 min and stored for 6 days at 25°C and chemical and microbial properties were analyzed. On day 6 the alcohol content of untreated Makgeolli was 8.27%, whereas HHP-treated showed 7.50%, and pH were 2.76 and 3.22, respectively. Titratable acidity of HHPtreated Makgeolli was increased by less than 0.1%, whereas the untreated was increased by more than 0.3% on day 6. Reducing sugar content, on the other hand, increased continuously in HHP-treated Makgeolli, and reached to 2.43% by day 6, but decreased to 1.13% in untreated Makgeolli. In HHP-treated Makgeolli, yeast was reduced to below detection limit and grew again on day 6. Lactic acid bacteria were also reduced by HHP, but reappeared within 2 days at the level of 1-2 logs CFU/mL. HHP slowed down the chemical changes such as pH, titratable acidity, and alcohol content; thus showing HHP treatment can be used to extend the shelf-life of Makgeolli by inactivating lactic acid bacteria and yeast.

**Min-Gi Kim, Ji-Yeon Yang, Hoi-Seon Lee. Phototactic behavior: Repellent effects of cigarette beetle, *Lasioderma serricorne* (Coleoptera: Anobiidae), to light-emitting diodes. J. Korean Soc. Appl. Biol. Chem. 56(3):331-333**

Repellent effects of specific light wavelengths against the cigarette beetle were evaluated in blue (470 nm), green (520 nm), yellow (590 nm), and red (625 nm) light-emitting diodes (LEDs). Under optimal light conditions (100 lx luminance intensity, 2 h light exposure time), the blue LED (59%) was the most repellent to Lasioderma serricorne adults, followed by green (34.3%), yellow (31.3%), and red (29.3%) LEDs. Moreover, the blue LED was approximately 1.3 times more repellent to L. serricorne adults than a luring lamp black light (BL), 45.7%. These results suggest that blue LEDs could be used for environmentally friendly insect control.

**Kyung Hwan Boo, Doseung Lee, Quyen Van Nguyen, Seong Beom Jin, Seungtae Kang, Cao Dang Viet, Se Pill Park, Dong-Sun Lee, Key Zung Riu. Fluctuation of 20-hydroxyecdysone in individual organs of *Achyranthes japonica* during reproductive growth stage and its accumulation into seed. J. Korean Soc. Appl. Biol. Chem. 56(3):335-338**

To better understand 20-hydroxyecdysone (20E) fluctuation and accumulation in perennial plant, 20E concentration in individual organs of Achyranthes japonica during reproductive growth stage were analyzed by high performance liquid chromatography (HPLC). Concentrations of 20E in root and floral part were much higher than those in stem and leaf during reproductive growth stage and rapidly increased from flowering stage in August to seed-setting stage in October, and thereafter decreased at the stage of seed maturing in November. In contrast, the 20E concentrations in stem and leaf gradually decreased during reproductive growth. In the analysis of detailed fluctuation of 20E in floral part, the 20E concentration was highest in the seed at the early stage of seed development, compared to flower, peduncle, seed coat, and/or seed in other growth stages, and decreased during seed maturation. The accumulation of 20E in reproductive organs, especially seed and root, suggests that 20E has a defensive role for protection of especially newly developing organs against phytophagous insects.

**Sunhwa Park, Ji-Hoon Lee, Yong-Joon Cho, Jongsik Chun, Hor-Gil Hur. Draft genome sequence of *Pseudomonas* sp. strain G5, isolated from a traditional indigo fermentation dye vat. J. Korean Soc. Appl. Biol. Chem. 56(3):339-341**

In previous study, alkaliphilic and thermotolerant bacterium strain, Pseudomonas sp. strain G5, capable of reducing insoluble indigo was isolated from Korean traditional fermentation liquor. Here, we report the draft genome sequence and annotation of strain G5 to provide the genomic information involved in indigo reduction process.

**Jong Min Lee, Soon Young Shin, Hyuk Yoon, Mi So Lee, You Ri Lee, Dongsoo Koh, Young Han Lee. Synthesis and biological evaluation of a novel pyrazolecarbothioamide derivative (DK115) inducing cell cycle arrest at the G1 phase in HCT116 human colon cancer cells. J. Korean Soc. Appl. Biol. Chem. 56(3):343-347**

A novel compound, 5-(2,3-dimethoxyphenyl)-3-(1-hydroxynaphthalen-2-yl)-N-(4-methoxyphenyl)-4,5-dihydro-1H-pyrazole-1-carbothioamide (designated DK115) was synthesized, and its antitumor efficacy was assessed. Exposure of DK115 to HCT116 human colon cancer cells inhibited cellular proliferation and clonogenicity. DK115 induced cell cycle arrest at the G1 phase. DK115 downregulated cyclin D1 expression, whereas upregulated p53 and p21 expressions. DK115-induced p21 was not observed in HCT116 cells lacking the p53 gene (p53−/−), suggesting that DK115 induces p21 expression via p53. These data demonstrate that a novel synthetic DK115 compound may possess antitumor activity through the induction of tumor suppressor p53-mediated G1 cell cycle arrest.

**Joungsu Joo, Youn Hab Lee, Dong Hee Choi, Jong-Joo Cheong, Yeon-Ki Kim, Sang Ik Song. Rice ASR1 has function in abiotic stress tolerance during early growth stages of rice. J. Korean Soc. Appl. Biol. Chem. 56(3):349-352**

OsASR1 expression was induced through Abscisic acid (ABA) and stress treatments in leaves. The constitutive overexpression of OsASR1 in rice reduced ABA sensitivity, and increased high salinity and osmotic stress tolerance in early growth stages. These results indicated that OsASR1 has function in abiotic stress tolerance during early growth stages of rice.

**Mi Kyoung Kim, Youhoon Chong. Design, synthesis, and biological evaluation of resveratrol derivatives as PPARα agonists. J. Korean Soc. Appl. Biol. Chem. 56(3):353-356**

The peroxisome proliferator-activated receptor subtype α (PPARα) was established as a molecular target in drug discovery research for new lipid-lowering drugs. Pterostilbene is a naturally occurring PPARα agonist that has been shown to lower plasma lipid concentrations via the activation of PPARα. In this study, various pterostilbene conjugates with methyl, amino acid, and pivaloxymethyl (POM) groups at the 4-OH position were synthesized, and the activating effect on PPARα were investigated. Of the conjugates investigated, 4-OMe-pterostilbene had lower activating effect than pterostilbene, but the pterostilbenes with either amino acid (4a and 4b) or POM moiety (5) showed a small but significant increase in PPARα activation of PPARα activity compared to pterostilbene. Therefore, the structure-activity relationship of the pterostilbene conjugates studied indicates that substitution of the free 4-OH moiety of pterostilbene with a nonmethyl group can increase PPARα agonistic activity. This finding warrants further investigation of the structure-activity relationship of the pterostilbene conjugates as potent PPARα agonists.

**Hoon Choi, Jeong-Han Kim. Volatile constituents of herbicide glufosinate-tolerant and non-transgenic rice by solvent-assisted flavor evaporation and gas chromatography-mass spectrometry. J. Korean Soc. Appl. Biol. Chem. 56(3):357-360**

The volatile components in leaves and roots of two glufosinate-tolerant rice varieties, Iksan483 and Milyang204, and conventional rice were extracted by solvent-assisted flavor evaporation prior to gas chromatography-mass spectrometry analysis. Five volatiles were identified in rice leaves as common constituents, whereas eight volatiles were identified in rice roots. These compounds include metabolites of different chemical groups such as acids, aldehydes, ketones, alcohols, phenols, and terpenes. In rice leaves, major volatile compounds were trans-2-hexenal (0.62–16.45 μg/g) and 3-methyl butanoic acid (0.43–1.36 μg/g). Benzyl alcohol (1.31–5.37 μg/g), hexanal (0.41–1.32 μg/g), and nonanal (0.33–1.14 μg/g) were detected as the major volatiles in rice roots. Statistically significant differences were not observed in contents of all volatiles isolated from varieties, according to results of the one-way analysis of variance at the 0.05 level, suggesting that the volatile composition of transgenic rice fall within the range of non-transgenic counterparts.

**Jannu Vinay Gopal, Ethiraj Subashini, Krishnan Kannabiran. Extraction of quinone derivative from *Streptomyces* sp. VITVSK1 isolated from Cheyyur saltpan, Tamilnadu, India. J. Korean Soc. Appl. Biol. Chem. 56(4):361-367**

Extraction of pigments from natural sources is gaining momentum due to many biological applications. The aim of our study was to extract and to identify the pigment produced by Streptomyces species isolated from saltpan soil samples. The pigment-producing isolate was characterized by molecular taxonomy, identified as Streptomyces species, and designated as Streptomyces sp. VITVSK1. The isolate produced green color pigmentation upon solid substrate fermentation using parboiled rice as a media for 7 days at 37°C. The pigment derivative was extracted using methanol as solvent and purified by silica gel column chromatography and preparative thin layer chromatography using chloroform: methanol as solvent system. The purified compound was identified as 2,5-di-tert-butyl-1,4-benzoquinone (DTBBQ) based on similarity index with reference compounds available in the mass spectra library, NIST. Structure of the pure compound was also elucidated by 1H and 13C nuclear magnetic resonance spectra. The compound DTBBQ showed 2,2-diphenyl-1-picrylhydrazyl (DPPH) radical scavenging activity with IC50 value of 0.6 μg/mL. DTBBQ also showed antimicrobial activity with a zone of inhibition of 21 mm against Bacillus cereus. The results of the present study showed that Streptomyces sp. VITVSK1 could be a promising source for the production of biologically active quinone-based pigments.

**Mario Soccio, Daniela Trono, Maura N. Laus, Donato Pastore. An improved spectrophotometric phospholipase A*2* assay using 1-palmitoyl-2-linoleoyl-*sn*-glycero-3-phosphatidylcholine as substrate and lipoxygenase as coupled enzyme. J. Korean Soc. Appl. Biol. Chem. 56(4):369-376**

An improved spectrophotometric assay of phospholipase A2 (PLA2) activity based on the coupled PLA2/lipoxygenase (LOX) reactions using 1-palmitoyl-2-linoleoyl-sn-glycero-3-phosphatidylcholine (PCLIN) as substrate is reported. The PLA2-mediated release of free linoleate is continuously monitored by following the absorbance increase at 234 nm caused by its conversion into the conjugated diene hydroperoxide catalyzed by the coupled soybean LOX-1 reaction. The new protocol includes the use of Tween 20 (3 μL/μmol phospholipid) as surfactant and of ethanol (15 μL/mL reaction mixture), that ensure clearness of reaction mixture and linear increase of absorbance in the course of reaction. This method was tested on a purified secretory PLA2 from honey bee venom (HBV-PLA2). The enzyme did not discriminate among PCLIN, phosphatidylcholine, and phosphatidylethanolamine, but showed the highest rate using 1,2-dilinoleoyl-sn-glycero-3-phosphatidylcholine (PCDILIN). Nevertheless, the use of PCDILIN is not recommended, as it may induce an overestimation of enzyme activity, because not only the free linoleate, but also the reaction product 1-linoleoyl-lysophosphatidylcholine, are known to be oxidized by LOX. HBV-PLA2 showed maximal activity at pH 9.0, hyperbolic kinetics (Km, 74.2±2.9 μM; Vmax, 827±7 μmol/min/mg protein) and competitive inhibition (Ki about 5 μM) by palmityl trifluoromethyl ketone, a classical PLA2 inhibitor. Interestingly, the HBV-PLA2/soybean LOX-1 coupled reactions also allow an accurate assay of PCLIN concentration. In the whole, these results demonstrate that this improved PLA2/LOX assay allows a very accurate, simple, and rapid measurement of enzyme activity and substrate concentration.

**Mi-Jeong Jeong, DongWon Bae, Hanhong Bae, Soo In Lee, Jin A. Kim, Sung Chul Shin, Sung Han Park, Soo-Chul Park. Inhibition of *Botrytis cinerea* spore germination and mycelia growth by frequency-specific sound. J. Korean Soc. Appl. Biol. Chem. 56(4):377-382**

The effect of sound waves on mycelial growth of Botrytis cinerea was investigated to explore whether frequency-specific sound could be used as a practical alternative to chemical fungicides to control plant diseases. The fungus was exposed to wave frequencies ranging from 1 to 5 kHz, and then observed using light and scanning electron microscopy to assess changes in several physiological and morphological aspects. Of the frequencies tested, 5 kHz sound wave significantly inhibited mycelial growth and spore germination. Furthermore, morphological changes, including low mycelial density, swollen mycelial tips, and irregular mycelial surfaces, were observed. Most internal hyphae were empty, and the ends of hyphae were significantly thinner or swollen. These observations suggest that 5 kHz sound waves create stressful growth conditions for the fungus, which leads to the inhibition of mycelia growth and spore germination. It is possible that sound wave treatment could represent an environmentally-friendly alternative to chemical fungicides. These results broaden our knowledge regarding the effective management of noxious nectrotrophic fungal pathogens by a nonchemical approach.

**Young Min Kang, Min Geun Kim, Han Dae Yun, Kye Man Cho. Construction and expression of a novel *Paenibacillus polymyxa* GS01 bifunctional *xyn*43A-*lin*16A gene through overlap extension PCR. J. Korean Soc. Appl. Biol. Chem. 56(4):383-389**

A shotgun method was adopted to clone the β-xylanase and lichenase genes from a genomic library of a Paenibacillus polymyxa GS01 genome library. Also, a fusion enzyme, Xyn3A-Lin16A, was designed by overlap extension polymerase chain reaction (PCR). The cloned Xyn3A and Lin16A proteins were successfully expressed and exhibited both xylanase and lichenase activities. The xyn43A and lin16A gene amplicons were 1,917 bp and 714 bp in size and encoded proteins of 635 and 238 amino acids, respectively. The Xyn43A and Lin16A gene products showed predicted molecular masses of 65 and 24 kDa with respective calculated pIs of 5.97 and 5.77, respectively. Furthermore, the fusion enzyme gene, Xyn43A-Lin16A, was 4,466 bp in length and encoded a protein of 847 amino acids, with apparent molecular mass of 89 kDa and a calculated pI of 5.93. This fusion enzyme showed optimum activity at pH 6.0–7.0 and 50°C. Thus, the xyn43A and lin16A genes from P. polymyxa GS01were able to exist in tandem, and recombinant DNA technologies can be used to improve enzyme productivity. Therefore, the development of functional fusion enzymes (xylanase-lichenase) using recombinant DNA technologies may lead to further improvements and their successful enzyme engineering in industrial application.

**Su Jeoung Suh, Seong-Hun Lee, Dong-Hoon Lee, In-Jung Kim. Transcriptome analysis of a spontaneous reddish mutant in Miyagawa Wase Satsuma mandarin. J. Korean Soc. Appl. Biol. Chem. 56(4):391-399**

Color is one of the main characteristics determining the fruit quality of Citrus. A spontaneous mutant of Miyagawa Wase Satsuma mandarin (Citrus unshiu Marc.) was selected for its reddish coloration. At the start of ripening, color development of the mutant fruit was faster than that in wild-type fruit. At the mature stage, the intensity of red color in the peel was higher in the mutant without other changes in fruit characteristics. To understand the molecular basis of the mutant phenotype, microarray analysis was performed to observe genome-wide transcriptomic alterations in the mutant compared to the wild-type fruit. In the mutant, the expression levels of 582 genes were altered by more than 2-fold (p <0.05). Up-regulated genes were predominantly classified as genes involved in metabolism, cellular processing, and signaling. The expression levels of enzymes involved in carotenoid and flavonoid metabolisms, which are responsible for pigmentation in plants, were increased in the mutant, whereas enzymes involved in carotenoid degradation also were up-regulated. Confirming the microarray results, real-time reverse transcription-polymerase chain reaction data showed that expression of genes for carotenoid and flavonoid metabolism was strongly increased in the mutant. These results suggest that the changes of gene expression involved in carotenoid and/or flavonoid metabolism could responsible for the red-coloration in mutant.

**Hyun Woo Sim, MiJa Jung, Yong Kweon Cho. Purification and characterization of protocatechuate 3,4-dioxygenase from *Pseudomonas pseudoalcaligenes* KF707. J. Korean Soc. Appl. Biol. Chem. 56(4):401-408**

Protocatechuate 3,4-dioxygenase was isolated and characterized from Pseudomonas pseudoalcaligenes KF707 for the purpose of developing a new anti-browning agent. The protocatechuate 3,4-dioxygenase from Pseudomonas pseudoalcaligenes KF707 was purified 296.8-fold, and showed specific activity of 121.7 U/mg. Based on the SDS-polyacrylamide and gel permeation chromatography, the molecular weight of protocatechuate 3,4-dioxygenase was 189.9 kDa and was composed of 3 αβ protomers, with molecular weights of 29.0 kDa of α subunit and 34.3 kDa of â subunit. The optimal pH and temperature were 7.5 and 38°C, respectively. Km values of catechol, protocatechuate, gallate, p-cresol, caffeic acid, catechin, L-DOPA, 4-methylcatechol and pyrogallol were 14, 17, 2, 10, 12, 20, 30, 21 and 3 μM, and the Vmax/Km (mim−1) values were 0.052, 3.06, 0.35, 0.01, 0.03, 0.02, 0.006, 0.008 and 0.11, respectively. This indicates that the enzyme is active on a wide range of phenyl compounds, in contrast to the high specificity of similar enzymes from other sources. Our data also show that the turnover number of protocatechuate 3,4-dioxygenase from Pseudomonas pseudoalcaligenes KF707 is 68 s−1, which is much higher than the known values from other sources.

**Leila Arab, Ali Akbar Ehsanpour, Nam Soo Jwa. Co-treatment effect of triadimefon and salt stress on antioxidant responses, NHX1 and LEA expression in two alfalfa cultivars (*Medicago sativa* L.) under *in vitro* culture. J. Korean Soc. Appl. Biol. Chem. 56(4):409-417**

This study was carried out to investigate the possibility of using Triadimefon as a plant growth regulator and salt stress protectant in order to decrease the adverse effects of salt stress. Two Medicago cultivars including Hamedani and Yazdi were treated with 0, 2 mg/L triadimefon (TRD) and 0, 100, and 140 mM NaCl. Salt stress increased Na+, ascorbic acid (AA), reduced glutathione (GSH), reactive oxygen species and phenol contents and activity of ascorbate peroxidase (APX), and glutathione reductase (GR), whereas decreased the K+ content and the activity of polyphenol oxidase (PPO) in both cultivars. When plants were treated with TRD and NaCl, they accumulated less Na+, K+, and ROS. Co-treatment of NaCl and TRD in both cultivars increased AA, GSH, and phenol contents, and the activities of APX and GR, whereas reduced PPO activity. Our results also showed that LEA gene was up-regulated by salt stress. TRD treatment resulted in down-regulation of this gene. Sodium/hydrogen exchanger gene was not affected by either salt or TRD treatments.

**Tae Jin Kim, Dong Yeol Choi, Ki-Hong Yoon, Keehyuk Kim, Seung Ju Lee. Application of mixture rule to determine arrhenius activation energy of time temperature integrator using mixture of laccase from *Pleurotus ostreatus* and PEGylated laccase from *Trametes versicolor.* J. Korean Soc. Appl. Biol. Chem. 56(4):419-425**

Two isoenzyme mixture system was developed to freely adjust the Arrhenius activation energy (Ea), which is one of the most important parameters to design a reliable time temperature integrators (TTIs). We hypothesized that the apparent Ea of a mixture of two isozymes would be expressed in a simple linear relationship with the ratio of the mixture, although it could be expressed with a rather complicate equation. To prove our hypothesis, laccase from Pleurotus ostreatus (Ea =27.06 kJ/mol) and PEGylated laccase from Trametes versicolor (Ea =50.35 kJ/mol) were used to prepare enzyme mixtures with ratios of 0, 0.25, 0.5, 0.75, and 1.0. The enzyme activity was determined by the increase of absorbance of 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) incubated at 5–30°C, pH 5.0, and Ea for each enzyme mixture was determined to be in the range of 27.06–50.35 kJ/mol. Relationship between Ea and a ratio of the enzyme mixture not only turned out to be linear, but also was well fitted to the linear mixture rule. This newly found linear dependency is much simpler than kinetically derived one, presumably because microscopic reaction paths and thermodynamic parameters were combined and cancelled out, resulting in linearity. This finding is important in that a mixture of two enzymes with a proper ratio determined from the simple linear mixture rule can customize Ea of an enzymatic TTI. This easier and convenient method can offer a practical and reliable way to adjust Ea of an enzymatic TTI on demand.

**Satheesh Kumar Gudi, Chandrasekhar Gurramkonda, Gulam Rather, Muniramanna Gari Subohsh Chandra, Usha Kiranmayi Mangamuri, Shdhakar Podha, Yong-Lark Choi. Glucoamylase from a newly isolated *Aspergillus niger* FME: Detergent-Mediated production, purification, and characterization. J. Korean Soc. Appl. Biol. Chem. 56(4):427-433**

Glucoamylase (EC 3.2.1.3) is an important group of enzymes in starch processing, also referred to as amyloglucosidases, which are exo-acting amylases that release glucose from the nonreducing end of starch and related oligosaccharides. The glucoamylase newly isolated from the Aspergillus niger FME) was reported for the first time. This enzyme was produced by detergent-mediated release and purified to ∼9.11 fold using Sephadex-G 100 and ion-exchange chromatography. Molecular mass of the glucoamylase was ∼36 kDa as determined by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE). The product of starch hydrolysis, analysed by thin-layer chromatography, showed the presence of glucose. The optimum pH and temperature for glucoamylase activity was 5.0 and 45°C, respectively. The Km and Vmax values of the enzyme were also determined using soluble starch as substrate as 94 μg/mL and 39.02 U/mg, respectively. Moreover, glucoamylase was slightly activated by presence of Na and K ions and 10–20% inhibition was observed in presence of Zn2+, Sn2+, Mg2+, Ni2+, Mn2+, and almost 80% with Cu2+ ions, whereas the presence of ethylene diamine tetra acetic acid (EDTA) did not show significant inhibition. Glucoamylase, also assayed for surfactant property, shows significant surfactant tolerance at high concentrations of detergent and can retain 90% of its activity. Finally, secondary structure analysis of glucoamylase by circular dichroism spectroscopy showed the presence of 48% α-helix, 11% β-sheet, and 41% random structure.

**In-Wook Hwang, Shin-Kyo Chung, Moon-Cheol Jeong, Hun-Sik Chung, Hu-Zhe Zheng. Optimization of enzymatic hydrolysis of persimmon peels for vinegar fermentation. J. Korean Soc. Appl. Biol. Chem. 56(4):435-440**

Response surface methodology (RSM) was used to determine the treatment conditions of optimal enzymatic hydrolysis for vinegar preparation from persimmon peel. Persimmon peel was hydrolyzed with different concentrations of Viscozyme L (0–4%) at different temperatures (40–60°C) for different lengths of time (2–10 h) followed by vinegar fermentation. Reducing sugar and soluble solids of the hydrolyzed juice were significantly affected by the hydrolysis conditions. Optimal condition was obtained with the enzyme concentration of 2.38 g/100 mL, reaction temperature of 49.19°C, and reaction time of 6.32 h. The titratable acidity of vinegar prepared from the juice hydrolyzed under the optimized condition increased by 276% (4.25 g/100 g). Acetic acid, citric acid, oxalic acid, and succinic acid were identified in the vinegar. Results suggest that the enzymatic hydrolysis pretreatment could be used for increasing the yield of the vinegar fermentation.

**Peck Loo Kiew, Mat Don Mashitah. Isolation and characterization of collagen from the skin of Malaysian catfish (Hybrid *Clarias* sp.). J. Korean Soc. Appl. Biol. Chem. 56(4):441-450**

Acid soluble collagen (ASC) and pepsin soluble collagen (PSC) were isolated from the skin of hybrid Clarias sp. with the yields of 18.11±0.32 and 26.69±0.54% (wet weight basis), respectively. Both collagens were characterized as type I collagen, containing α1 and α2 chains. Presence of high molecular weight crosslinks were observed in the gel electrophoresis of both collagens. Fourier transform infrared spectra of both collagens were almost similar, suggesting that pepsin hydrolysis did not disrupt the triple helical structure. The amino acid analysis showed glycine was the most abundant, with 207/1000 and 223/1000 residues present in ASC and PSC, respectively. The amounts of imino acids were 185/1000 residues for both. Thermal denaturation temperatures were determined to be 31.5 and 31.0°C, respectively. Both collagens exhibited high solubility in acidic pH (1–5) and below 4% (w/v) NaCl concentration.

**Hyun-Joo Chang, Young Sup Kim, Shi Yong Ryu, Hyang Sook Chun. Screening of various sources of phytochemicals for neuroprotective activity against oxygen-glucose deprivation *in vitro.* J. Korean Soc. Appl. Biol. Chem. 56(4):451-455**

Neuroprotective activities of 176 phytochemicals were investigated against oxygen-glucose deprivation in vitro using primary cortical neuron culture. Diterpenes (taxol and taxol C) were the most potent neuroprotective compounds. EC50 of taxol and taxol C were 0.402 and 0.452 μM, respectively. This result supports the use of an in vitro model as initial screening for neuroprotective candidates, which warrants further testing in animal models.

**Dong Young Rhyu, Si Hyung Park. Characterization of alkyl thiosulfinate in *Allium hookeri* root using HPLC-ESI-MS. J. Korean Soc. Appl. Biol. Chem. 56(4):457-459**

Allicin produced by alliinase system of Allium hookeri was evaluated via high performance liquid chromatography (HPLC). Allicin contents of A. hookeri were 56.6±3.5 μg per g of fresh root and 12.7±3.2 μg per g of fresh stem. These values were relatively low as compared with garlic. HPLC-electrospray ionization-mass spectrometry analyses showed A. hookeri root extract contained ten alkyl thiosulfinates, and the chemical structures were characterized by MS/MS analyses.

**Mahtab Ahmad, Deok Hyun Moon, Mahmoud Wazne, Hee Joung Kim, Young Han Lee, Yong Sik Ok. Effects of natural and calcined oyster shells on antimony solubility in shooting range soil. J. Korean Soc. Appl. Biol. Chem. 56(4):461-464**

Waste oyster shells (OS) and calcined oyster shells (COS) were used to treat metal-contaminated shooting range soil, where antimony (Sb) leachability was assessed. Changes in soil pH induced by the amendments strongly influenced Sb leachability. Sb was immobilized by COS most likely due to calcium antimonate precipitation. This is the first time to our knowledge to report that COS can effectively immobilize Sb in the soil.

**Hoon Choi, Ji-Youn Byoun, Jeong-Han Kim. Determination of reentry interval for cucumber harvesters in greenhouse after application of insecticide methidathion. J. Korean Soc. Appl. Biol. Chem. 56(4):465-467**

Determination of reentry interval for harvesters after application of insecticide methidathion on cucumber in greenhouse was performed. Dislodgeable foliar residue of methidathion ranged from 12.1∼222.5 ng/cm2 for 7 days after application. First-order rate constant for methidathion residue on foliage was −0.4915, and half-life was 1.4 days. The reentry interval (REI) without personal protective clothing or equipment was calculated as 44 h (1.8 days), which is not practical, because cucumber is usually harvested everyday during production period due to its fast growing characteristics. However, when harvester wear personal protective clothing or equipment, −69 h (−2.9 days) of REI was determined, indicating they could reenter greenhouse on the day of application. Therefore, harvesters must wear personal protective clothing or equipment for safe harvesting activity in cucumber greenhouse on the day of application.

**Yong-ung Kim, Jaehong Han. Steroid 5*α*-reductase inhibition by polymethoxyflavones. J. Korean Soc. Appl. Biol. Chem. 56(4):469-471**

Steroid 5α-reductase inhibition was studied using eleven polymethoxyflavones (PMFs). Homologous eleven PMFs showed wide range of steroid 5α-reductase inhibitory effects. Among the tested PMFs, 5-hydroxy-7,4′-dimethoxyflavone (5) was found to be the most potent inhibitor of steroid 5α-reductase with the IC50 of 20 μM. These results showed PMFs could be used as a nonsteroidal steroid 5α-reductase for the treatment of benign prostatic hyperplasia.

**Xue Jiang, Il-Hwan Oh, Seul-Gi Lee, Hyung-Kyoon Choi. The application of metabolomics to processed traditional Chinese medicine. J. Korean Soc. Appl. Biol. Chem. 56(5):475-481**

Processing technologies, which are required in the production of traditional Chinese medicine (TCM), has garnered attention in recent years. To address challenges associated with processed TCM and to promote its development in academia and industries, the application of metabolomics was introduced in this review, which primarily focuses on exploring TCM theories, identification of discovered compounds, and the evaluation and quality control of TCM through metabolomics. Thus metabolomics could be a powerful method for the TCM processing industry.

**Moo-Hyeog Im. Review of Codex Alimentarius and comparison between the US and Korean food classifications for pesticide residues of the US and Korea. J. Korean Soc. Appl. Biol. Chem. 56(5):483-495**

All countries worldwide are experiencing difficulties in setting maximum residue limits (MRLs) for pesticide residues in food commodities due to prohibitive costs, labor, and other expenses. The Codex Alimentarius (Codex) is actively engaged in revising the classification of food commodities that are grown in small areas; however, setting MRLs for all agricultural commodities has not been effective. Modified food classifications for groups of agricultural commodities were established for setting MRLs of pesticides for each food commodity. Codex accepted various countries’ opinions that the old food classification of commodities can no longer be applied to the present food classifications; therefore, from 2009, Codex started to revise their food classifications. To set pesticide MRLs for agricultural products grown in small fields, groups of agricultural commodities were subdivided, and new food classifications were used. The food classification revised by Codex made it easy to set up group MRLs. After the Codex food classification was revised, jujube and persimmon, which were previously classified as tropical fruits, were grouped as pome fruits and stone fruits based on the opinion of the Korea Food & Drug Administration (KFDA). In addition, KFDA submitted more comments on the classification of various vegetables. As a result, Korean vegetables were included in the food classification by Codex. The current Codex food classifications in Korea still have not adopted a group-specific subdivision system that is already used in Codex and the US internationally harmonized food classification revisions by Codex might resolve the difficulty of setting up pesticide MRLs for agricultural commodities such as vegetables in Korea. Consequently, food classifications in Korea, which are in harmony with the Codex food classification, will be of great help in setting the group MRLs for the minor crops of Korea.

**amasamy Rajesh Kumar, Bong Ju Park, Jae Young Cho. Application and environmental risks of livestock manure. J. Korean Soc. Appl. Biol. Chem. 56(5):497-503**

Over the past few decades, livestock production has undergone an industrial revolution, resulting in the large-scale generation of livestock manure. Livestock manure has many beneficial nutrients, which can improve agricultural crop production, and is an organic alternative to chemical fertilizers. Livestock manure requires proper treatment before application to agricultural land, because it contains toxic heavy metals and pathogenic microorganisms. When improperly treated, stored or used, livestock manure can pollute rivers, soil ecosystems, and underground drinking water, thereby affecting all living organisms nearby. In this article, we illustrate the land applications and environmental risks associated with the use of livestock manure.

**K. K. I. U. Arunakumara, Buddhi Charana Walpola, Min-Ho Yoon. Alleviation of phyto-toxicity of copper on agricultural plants. J. Korean Soc. Appl. Biol. Chem. 56(5):505-517**

Copper (Cu), a redox-active transition metal, is known to be involved in protein metabolism, photosynthetic and respiratory electron transport, cell wall metabolism, antioxidant activity, nitrogen fixation, ion metabolization, and hormone perception, among others in plants. Though Cu has been listed among the essential elements, it could potentially result in complete inhibition of plant growth and development at excess concentrations. Measures available for alleviating Cu toxicity in plants are discussed in the present paper. Exogenous application of nitric oxide through up-regulating the components of antioxidant defense system [catalase (CAT-EC 1.11.1.6), peroxidase (POD-EC 1.11.1.7), superoxide dismutase (SOD-EC 1.15.1.1), and ascorbate peroxidase (APX-EC 1.11.1.11) activities] and stimulating the enzyme P5CS (D1-pyrroline-5-carboxylate synthetase), which catalyzes proline biosynthesis, has been proved to stand against the adverse impacts of Cu toxicity. Addition of cations (such as Ca2+ and Mg2+) through stimulating site-specific competition for metal ions could also prevent excess accumulation of Cu in cell interior. Silicon application, through nutrient balancing and physically blocking the apoplastic bypass flow has also been recognized to be effective in alleviating Cu toxicity. Addition of organic amendments and use of arbuscular mycorrhizal fungi as soil inoculants have also proved successful in amelioration of Cucontaminated soils. Though molecular and physiological mechanisms associated with Cu toxicity have been substantially investigated, information on the regulation of the expression of stress-related genes in key agricultural plant species is still lacking. Additional research efforts focusing at field validation of the toxicity alleviation methods are also equally important.

**Sae-Kwang Ku, In-Chul Lee, Jong-Sup Bae. Inhibitory effects of purpurogallin on the endothelial protein C receptor shedding *in vitro* and *in vivo.* J. Korean Soc. Appl. Biol. Chem. 56(5):519-524**

Endothelial cell protein C receptor (EPCR) plays important roles in the regulation of blood coagulation and inflammation. Activity of EPCR is markedly changed by ectodomain cleavage and released as soluble protein (sEPCR). EPCR can be shed from the cell surface, and this is mediated by tumor necrosis factor-α converting enzyme (TACE). Purpurogallin (PPG) plays an important role in inhibiting glutathione S-transferase and xanthine oxidase as well as effective in the cell protection of several cell types. Here, we investigated the effects of PPG on phorbol-12-myristate 13-acetate (PMA), tumor necrosis factor (TNF)-α, interleukin (IL)-1β, and on cecal ligation and puncture (CLP)-mediated EPCR shedding and underlying mechanisms. Human umbilical vein endothelial cells pretreated with PPG (0, 5, 10, 20 or 50 μg/mL) for 6 h and exposed to PMA (1 μM) for 1 h, and CLP-operated mice were administrated with PPG. Data showed that treatment with PPG resulted in potent inhibition of PMA, TNF-α, IL-1β, and CLP-induced EPCR shedding by suppression of TACE expression. In addition, PPG reduced PMA-stimulated phosphorylation of p38, extracellular regulated kinases 1/2, and c-Jun N-terminal kinase. These results suggest the potential for use of PPG as an anti-sEPCR shedding reagent against PMA and CLP-mediated EPCR shedding.

**Bong-Gyu Kim, Joong-Hoon Ahn. Characterization of uridine diphosphate-sugar pyrophosphorylase from *Populus deltoids.* J. Korean Soc. Appl. Biol. Chem. 56(5):525-531**

Nucleotide sugars serve as sugar donors for the biosynthesis of various cell components including cell wall, glycoproteins, and small molecules. Among them, uridine diphosphate (UDP)-glucose is one of main nucleotide sugars that serve as a substrate for the synthesis of other UDP-sugars. UDP-sugar pyrophosphorylase (USPase) mediates the formation of UDP-glucose from uridine triphosphate (UTP) and glucose-1-phosphate. A USPase, PdUSPase was cloned from Populus deltoids and expressed in Escherichia coli as glutathione Stransferase fusion protein. The purified recombinant PdUSPase catalyzed the reaction for the formation of UDP-glucose from glucose-1-phosphate and UTP, and for the formation of UDP-galactose from galactose-1-phosphate and UTP. However, the enzyme did not show any activity toward mannose-1-phosphate and UTP. These results indicate that PdUSPase belonging in UGPase A in phylogenetic analysis is the first UDP-glucose synthesizing enzyme showing a discrepancy between phylogenetic analysis and substrate range. E. coli complementation was also carried out to confirm the function of PdUSPase using E. coligalU mutant, which was mutated in UTP glucose-1-phosphate uridyltransferase. The galU mutant was transformed with the PdUGTase gene and a flavonoid glucosyl-transferase gene, AtUGT78D2. The resulting transformant was able to convert quercetin into quercetin 3-O-glucose similarly to that by the wild type E. coli strain harboring AtUGT78D2. These results indicated that PdUSPase catalyzed the formation of UDP-glucose from UTP and glucose-1-phosphate.

**Samira Jebahi, Hassane Oudadesse, Jiheun Elleuch, Slim Tounsi, Hassib Keskes, Pascal pellen,**

**Tarek Rebai, Abdelfatteh El Feki, Hafed El Feki. The potential restorative effects of strontium-doped bioactive glass on bone microarchitecture after estrogen-deficieny induced osteoporosis: Physicochemical and histomorphometric analyses. J. Korean Soc. Appl. Biol. Chem. 56(5):533-540**

Strontium (Sr) compounds have become increasingly popular in the field of osteoporosis treatment. However, the quality of new bone after implantation of strontium-containing bioceramics has yet to be investigated. In the present study, the newly formed bone tissue around strontium-doped bioactive glass (BG-Sr) implants was characterized. BG-Sr was implanted in the femoral condyl of ovariectomised rats (OVX). The resected bone was prepared for analysis using several physico-chemical and biological assays such as Fourier transform infrared spectroscopy, X-ray diffraction, scanning electron microscopy, energy-dispersive X-ray, and histomorphometry. BG-Sr biomaterial favored calcium phosphate layer integration on the surface of the glass and offered better bioactivity. Moreover, the histomorphometric analysis demonstrated that BV/TV, N. Ob were significantly higher in BG-Sr treated rats groups than those of BG groups. However, Ob. S/BS, and OV/BV were significantly lower in BG-Sr treated rats groups than those of BG groups. The (Oc.S/BS) was significantly decreased in BG-Sr groups, when compared with that of BG rat groups. On the other hand, the MS/BS had not significantly decreased in the BG-Sr treated rats groups when compared with that of BG groups, however; it was significantly higher when compared with control and OVX groups. These findings suggest that BG-Sr can be used as an inhibitory therapeutic potential of osteoporosis by delivering strontium to stimulate new bone remodeling.

**Jin Kyu Kim, Joa Sub Oh, Jin-Koo Lee. Antinociceptive effect of glyasperin F isolated from *Glycyrrhiza inflata* in mice. J. Korean Soc. Appl. Biol. Chem. 56(5):541-545**

Antinociceptive effect of glyasperin F isolated from Glycyrrhiza inflata extract (GIE) in ICR mice was studied. Oral administration of GIE (1–100 mg/kg) caused a dose-dependent reduction in acetic acid-induced writhing responses. To identify the active antinociceptive compound from the GIE, sub-fractions were obtained from the EtOAc layer of GIE by using a medium pressure liquid chromatography. From the sub-fractions obtained, the sub-fraction, which, when administered orally (10 mg/kg) showed an antinociceptive effect in both the writhing test and second phase of the formalin test was identified as glyasperin F using NMR and MS analyses. Finally, the antinociceptive effect of glyasperin F in mouse models of pain was confirmed. Orally administered glyasperin F (0.1–10mg/kg) showed a dose-dependent antinociceptive effect in both the writhing test and second phase of the formalin test. Taken together, glyasperin F isolated from the GIE may be used as a leading compound for further studies on pain and as a new drug derived from natural products for pain therapy.

**Jeong-Yong Cho, Kang-Deok Lee, Sun-Young Park, Won Chul Jeong, Jae-Hak Moon, Kyung-Sik Ham. Isolation and identification of *α*-glucosidase inhibitors from the stem bark of the nutgall tree (*Rhus javanica* Linné). J. Korean Soc. Appl. Biol. Chem. 56(5):547-552**

Ethyl acetate (EtOAc) layer obtained after the solvent fractionation of hot water extracts from nutgall tree (Rhus javanica) stem bark showed higher α-glucosidase inhibition activity than other layers. A novel acetophenone glucoside (4) and six known phenolic compounds were isolated from the EtOAc layer. The structure of 4 was determined to be 3,4,5-trihydroxyacetophenone 4-O-β-d-glucopyranoside. The six known compounds were identified as gallic acid (1), 5-methylresorcinol (2), methylgallate (3), 3-hydroxy-5-methylphenol 1-O-β-d-(6′-galloyl)glucopyranoside (5), scopoletin (6), and phlorizin (7). Their chemical structures were determined by electrospray ionization mass spectrometry and nuclear magnetic resonance analyses. Compound 5 was newly identified from this plant. Compounds 6 and 7 showed significantly higher α-glucosidase inhibition activity than other compounds.

**Dongbum Kim, Younghee Lee, Hyung-Joo Kwon. Expression of IFN-*γ* induced by CpG-DNA stimulation in a human myeloid leukemia cell line KG-1. J. Korean Soc. Appl. Biol. Chem. 56(5):553-558**

CpG-DNA has potent immunostimulatory effects to induce expression of cytokines and chemokines in macrophages, dendritic cells, and B cells. KG-1 is a human myeloid leukemia cell line used as an in vitro model system for dendritic cell differentiation. Here, we investigated effect of CpG-DNA on IFN-γ expression in KG-1 cells. Based on the mRNA and protein expression, stimulation of KG-1 cells with the phosphorothioated form of CpG-DNA induced expression of IFN-γ. The IFN-γ promoter includes one NF-κB binding site and two AP-1 binding sites. Induction of IFN-γ was markedly reduced in the presence of NF-κB, p38, and MEK1 inhibitors. Furthermore, AP-1 was found to interact with both of the two binding sites in the IFN-γ promoter. Therefore, we conclude that CpG-DNA induced activation of NF-κB and AP-1 leads to induction of IFN-γ, which may further contribute to immunostimulatory activity of CpG-DNA.

**Yong-Joo Kim, Chang-Hyun Choi. The analysis of paddy soils in Korea using visible-near infrared spectroscopy for development of real-time soil measurement system. J. Korean Soc. Appl. Biol. Chem. 56(5):559-565**

Precision farming aims at reducing environmental risks and increasing productivity. Soils are multi-functional media, in which air, water and biota occur together to form an essential part of the landscape, with a fundamental role in the environment. The requirement for herbicides and fertilizers can vary within a field in response to spatial differences in soil properties. Near infrared (NIR) spectroscopy is widely used today as a nondestructive analytical technique, which is capable of determining a number of physio-chemical parameters. The objective of this study was to develop optimal models for predicting chemical properties of paddy soils by visible and NIR reflectance spectra. Reflectance spectra, moisture contents, pH, total nitrogen, organic matter, available phosphate, exchangeable potassium, ex. calcium, ex. magnesium, ex. sodium, iron, manganese, zinc, and copper of soil samples were measured. The reflectance spectra were measured in the wavelength range of 400–2,500 nm with 2-nm intervals. The method of moving window partial least square (MWPLS) analysis, which is a wavelength interval selection method for multi-component spectra analysis, was used to determine the soil properties. MWPLS models showed the possibility to predict chemical properties of soil samples in the wavelength range of 1,000–2,500 nm, offering the possibility of considerable cost savings and increased efficiency over the conventional analysis method.

**Sunyi Lee, Sora Han, Jeong Su Park, Ae Lee Jeong, Seung Hyun Jung, Kang-Duk Choi, Tae-Young Han, Il-Young Han, Young Yang. Herb mixture C5E aggravates doxorubicin-induced apoptosis of human breast cancer cell lines. J. Korean Soc. Appl. Biol. Chem. 56(5):567-573**

A number of extracts from Asian traditional medicinal herbs have been successfully used as therapeutic agents against cancers. In this study we assessed the effect of C5E on the proliferation inhibition and apoptosis of breast cancer cell lines. C5E is an ethanol extract from traditional Asian medicinal plants which have anticancer activity. Nonetheless, little is known about the underlying mechanism. Thus, we studied the mechanism of C5E-induced cell death in the human breast cancer cell line MDA-MB-231 and MCF7 cells. The cell survival rate was reduced in a concentration- and time-dependent manner, as assessed by direct cell counting. After incubation for 48 h, typical apoptotic morphological changes were observed by microscope. To determine the synergetic effect with doxorubicin, we co-treated C5E with doxorubicin in breast cancer cells, and flow cytometry revealed that co-treatment obviously enhanced sub-G1 arrest and apoptosis in MDA-MB-231 and MCF7 cells. Furthermore, we showed that pro-apoptotic marker cleaved PARP was synergistically increased with the combined treatment of doxorubicin and C5E in MDAMB-231, but not in MCF-7. These results suggest that the effect of combined treatment of C5E with doxorubicin on sub-G1 arrest and apoptosis in breast cancer cells could be exerted by the different mechanism and its potential use as a therapeutic agent will be helpful in treatment for breast cancer.

**Jun-Hyeok Kim, Ngoc Trinh Nguyen, Vu Van Kien, Nguyen Hoai Nguyen, Young-Seok Jang, Hojoung Lee, Suk-Whan Hong. Induction of oxidative stress by overexpression of *α*-zein cDNA with mutation in signal peptide in *Arabidopsis.* J. Korean Soc. Appl. Biol. Chem. 56(5):575-581**

Defective endosperm (De\*)-B30 is a dominant maize mutation in the gene that encodes the storage protein, α-zein protein. The De\*-B30 mutation results in a defective signal peptide in a 19-kD α-zein protein, which triggers endoplasmic reticulum (ER) stress, leading to up-regulation of genes associated with the unfolded protein response. To extend our knowledge of the physiological responses to constitutive ER stress in plants, transgenic Arabidopsis plants were constructed, in which De\*-B30 transcripts were constitutively expressed under the control of the CaMV 35S promoter. Transgenic plants exhibited pale green leaves and growth retardation during the early vegetative stage. In addition, the growth rate of hypocotyl elongation was depressed in dark-grown transgenic seedlings. However, RNA blot analyses revealed no induction of the ER stress-inducible genes, including AtBiP1, AtCNX1, and AtCRT1 in transgenic Arabidopsis plants. Even though transgenic plants also were revealed to retain wild-type level of tunicamycin sensitivity, they showed an increase in hydrogen peroxide production. Higher levels of AtGST1 gene expression in transgenic plants were revealed. These findings suggest that reactive oxygen species are involved in the response to constitutive ER stress in Arabidopsis.

**Jin-Hyeob Kwak, Kwang-Seung Lee, Sang-Sun Lim, Miwa Matsushima, Kye-Han Lee, Sang-Mo Lee, Woo-Jung Choi. Historical responses of *Quercus variabilis* growth to environmental changes in Southern Korea: Evidence from tree ring width and *δ*13C. J. Korean Soc. Appl. Biol. Chem. 56(5):583-590**

Historical growth response of Quercus variabilis, which is the most important deciduous timber species in Korea, was investigated using the width and C isotope ratio (13C/12C denoted as δ13C) of the annual ring from 1975 to 2007. Tree disks were collected from three Q. variabilis trees with different growth statuses from a site in the Mt. Naejang area, and analyzed for annual ring width and δ13C. Basal area increment (BAI) of the annual ring was calculated from the width data, and carbon isotope discrimination (Δ) was calculated using δ13C. The intercorrelations among BAI, Δ, and environmental variables were explored. The BAI was positively (p <0.001) correlated with atmospheric CO2 concentration ([CO2]), reflecting increased net photosynthesis with [CO2], whereas the negative correlations of BAI with either NO2 (p <0.05) or O3 (p <0.05) concentrations suggested that atmospheric pollution might have restricted tree growth to some degree. The Δ was positively correlated with both temperature (p <0.05) and [CO2] (p <0.001), and BAI was also positively correlated with Δ (p <0.001). However, precipitation was correlated with neither BAI nor Δ, indicating that the precipitation amount is sufficient for tree growth in the study site. Such relationships suggest that stomatal rather than non-stomatal control is the predominant mechanism of photosynthetic acclimation of Q. variabilis under changing environmental conditions in the study site where water availability is not limited.

**Ju-Hyun Jeon, Min-Gi Kim, Hoi-Seon Lee. Insecticidal activities of *Ruta chalepensis* leavesisolated constituent and structure-relationships of its analogues against *Sitophilus oryzae.* J. Korean Soc. Appl. Biol. Chem. 56(5):591-596**

The insecticidal activities of active component isolated from Ruta chalepensis L. (Rutales: Rutaceae) leaves and its derivatives were examined using fumigant and contact toxicity methods against rice weevil, Sitophilus oryaze L. (Coleoptera: Curculionidae) adults. Administering the chloroform fraction of the methanol extract resulted in 87.7% mortality at 1.02 mg/cm2 against S. oryzae adults, using a fumigant method. The insecticidal constituent of R. chalepensis leaves was isolated by chromatographic techniques, and identified as quinoline-4-carbaldehyde (C10H7NO). Based on the LD50 values, the most toxic compound against S. oryzae was quinoline (0.063 mg/cm2), followed by quinoline-4-carbaldehyde (0.084 mg/cm2), and quinoline-3-carbaldehyde (0.173 mg/cm2) using the fumigant method. In the contact method, the most active compound against S. oryzae was quinoline (0.057 mg/cm2), followed by quinoline-4-carbaldehyde (0.065 mg/cm2), and quinoline-3-carbaldehyde (0.092 mg/cm2). Changing the position of aldehyde groups in the quinoline skeleton increases the insecticidal activities against S. oryzae. Furthermore, these results suggest that naturally occurring quinoline-4-carbaldehyde and its derivatives could have potential for managing populations of insect pests affecting stored food products.

**Jae-Woon Jung, Ha-Na Park, Kwang-Sik Yoon, Dong-Ho Choi, Byung-Jin Lim. Event mean concentrations (EMCs) and first flush characteristics of runoff from a public park in Korea. J. Korean Soc. Appl. Biol. Chem. 56(5):597-604**

Characteristics of non-point source (NPS) pollution runoff from a public park in Gwangju, Korea were investigated. Results exhibited the highest pollutant concentrations at the start of the rainfall events due to their build-up and wash off processes. The average event mean concentrations (EMCs) were 27.8, 7.2, 56.3, 7.5, and 0.84 mg/L (range: 4.2–54.8 mg/L) for COD, (0.5–20.8 mg/L) for TOC, (22.3–138.4) for SS, (1.4–18.5 mg/L) for T-N, and (0.17–2.02 mg/L) for T-P, respectively. The study site presented a strong first flush effect for most rainfall events. However, no first flush effect was observed in rainfall events with small rainfall factors (e.g. intensity, amount, and runoff depth). On the other hand, the ratios of total pollution loads discharged by the first 20% of runoff volume were 32% for COD, 34% for TOC, 36% for SS, 42% for T-N, and 50% for T-P. Especially, MFF20 (mass first flush) values of T-N and T-P were larger than those of other pollutants (COD, TOC, SS), indicating that T-N and T-P are easily transported by stormwater runoff from the public park. First flush management of T-N and T-P, therefore, is required for efficient water quality management of the public park.

**Jin Hwan Lee, Byong Won Lee, Balo Kim, Hyun Tae Kim, Jong Min Ko, In-Yeoul Baek, Weon Taek Seo, Young Min Kang, Kye Man Cho. Changes in phenolic compounds (Isoflavones and Phenolic acids) and antioxidant properties in high-protein soybean (*Glycine max* L., cv. Saedanbaek) for different roasting conditions. J. Korean Soc. Appl. Biol. Chem. 56(5):605-612**

Contents of phenolic compound including isoflavones and phenolic acids as well as antioxidant effects in high-protein soybean cultivar “Saedanbaek” were evaluated under different roasting conditions. The roasted soybean exhibited significantly higher antioxidant activity than unroasted soybean in the three antioxidant methods including 2,2-diphenyl-1-picrylhydrazyl, 2,2-azino-bis(3-ethylbenzthiazoline-6-sulphonic acid), and Ferric reducing antioxidant power. In particular, the roasted soybean at 200°C for 15 min showed the highest antioxidant activity in comparison with other conditions. The contents of phenolic compounds, isoflavone aglycones (genistein, daidzein, and glycitein), isoflavone β-glucosides (genistin, daidzin, and glycitin), and phenolic acids increased, whereas isoflavone malonyl-β-glucosides decreased during roasting process. Moreover, total phenolic and flavonoid contents as well as those of isoflavone aglycones, isoflavone-β-glucosides, and phenolic acids increased, leading to a general increase in antioxidant activity after roasting. These results suggest that the roasting soybean extracts could contribute to obtaining natural antioxidants in certain food applications.

**Yu Qian, Guijie Li, Kai Zhu, Peng Sun, Xia Feng, Xin Zhao. Effect of resistant starch on HCl/ethanol-induced gastric injury in rats. J. Korean Soc. Appl. Biol. Chem. 56(5):613-619**

Three types of resistant starch (RS) products were purchased for the evaluation of gastric injury preventive effect in Sprague-Dawley rats. We used an animal model to check for gastric injury preventive activities of these RS products in vivo. RS3 reduced the levels of serum proinflammatory cytokines of IL-6 and TNF-α as compared to those of RS2 and RS4. The gastric secretion volumes from high to low order were control rats, RS2-treated rats, RS4-treated rats, RS3-treated rats, and normal rats, whereas pH levels of gastric juice showed the opposite trend. The gastric injury level was significantly decreased by RS, demonstrating its anti-inflammatory properties, with RS3 showing the best anti-inflammatory effect. Gastric tissues of RS3 group rats showed significantly decreased mRNA and protein expression levels of inflammation-related genes of iNOS, COX-2, TNF-α, and IL-1β compared with the control group, as shown by RT-PCR and Western blot analyses. These results suggest that RS shows a gastric injury preventive effect, with RS3 showing the best inhibitory effect on gastric injury.

**Seong Yeong Kim, Ho Lee. Effects of eating quality on milled rice produced from brown rice with different milling conditions. J. Korean Soc. Appl. Biol. Chem. 56(5):621-629**

This study was conducted to determine the optimal milling condition including moisture content (11, 13, 15, 17, and 19%) and kernel temperature (0, 10, 20, 30, and 40°C) of brown rice to produce milled rice with predominant eating quality, which was examined by a sensory evaluation. Intensity of glossiness and taste on cooked rice decreased with the increase of moisture content and kernel temperature of brown rice, whereas yellow color and off-flavor intensity increased (p <0.001). Quality scores of appearance, flavor, taste, texture, and overall eating quality showed relatively higher value in below kernel temperature 20°C, particularly in moisture content 15 and 17% at kernel temperature 0 and 10°C, whereas ≥15% of moisture content at kernel temperature 40°C showed very low quality scores (p <0.001). Consequently, optimum milling condition of brown rice should be moisture content 15–7% and kernel temperature 0–10°C for the production of milled rice with good eating quality.

**Yeon Woo Song, Sanggyu Park, Somi K. Cho, Dongsoo Koh, Moonjae Cho. Synergistic effect of the novel benzochalcone derivative DK-78 and doxorubicin on MCF7-VN breast cancer stem cells. J. Korean Soc. Appl. Biol. Chem. 56(5):631-635**

Several naturally occurring or synthesized forms of chalcone have been shown to possess multiple biological properties, including antitumor activities. A novel synthetic flavonoid, the benzochalcone derivative DK-78, was administered with the anticancer drug doxorubicin to two breast cancer cell lines (MCF7-VN and MDA-MB-231), and was evaluated for a synergistic cytotoxic effect. DK-78 reduced the expression of mesenchymal marker proteins and reduced cell migration and attachment. Sequential treatment with DK-78 and doxorubicin showed synergistic effects.

**Hyuk Jung, SangJun Moon. Purification, Distribution, and Characterization Activity of Lipase from Oat Seeds (*Avena sativa* L.). J. Korean Soc. Appl. Biol. Chem. 56(6):639-645**

Plant lipases have been chiefly studied as an esterase for hydrolyzation of triacylglycerol (a true lipase), which supplies energy for seed germination. Lipases are widely distributed in plants, animals, insects, and microorganisms. However, recent studies suggest that plant lipases have physiological functions other than triacylglycerol hydrolysis. In the present study, a plant lipase that has enzyme properties distinct from those of a true lipase was purified and characterized from oat seedlings. The lipase was purified 189-fold to a 0.53% purification ratio with high specific activity (34.656 U/mg). Analysis of the protein by Sodium dodecyl sulfate polyacrylamide gel electrophoresis showed a homogenous purified lipase. The lipase had higher enzyme specificity to monoacylglyceride and short chain fatty acids. Synthesis of the lipase was active at an early stage of germination for 6 days and decreased thereafter. Most of the lipase was found in the upper part of the oat seedling excluding the root. Within the young leaves, the lipase is located only in vessels and sieve tubes. However, infection of a pathogen, *Pseudomonas syrinae* pv. *oryza*e, elevated the lipase synthesis. In addition, the lipase had an ability to hydrolyze *E.coli* lipopolysaccharide. These results suggested that oat lipase may play a physiological role in defense against pathogens.

**Won-Sik Choi, Sun-Ho Chang, Jang-Eok Kim, Sung-Eun Lee. Hypolipidemic Effects of Scoparone and Its Coumarin Analogues in Hyperlipidemia Rats Induced by High Fat Diet. J. Korean Soc. Appl. Biol. Chem. 56(6):647-653**

In the present study, 17 coumarins were evaluated for cholesterol-lowering activity in rats fed a high-fat diet. Two statins, atorvastatin and simvastatin, were used as positive controls. Each group consisted of eight rats; weight gain, food intake, and feed efficiency ratio within 4 weeks were determined. Four biochemical parameters (total cholesterol, low-density lipoprotein, high-density

lipoprotein, and total glycerides) were determined in each tested group. Atherogenic index, cardiac risk factor, and liver indexes were also calculated to explain structure-activity relationships of coumarins. With the results of weight gain and food intake, the feed efficiency ratio (FER) was calculated for the 17 coumarins. The positive control groups did not recover FER values to the level of the normal group. The high-fat diet increased concentrations of total cholesterol, low-density lipoprotein, and total glycerides in the control rats as compared to the normal rats, whereas highdensity lipoprotein decreased in the control rats. The two statins and all coumarins lowered cholesterol and increased high-density lipoprotein level to those of the normal rats. 7-Methoxycoumarin was the highest cholesterol-lowering coumarin and showed potent recovery rate of cardiac risk factor, and the atherogenic and liver indices as compared to the normal rats. Structure-activity analyses of coumarins implicated a double bond at C3-C4 and a methoxy group at C7 as being essential for the cholesterol-lowering activity. 7-Methoxycoumarin may partially inhibit the intestinal absorption of cholesterol by interfering with micelle formation.

**Mi Oh, Seon Young Bae, Mi Sook Chung. Mulberry (*Morus alba*) Seed Extract and Its Polyphenol Compounds for Control of Foodborne Viral Surrogates. J. Korean Soc. Appl. Biol. Chem. 56(6):655-660**

Noroviruses are the most frequent cause of foodborne viral gastroenteritis, causing approximately 90% of non-bacterial epidemic outbreaks around the world. Mulberry (*Morus alba*) seeds are by-products of juice and wine industries. Antiviral effects of mulberry seed extract (MAS) on foodborne viral surrogates, feline calicivirus-F9 (FCV-F9), and murine norovirus-1 (MNV-1) were evaluated by plaque assays and reverse transcription polymerase chain reaction. Polyphenol compound analysis using liquid chromatography-mass spectrometry revealed that caffeic acid, 3,4-dihydroxybenzoic acid, rutin, and cyanidin-3-rutinoside were the major compounds of MAS in a decreasing order. Its fraction (MAS-F1) with molecular weight less than 1 kDa, showed a similar composition, except for caffeic acid, a minor component. The maximal antiviral effect of FCV-F9 and MNV-1 was achieved when MAS or MAS-F1 was incubated with FCVF9 and MNV-1 simultaneously added to cells. MAS-F1 further exhibited significant reduction of the MNV-1 or FCV-F9 polymerase gene expression in a dose-dependent manner. Among the polyphenols, cyanidin-3-rutinoside was effective in reducing MNV-1 polymerase gene expression. The inhibition of viral infection by MAS or MAS-F1 against foodborne viral surrogates may occur at the initial stage of viral replication.

**Hyun-A Lee, Hye Won Lee, Jin Ah Ryuk, Ki-Jung Kil, Byoung Seob Ko. Anti-Rheumatoid Arthritis Effect of *Vitex rotundifolia* Extract on Mice with Collagen-Induced Arthritis. J. Korean Soc. Appl. Biol. Chem. 56(6):661-666**

Effects of 70% ethanol extract of the stems and leaves of V. *rotundifolia* (VRE) on the activation of IgG2 and histology in collagen-induced arthritis (CIA) as a model of rheumatoid arthritis were examined. Histological changes in the knee joints were evaluated and determined the serum anti-type II collagen IgG2a and IgG2b levels in CIA. VRE treatment significantly decreased the arthritis index, the synovial cartilage erosion, and the serum IgG2a and IgG2b levels, suggesting that V. *rotundifolia* might be useful for treating rheumatoid arthritis.

**Tran Minh Hoi, Ha Van Anh, Nguyen Thi Thanh Huong, Nguyen Van Tuyen, Le Thi Tu Anh, Nguyen Thanh Tra, Ba Thi Cham, Nguyen Thi Thu Ha, Pham Thuy Linh, Doan Duy Tien, Phan Van Kiem, Ninh Khac Ban, Lidziya Kukhareva, Gill Tatiana, Young Ho Kim. *Artocarpus nigrifolius*: Cytotoxic and Antibacterial Constituents. J. Korean Soc. Appl. Biol. Chem. 56(6):667-672**

Six known compounds including α-amyrin 3-acetate (1), β-sitosterol (2), betulinic acid (3), friedelan-3-one (4), artochamin B (5), and 2-C-methyl-D-erythritol 4-O-α-D-glucopyranoside (6) were isolated from the stem barks and leaves of *Artocarpus nigrifolius* (Moraceae) for the first time. Their structures were identified by spectroscopic methods as well as comparison with literatures. Cytotoxicity and antibacterial activity of 1-6 were evaluated. Results showed that artochamin B (5) possessed the highest cytotoxicity towards MCF7, Lu, HepG2, and KB cell lines with IC50 values of 4.59, 20.00, 3.60, and 1.18 μg/mL, respectively. It also inhibited the growth of Gram-positive bacteria (*Bacillus subtilis, Staphylococcus aureus*), whereas inactive on the growth of both Gram-negative bacteria and yeast.

**Krishna Chaitanya Sadanala, Bong Chul Chung. Graphene Nanoplatelets as a Solid Phase Extraction Sorbent for Analysis of Chlorophenols in Water. J. Korean Soc. Appl. Biol. Chem. 56(6):673-678**

Graphene nanoplatelets are a novel class of carbon nanostructures. They possess an ultra high surface area, and thus have great potentials for the use as sorbent materials. We herein demonstrate the use of graphene nanoplatelets as an adsorbent material for solid-phase extraction. Surface compositions of grapheme nanoplatelets were examined by X-ray photoelectron spectroscopy. Scanning electron and transmission electron microscopies were performed to elucidate the morphology of graphene nanoplatelets. Three chlorophenols, 3-chlorophenol, 4-chlorophenol, and 2,4-dichlorophenols were selected as model analytes and extracted on a graphene nanoplatelets-packed solid-phase extraction cartridge, followed by elution with alkaline methanol. The extracted chlorophenols were identified and quantified by UV-vis spectrophotometer. Under the optimized experimental conditions, good linearity (R2 >0.9969), recovery (95–103%), precision (<12%), and accuracy (<±9%) were achieved. The advantages of grapheme nanoplatelets as solid phase extraction adsorbent, such as good reusability and no impact of sorbent drying, have been detailed. The present study proposes a useful method for water sample pretreatment and reveals the potential of graphene nanoplatelets as an excellent sorbent material in analytical processes.

**Myoung-Ho Shin, Hyun-Seob Hwang, In-Bok Lee, Young-Ho Seo, Min-Kyun Kim. Dust Collection and Nutrient Absorption by Halophyte Communities in Saemanguem Reclaimed Land. J. Korean Soc. Appl. Biol. Chem. 56(6):679-686**

Halophyte community was established for dust prevention in Saemangeum reclaimed land from 2006 to 2008. In the present study, the functions of halophyte community were examined on-site in aspects of dust collection and nutrient absorption. In dust collection experiments, total suspended particulate (TSP) decreased through transplanted halophyte community and the reduction effect continued to 50 m leeward, which was 5.6 times of plant height. TSP reduction behind in-situ halophyte communities amounted to 25.6% on seven-monthly average. TSP collected within four halophyte communities varied among halophytic species in the field. Harvested in the reclaimed land, halophytic samples contained significant amount of nitrogen (0.84 to 1.71% of dry weight), P2O5 (0.05 to 0.21% of dry weight), and Na+ (0.08 to 3.20% of dry weight). On the basis of halophyte community area in 2006, the amount of total nitrogen, P2O5 and Na+ absorbed by *Suaeda asparagoides* was estimated up to 404,000, 47,000, and 498,000 kg, respectively. These results implied that halophyte communities are capable of both collecting significant dust particulates and absorbing of nitrogen, phosphorus, and sodium in the reclaimed land.

**Jeong Yong Moon, Sarah Lee, Seongweon Jeong, Jong-Chan Kim, Kwang Seok Ahn, Ashik Mosaddik, Somi Kim Cho. Free Radical-scavenging Activities and Cytoprotective Effect of Polyphenol-rich ethyl acetate Fraction of Guava (*Psidium cattleianum*) Leaves on H2O2-treated HepG2 Cell. J. Korean Soc. Appl. Biol. Chem. 56(6):687-694**

Total phenolic contents of different fractions of the Psidium cattleianum leaf extract and their antioxidant capacity against several free radicals were examined. Protective effect of the ethyl acetate fraction (EAF) on H2O2-induced DNA damage in HepG2 cells were also evaluated, and the phytochemical profile of EAF was analyzed using tandem mass spectrometry. EAF derived from the 80% methanol extract of the leaf contained a remarkable amount of polyphenol and showed high levels of DPPH and alkyl radical scavenging activity, promoted cell viability, and protected

against H2O2-induced DNA damage in HepG2 cells. Phytochemical analysis revealed that the major components in the EAF included quercetin monoglycoside, phloridizin, quercetin 3-diglycoside, quercetin-3-glucuronide, 2,6-dihydroxy-3,5-dimethyl-4-glucopyranosylbenzophenone,

phenolic acid, guaijaverin, and naringin. The present study suggests possible synergistic or competitive antioxidant action of the major compounds of cattley guava leaf on H2O2-induced DNA damage in HepG2 cells. These results indicate that the ethyl acetate fraction of the guava leaf could be used as a potential source of natural antioxidants, and these findings will facilitate the utilization of guava leaf as a source of functional food.

**Jae Hoo Lee, Hong Jin Lee. A Daidzein Metabolite, 6,7,4'-Trihydroxyisoflavone Inhibits Cellular Proliferation through Cell Cycle Arrest and Apoptosis Induction in MCF10CA1a Human Breast Cancer Cells. J. Korean Soc. Appl. Biol. Chem. 56(6):695-700**

Despite recent findings of hepatic daidzein metabolites on prevention of skin and colon cancers, little study has been performed on breast cancer. In this study, we found that 6,7,4'-trihydroxyisoflavone, one of the major hepatic metabolite of the daidzein more significantly inhibited proliferation of MCF10CA1a human estrogen receptor (ER)-negative breast cancer cells, which was derived from arresting cell cycle at S- and G2/M phase. Cyclins and cyclin-dependent kinases (CDKs) involved in S- and G2/M phases, including cyclins A, B, E, CDK1 and CDK2 were

regulated by 6,7,4'-trihydroxyisoflavone as well as CDK inhibitor, p21 and p27, in a dose-dependent manner. In addition, 6,7,4'-trihydroxyisoflavone induced apoptosis by enhancing death

receptor4 (DR4) expression and suppressing the X-linked inhibitor of apoptosis protein, leading to poly ADP-ribose polymerase cleavage. Taken together, 6,7,4'-trihydroxyisoflavone inhibits cell proliferation via arresting cell cycle at S- and G2/M phases and inducing apoptosis in MCF10CA1a human breast cancer cells. These results suggest that the hepatic metabolite of daidzein, 6,7,4'-

trihydroxyisoflavone, may be considered as a more potent agent in inhibiting ER-negative breast carcinogenesis.

**Young-Sook Cho, Dae-Sung Lee, Young-Mog Kim, Chang-Bum Ahn, Do-Hyung Kim, Won-Kyo Jung, Jae-Young Je. Protection of Hepatic Cell Damage and Antimicrobial Evaluation of Chitosan-Catechin Conjugate. J. Korean Soc. Appl. Biol. Chem. 56(6):701-707**

The chitosan-catechin conjugate was developed by free radical-induced conjugating reaction, and its protection ability against hydrogen peroxide-induced hepatic damage in human normal Chang liver cells and antimicrobial activity against methicillin-resistant Staphylococcus aureus (MRSA) and foodborne pathogens were investigated. Treatment of hydrogen peroxide (650 μM) on Chang liver cells decreased cell viability up to 59.38% compared to the non-treatment group; however, cotreatment of the chitosan-catechin conjugate increased cell viability up to 76.90% at 200 μg/mL, and the protection ability was significantly higher than the unmodified chitosan (p <0.05). The chitosan-catechin conjugate significantly (p <0.05) inhibited the formation of intracellular reactive oxygen species and lipid peroxidation in Chang liver cells. Moreover, the chitosan-catechin conjugate increased glutathione levels in normal condition as well as under oxidative stress by hydrogen peroxide. Additionally, the chitosan-catechin conjugate showed increased antimicrobial

activity against MRSA and foodborne pathogens as compared to those of the unmodified chitosan.

**Hee-Sook Park, Soon-Mi Shim, Gun-Hee Kim. Silydianin in Chloroform Soluble Fraction of**

***Cirsium japonicum* Leaf Inhibited Adipocyte Differentiation by Regulating Adipogenic Transcription Factors and Enzymes. J. Korean Soc. Appl. Biol. Chem. 56(6):709-713**

*Cirsium japonicum*, Compositae, a wild perennial herb found in Korea, Japan and China, has been used in traditional medicines. Effects of various solvent extracts of C. *japonicum* leaf on adipocyte differentiation in 3T3-L1cells were determined, and its mechanism was elucidated. 3T3-L1 cells were incubated with adipogenic hormone mixture mixed with various solvent fractions (hexane, chloroform, ethyl acetate, butanol, and water) of C. *japonicum* leaf. Adipogenesis was evaluated by triglyceride accumulation and expression of adipogenic genes by reversetranscription-polymerase chain reaction. All solvent fractions of C. *japonicum* leaf inhibited adipogenesis in adipocytes by

decreasing triglycerol concentration in a dose-dependent manner. Among solvent fractions of C. *japonicum*, the chloroform-soluble fraction was found to have the highest inhibitory effect on adipocyte differentiation. Silydianin was identified as a major bioactive component in chloroform-soluble fraction of C. *japonicum*. The extract suppressed the expression of genes such as PPARγ, C/EBPα, adiponectin, lipoprotein lipase, and fatty acid synthetase involved in adipogenesis, indicating that chloroform-soluble fraction of C. *japonicum* inhibited lipid accumulation in adipocyte by suppression genes involving adipogenesis. Thus, C. *japonicum* leaf extract containing silydianin could be a good natural candidate for the management of obesity.

**Yoo Seok Jeong, Hee Kyoung Jung, Joo-Heon Hong. Multiplex Real-time Polymerase Chain Reaction for Rapid Detection of *Staphylococcus aureus, Vibrio parahaemolyticus*, and *Salmonella typhimurium* in Milk and Kimbap. J. Korean Soc. Appl. Biol. Chem. 56(6):715-721**

This study presented a multiplex, single-tube, realtime polymerase chain reaction (RTi-PCR) approach for detecting *Staphylococcus aureus, Vibrio parahaemolyticus*, and *Salmonella typhimurium*, three of the more frequent foodborne pathogenic bacteria typically investigated in a variety of foods. New primer sequences were designed for detection of specific gene fragments in the 23s ribosomal RNA, transmembrane transcription regulator, and replication origin sequences of S. *aureus*, V. *parahaemolyticus*, and S. *typhimurium*. Simultaneous amplifications were performed under the optimized reaction conditions. Melting curve analysis using SYBR Green I RTi-PCR analysis produced characteristic Tm values for each target amplicon, demonstrating specific and efficient amplification of the three fragments. Addition of an internal amplification control did not affect detection sensitivity for the target pathogen. The analysis of frequent foodborne pathogenic bacteria in artificially inoculated food demonstrated analytical sensitivity for direct detection of each pathogen using the Chelex method rather than a commercial DNA extraction kit. The assay was sensitive to 103 colony-forming units (CFU)/reaction. With enrichment (2 or 4 h), each species could be detected at 101 CFU/g. These results provided that RTi-PCR is a rapid and costeffective procedure to detect foodborne pathogens. This assay could become a valuable tool for routine microbiological analysis in the food industry.

**Zulfiqar Ahmad, Masood Sadiq Butt, Anwaar Ahmed, Nauman Khalid. Xylanolytic Modification in Wheat Flour and its Effect on Dough Rheological Characteristics and Bread Quality Attributes. J. Korean Soc. Appl. Biol. Chem. 56(6):723-729**

Effects of various xylanase treatments applied at different stages of bread making process on dough rheological characteristics and bread quality attributes were investigated. Different doses (200, 400, 600, 800, and 1000 IU) of purified enzyme were applied at two stages (tempering and mixing). In milling and dough making processes, both types of flour (subjected to enzyme treatment during tempering and flour mixing) exhibited decreasing trend in water absorption, dough development time, dough stability, softening of dough, dough mixing time, viscosity peak, set back, and increasing tendency in peak height and pasting temperature. Treatments during tempering resulted in more significant effects as compared to applications during flour mixing. The dough rising during proofing resulted in enhancement from 137±3.21% (control) to maximum value (192.33±2.90%), when 600 IU of xylanases were applied to 1 kg of wheat grains during tempering. The bread sensory attributes also exhibited significant improvement in response to various doses of purified enzymes.

**Hui-Seung Kang, Sang-Do Ha, Seung-Weon Jeong, Mi Jang, Jong-Chan Kim. Predictive Modeling of Staphylococcus aureus Growth on Gwamegi (semidry Pacific saury) as a Function of Temperature. J. Korean Soc. Appl. Biol. Chem. 56(6):731-738**

Gwamegi (semidry Pacific saury [*Cololabis saira*]) is a Korean food made by a traditional method of repeated freezing and de-freezing during winter. The present study aimed at developing predictive modeling of S. aureus growth on Gwamegi as a function of temperature (10–35℃). Modified Gompertz, Baranyi, and logistic primary models were fitted to experimental values. Polynomial quadratic, nonlinear Arrhenius and square root models were selected as secondary models and analyzed using specific growth rate (μmax) and lag time (λ) values obtained from the primary models. Based on the optimized models derived from the Baranyi and square root equations for μmax, its r2 and mean square error (MSE) were 0.991 and 0.00058, and bias factor (Bf) and accuracy factor (Af) were 1.0087 and 1.0801, respectively. The logistic and polynomial quadratic equations for λ, its r2 and MSE were 0.989 and 0.22834, Bf and Af were 0.9742 and 1.0271, respectively. These predictive models can provide basic information for quantitative microbial risk assessment of Gwamegi and other processed semidried seafood.

**Yu Qian, Gui Jie Li, Kai Zhu, Hua Yi Suo, Peng Sun, Xin Zhao. Effects of Three Types of Resistant Starch on Intestine and Their Gastric Ulcer Preventive Activities *in vivo.* J. Korean Soc. Appl. Biol. Chem. 56(6):739-746**

To examine the effects of three types of resistant starch (RS) on intestinal metabolites, structure and their gastric injury preventive activities, Sprague-Dawley mice were fed diet containing 15% RS for 4 weeks. Response relationships among three types of RS (RS2, RS3, and RS4) food intake, body weight gain, food efficiency, wet weight of cecum (with or not with contents), pH, ammonia production, and short-chain fatty acids (SCFAs) concentration of cecal contents as well as intestinal

structure were investigated. All three types of RS had effects on food intake, weight control, lowering of pH, ammonia production in cecal contents, increasing the wet weight of cecum (with or without contents), changes in SCFAs concentration of cecal contents, and physiological structure of small intestine and cecum compared to the control group (common starch-fed rats). RS3 group showed minimum weight gain and food efficiency, compared to both the control group and the other two types of RS diet. RS3 group showed more significant lowering of pH, ammonia production, and SCFAs of cecal contents. In addition, all three types of RS shortened villous height, and muscle and mucosal thickening in small intestine, resulting in significantly decreased villous height and mucosal thickness, whereas significantly increased muscle thickness in the cecum. However, they did not cause detectable pathological changes in the small intestine and cecum. Animal model was also used to check its gastric ulcer preventive effects. The gastric ulcer level was significantly down-regulated by RS3, demonstrating its anti-inflammatory properties. RS3 reduced the levels of serum proinflammatory cytokines of IL-6, IL-12, TNF-α, and IFN-γ compared to RS2 and RS4. RS3 increased the somatostatin (SS) and vasoactive intestinal peptide (VIP), decreased the motillin (MOT) and substance P (SP) serum levels. These results suggest that RS3 shows the best gastric ulcer preventive effect.

**Kyeong-Hwa Seo, Dae-Young Lee, Tae-Gyu Nam, Dae-Ok Kim, Dong-Geol Lee, Eun-Kyung Kim, Hee-Cheol Kang, Myoung-Chong Song, Nam-In Baek. New Tocopherol Analogue with Radical-Scavenging Activity from the Peels of *Citrus unshiu* Marcovich. J. Korean Soc. Appl. Biol. Chem. 56(6):747-750**

One new tocopherol analogue, methoxytocopherol (1), and two known analogues, α-tocopherol (2) and γ-tocopherol (3), were isolated from the peels of *Citrus unshiu* Marcovich. The chemical structures of compounds 1-3 were determined by interpretation of spectroscopic data. All isolated compounds were evaluated for radical-scavenging capacity using 2,2'-azino-bis(3-ethylbenzthiazoline-6-sulfonic acid) diammonium salt, 1,1-diphenyl-2-picrylhydrazyl, and oxygen radical absorbance capacity assays.

**Dong Cheon Yun, Si Young Yang, Young Cheol Kim, In Seon Kim, Yong Hwan Kim. Identification of Surfactin as an Aphicidal Metabolite Produced by *Bacillus amyloliquefaciens* G1. J. Korean Soc. Appl. Biol. Chem. 56(6):751-753**

An aphicidal metabolite produced by *Bacillus amyloliquefaciens* G1 was isolated, and its activity was examined against green peach aphid (*Myzus persicae*). Bioassay-guided column chromatography followed by instrumental analyses identified surfactin as a major metabolite, showing LC50 value of 35.82 μg/mL. This is the first report of surfactin as an insecticidal metabolite against Myzus persicae.

**Jae-Joon Kim, Woo-Yeon Kim. Substrate Specificity of the Magnolia Flower Polyphenol Oxidase Separated on the Cation Exchanger and Hydrophobic Interaction Column. J. Korean Soc. Appl. Biol. Chem. 56(6):755-757**

Polyphenol oxidase (PPO) was separated from Magnolia (*Magnolia kobus*) flower by acetone precipitation and CMSepharose and Phenyl-Sepharose chromatographies. Molecular weight of the purified PPO from Magnolia flower was assumed to be just over 20 kDa on the sodiumdodecylsulfate-polyacrylamide gel electrophoresis and around 40 kDa under non-boiling without β-mercaptoethanol. Magnolia flower PPO showed the highest enzyme activity with chlorogenic acid as a substrate.

**Seon Ah Hwang, Kyeong-Bo Lee, Jae Young Cho. Degradation of Veterinary Antibiotic Oxytetracycline Using Electron Ionizing Energy. J. Korean Soc. Appl. Biol. Chem. 56(6):759-762**

Electron ionizing energy was used to determine the degradation rate and degraded products of oxytetracycline in aqueous solutions. The degradation efficiency on oxytetracycline after irradiation with electron ionizing energy was 72.2% at 1 kGy, 99.2% at 5 kGy, and 100% at 10 kGy. The degraded products of oxytetracycline after irradiation with electron ionizing energy were OTC1 ([M+H] *m/z* 447.2), OTC2 ([M+H] *m/z* 433.2) and OTC3 ([M+H] *m/z* 415.2). The results demonstrate that the irradiation technology using electron ionizing energy is an effective means to remove veterinary antibiotics in aquatic ecosystem.

**Ji-Yeon Yang, Jun-Hwan Park, Hoi-Seon Lee. Isolation of 8-hydroxyquinoline from *Sebastiania corniculata* and Antimicrobial Activity against Food-borne Bacteria. J. Korean Soc. Appl. Biol. Chem. 56(6):763-766**

Antimicrobial activities of the five fractions obtained from the methanol extract of *Sebasticania corniculata* plant were evaluated against five food poisoning bacteria using the agar diffusion method. The chloroform fraction possessed strong antimicrobial activities against five food poisoning bacteria. 8-Hydroxyquinoline was isolated from the chloroform fraction by the various chromatography analyses. When to the agar diffusion method was used, 8-hydroxyquinoline showed potent antimicrobial activities against five food poisoning bacteria. In the case of minimum bactericidal concentration or minimum inhibitory concentration, 8-hydroxyquinoline showed significantly higher antimicrobial activity against five food poisoning bacteria. Thus, the extract of S. *corniculata* and 8-hydroxyquinoline could be useful for the development of eco-friendly food supplemental agents.

**Hyoung-Woo Bai, Sung Hyun Hong, Chul-Hong Park, Dong Min Jang, Tae Hoon Kim, Byung Yeoup Chung. Degradation of Limonene by Gamma Radiation for Improving Bioethanol Production. J. Korean Soc. Appl. Biol. Chem. 57(1):1-4**

Use of orange peel as a raw material for bioethanol production requires removal of its limonene content, which inhibits fermentation. Orange peel was pretreated using electron beam or gamma ray irradiation. Limonene content decreased in a dose-dependent manner, with approximately 60% reduction compared to the control after gamma irradiation at a dose of 800 kGy. However, electron beam irradiation did not demonstrate the same effectiveness. Therefore, gamma irradiation was deduced to be a promising pretreatment method for removing limonene from

orange peel.

**Jiyeon Kim. Isolation and characterization of a biosurfactant-producing bacterium *Bacillus pumilus* IJ-1 from contaminated crude oil collected in Taean, Korea. J. Korean Soc. Appl. Biol. Chem. 57(1):5-14**

A bacterial strain, designated as IJ-1, was newly isolated from crude oil sample collected in Taean oil spill contaminated area, Korea. The isolate had a biosurfactant-producing activity due to development of a hemolysis zone around the colony on blood agar plate. The strain was identified as Bacillus pumilus IJ-1 based on its morphological and biochemical characteristics. Phylogenetic analysis using 16S [rDNA](http://link.springer.com/search?dc.title=rDNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) sequences confirmed the strain as B. pumilus IJ-1. Glycerol was the best carbon source for the biosurfactant production by B. pumilus IJ-1. The maximum production of the biosurfactant was obtained when tryptone was supplied as a nitrogen source. Biosurfactant production was associated with the growth of B. pumilus IJ-1. The yield of biosurfactant reached maximum level (2.6 g/L) during the stationary phase, during which the cell-free broth containing the biosurfactant could reduce the surface tension from 58.6 dyne/cm to 27.5 dyne/cm. B. pumilus IJ-1 was able to degrade crude oil, diesel, gasoline, and kerosene. The biosurfactant produced by B. pumilus IJ-1 showed the good emulsification activities on vegetable oils, paraffin, and crude oil. In particular, olive oil was the best substrate for emulsification activity. GC-FID analysis of the crude oil remaining in the culture medium showed that B. pumilus IJ-1 was almost completely degraded during incubation for 96 h.

**Gun-Yeob Kim, Hyun-Cheol Jeong, Yeon-Kyu Sonn, Sang Yoon Kim, Jong-Sik Lee, Pil Joo Kim. Effect of soil water potential on methane and nitrous oxide emissions in upland soil during red pepper cultivation. J. Korean Soc. Appl. Biol. Chem. 57(1):15-22**

Under intensive vegetable production, increased productivity is primarily considered for selecting better water management and irrigation intensity in upland soils. Soil water potential at −30 kPa (field capacity) for red pepper (Capsicum annum L.) production, which is the optimum moisture potential for plants, is recommended for Korean upland soils to maximize fruit yield; however its impact on greenhouse gas (GHG) emissions have not yet been considered. In this study, red pepper was cultivated under two soil water potentials at −30 and −50 kPa by drip irrigation control in two different textured soils (clay and sandy loams). Nitrous oxide (N2O) and methane (CH4) emissions were simultaneously investigated during the cultivation period. Results indicated N2O was the main GHG and contributed to approximate 97–9% of the total global warming potential (GWP), though the extent of its contribution varied depending on soil texture and soil moisture control with emitted CH4 being negligible throughout the investigation period. Between the treatments, soil moisture control at −50 kPa was effective in reducing the emissions of the two GHGs and also increased red pepper productivity in both clay loam and sandy loam soils. Comparing the gross GWP per unit pepper fruit yield between the treatments, maintaining soil water potential at −50 kPa by controlled irrigation led to a 50% reduction of GWP per unit pepper fruit yield. Therefore, drip irrigation control to lower soil water potential at −50 than −30 kPa is recommended to obtain high crop yield and reduce GWP per unit red pepper fruit yield for red pepper production in Korea.

**Kitaik Lee, Hyun Sook Kim, Won Kyu Lee, Ah Reum Han, Jun Soo Kim, Kwang Yeon Hwang. Overexpression, purification, crystallization, and preliminary X-ray characterization of a methionine sulfoxide reductase AB from Helicobacter pylori. J. Korean Soc. Appl. Biol. Chem. 57(1):23-26**

The main function of methionine sulfoxide reductases (Msr) in many organisms is to protect cells against oxidative stress caused by the catalyzed reduction of oxidized methionine to normal methionine. In a few micro-organisms, the existence of Msr as a fusion protein on a single polypeptide, MsrAB, was reported. However, Msr generally exists as separate enzymes MsrA and MsrB. Here, MsrAB from Helicobacter pylori (HpMsrAB) was overexpressed in Escherichia coli, purified, and crystallized to determine its structure. HpMsrAB X-ray diffraction data were collected to the resolution of 3.3 Å, and the crystals were found to belong to the tetragonal space group P41212, with the unit cell parameters a =100.91, b =100.91, and c =160.08 Å. The crystals corresponded to 5.38 Å3 Da−1 of Matthews coefficient and 77.2% solvent content from the molecular replacement suggest that there is a single molecule in an asymmetric unit. Due to their unusually high solvent content, diffraction of these crystals only reach a resolution of 3.3 Å. A preliminary solution was determined by molecular replacement. Further refinement of the structure is in progress.

**Ye Jin Choi, Gyeong Min Do, Jae-Ho Shin, Ji Yeon Kim, Oran Kwon. Standardized Rhus verniciflua stokes extract and its major flavonoid fustin attenuate oxidative stress induced by tert-butyl hydroperoxide via activation of nuclear factor erythroid 2-related factor. J. Korean Soc. Appl. Biol. Chem. 57(1):27-30**

The antioxidant effects of an urushiol-free standardized Rhus verniciflua Stokes (RVS) extract and fustin were investigated using oxidative stress-induced rats by tert-butyl hydroperoxide (t-BHP). Hepatic glutathione levels were higher in RVS and fustin groups than those of the t-BHP treated control group. The level of hepatic nuclear factor erythroid 2-related factor was increased by RVS and fustin. The histology results indicated that rats fed RVS had a lower rate of necrosis than the control rats injected with t-BHP.

**Boram Lee, Wonku Kang, Jongcheol Shon, Ki Hun Park, Kyung-Sik Song, Kwang-Hyeon Liu. Potential of 4′-(p-toluenesulfonylamide)-4-hydroxychalcone to inhibit the human cytochrome P450 2J2 isoform. J. Korean Soc. Appl. Biol. Chem. 57(1):31-34**

Human CYP2J2 isoform, the only member of the human CYP2J subfamily, is also over-expressed in human liver carcinoma tissues and hepatocarcinoma cells, and promotes tumor growth and proliferation. 4′-(p-Toluenesulfonylamide)-4-hydroxychalcone (TSAHC) is a synthetic sulfonylamino chalcone compound, which has anti-cancer effect. Inhibitory potential of a promising anti-cancer agent TSAHC against CYP2J2 activity was evaluated using human liver microsomes. TSAHC inhibited CYP2J2-mediated astemizole O-demethylation activity with K i value of 2.03±0.40 μM in a competitive mode, suggesting that TSAHC is a potential candidate for further evaluation for its CYP2J2 targeting anti-cancer activities. Studies are presently underway to estimate TSAHC as potential therapeutic agent for cancer.

**Pamella Marie Sendon, Moe Moe Oo, Jong-Beum Park, Byung Ha Lee, Jeong Hoe Kim, Hak Soo Seo, Soon-Ki Park, Jong Tae Song. Activation of C2H2-type zinc finger genes induces dwarfism in Arabidopsis thaliana. J. Korean Soc. Appl. Biol. Chem. 57(1):35-41**

Zinc finger proteins compose one of the largest transcription factor families in plants, but only a handful have been functionally specified in plant growth. In this study, a semidominant mutant, [*Arabidopsis thaliana*](http://link.springer.com/search?dc.title=Arabidopsis+thaliana&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) dwarf1 (Atdwa1), was discovered from activation tagging screening using the SKI015 TDNA vector. The Atdwa1 mutant displayed severe dwarfism and loss of apical dominance, as well as other pleiotropic defects, such as earlier flowering, fewer leaves, and shorter sliliques than those of the wild-type plant. Thermal asymmetric interlaced-polymerase chain reaction analysis revealed that activated T-DNA was inserted into the At5g54330 gene, disrupting its coding sequence. We also demonstrated that At5g54330 expression was nullified by the insertion, whereas expression of its downstream genes, At5g54340, At5g54350, and At5g54360, were activated. A database search revealed that all three downstream genes encode proteins related to C2H2-type zinc finger proteins. Overexpression of each gene resulted in dwarfism similar to that of Atdwa1. These findings indicate that Atdwa1 mutant was caused by synergistic manifestation of concomitant activation of At5g54340 to At5g54360, and that the zinc finger proteins may play a role in regulation of plant growth and development.

**Lei Chen, Ji-Eun Hwang, Boram Choi, Kang Mo Gu, Youmie Park, Young-Hwa Kang. Antioxidant capacities and cytostatic effect of Korean red pepper (Capsicum annuum L): a screening and in vitro study. J. Korean Soc. Appl. Biol. Chem. 57(1):43-52**

Methanol extracts from 100 Korean varieties of red pepper (Capsicum annuum L) were obtained. Chromatic parameters (L\*, a\*, and b\*) and total phenolic content were analyzed. By evaluation of total phenolic content and 2,2′-azino-bis-(3-ethylbenzothiazoline-6-sulphonic acid) (ABTS) radical scavenging based-antioxidant associated with surface color measurement, red pepper varieties were classified into four groups by hierarchical cluster analysis. Cultivars of ‘PR-Sangsaeng’, ‘PR-Jijon’, ‘PREowoolrim’, ‘PR-Chambut’, ‘PAK37’, and ‘Hojanggoonbigalim” had high quantity of pigments and high phenolic content. These six cultivars also with higher levels of antioxidant might give an advantage to local growers in Korea. For further cytostatic activity evaluation, extracts from various parts including pericarp, seed, and stalk of cultivar ‘PAK37’ and ‘Hojanggoonbigalim’ were prepared. Four human cancer cells (HepG2, AGS, MCF-7, and HT-29) were used. The tumor cell growth inhibitory effect was evaluated by in vitro MTT (3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide) assay. High capsaicin content and antioxidant activity-containing red pepper stalk extract showed the strongest cytostatic activity. Tumor cell growth inhibitory activity was positively correlated with the capsaicin content. The anticancer potentials of various red pepper parts were in the following order: stalk > seed > pericarp. The data suggest that red pepper parts might have a promising health benefit against liver cancer, colon cancer and gastric cancer more than breast cancer.

**Peck Loo Kiew, Mat Don Mashitah, Zainal Ahmad. Kinetics and modeling of pepsin soluble collagen (PSC) extraction from the skin of malaysian catfish (Hybrid Clarias sp.). J. Korean Soc. Appl. Biol. Chem. 57(1):53-66**

The empirical kinetic models for the pepsin soluble collagen extraction from the skin of cultured hybrid catfish (Claris sp.) were studied using four two-parametric models, namely the power law, parabolic diffusion, Peleg’s and Elovich’s models. The Peleg’s model was found to be the best model capable of predicting the extraction data with R 2 >0.9, p-value >2.0%, and RMSD <10.0%, respectively. Kinetic models based on the second order rate equation were successfully developed to describe the extraction processes with different processing variables. Extraction rate constant, initial extraction rate and equilibrium concentrations for different acetic acid concentrations, liquid to solid ratios, and pepsin dosages were predicted. The verification of the developed models showed that the experimental values agreed with the predicted ones, with percentage error differences in the range of 0.03–3.91%.

**Hye Seon Kim, Bok-Kyu Shin, Jaehong Han. High-Throughput HDR Inhibitor Screening. J. Korean Soc. Appl. Biol. Chem. 57(1):67-72**

Isopentenyl diphosphate (IPP) and dimethylallyl diphosphate (DMAPP), biochemical precursors of the isoprenoids, are biosynthesized by mevalonate pathway and methylerythritol phosphate (MEP) pathway. Because these two pathways are mutually exclusive in most organisms, inhibition of MEP pathway has become a target for the development of new bioactive materials, including antibiotics, antimalarial drugs, and herbicides. In the final step of MEP pathway, (E)-4-hydroxy-3-methylbut-2-enyl diphosphate reductase (HMBPP reductase, HDR) catalyzes reduction of HMBPP to IPP and DMAPP. HDR requires electron transfers to the Fe/S cluster in the active site for the catalysis, and methyl viologen has been used as a common redox mediator for in vitro studies. We developed a high throughput colorimetric HDR inhibitor screening method by utilizing microtiter-plate screening method. This method was applied to various plant extracts to measure HDR inhibition activity, and potent HDR inhibitor was successfully screened.

**Kahled M. El-Zahar, Ahmed M. Abd El-Zaher, Mohamed Fawzy Ramadan. Levels of biogenic** **amines in cheeses and their impact on biochemical and histological parameters in rats. J. Korean Soc. Appl. Biol. Chem. 57(1):73-81**

Composition of amino acids and biogenic amines (BA) in different cheeses (Ras, Blue and Mish) were estimated. The amino acids content of Ras cheese after 6 and 24 months of ripening were 33.1 and 26.6 mg/g, respectively. In Blue cheese, after 6 and 12 months ripening, the levels ranged from 29.2 to 25.5 mg/g, whereas in Mish cheese the levels were 33.9 and 30.0 mg/g, respectively. The concentrations of cadaverine and tryptamine were similar in the Mish and Ras cheeses. Level of phenylethylamine accumulation was relatively similar in Ras and Blue cheeses, whereas levels of histamine and tryptamine were high in Ras cheese, reaching 260 and 200 mg/kg, respectively. The toxicological effects of specific BA on liver and kidney functions, as well as biochemical parameters in rats were assayed. The type and the concentration of BA accumulation in cheeses affected the functions of liver and kidney in rats treated with BA. Rats treated with 1 mg amines showed difference in total proteins and albumin during the experimental period except after 6 days, wherein no difference in albumin was noted. In addition, treatment with 2 mg amines showed significant decreased in total proteins and albumin during the testing period, except after 2, 4, and 6 days, wherein no changes in total proteins and albumin levels were detected. The highest concentration of amines (3 mg/ kg/daily) showed decrease in total proteins and albumin after 2, 8, and 10 days. Histological examination revealed that organs were moderately affected by direct injection of BA as compared with organs from control groups. Liver marked vascular congestion with abnormal double central vein occurances leading to fibrosis, whereas in the kidney, thickened vascular spaces were observed.

**Sang-Mok Lee, Jae-Young Kim, Han-Jin Lee, Moon-Ik Chang, Young-Sik Chae, Gyu-Seek Rhee. Establishment of analytical method for 6-benzylaminopurine residue, a plant growth regulator for brown rice, mandarin, pepper, potato, and soybean by using GC/NPD. J. Korean Soc. Appl. Biol. Chem. 57(1):83-89**

Improvement of an analytical method on 6-benzylaminopurine (BAP), a plant growth regulator, and a first-generation synthetic cytokinin for agricultural commodities was undertaken. Analytical method for BAP in the agricultural commodities by gas chromatography in cooperation with nitrogen-phosphorous detector (NPD) was adopted. BAP was extracted with acetone in all samples followed by the ion-associated partitioning method. Vapor pressure of BAP was increased by N-methylation with iodide methane [BAP→6-Benzylamino-N-methylpurine (BAMP)]. Finally, N-methylated BAMP was separated with ethylacetate. The quantitation was done by GC using Nitrogen Phosphorous Detector with DB-608, a moderate polarity column under the temperature-rising condition. The standard calibration curve presented the linearity of correlation coefficient (r 2)>0.9999, analyzed from 0.2 to 4 mg/kg. The limit of quantitation in agricultural commodities showed 0.05 mg/kg. The average recoveries of intraand inter-day experiments ranged from 70.4 to 103.5% and 70.3 to 105.6%, respectively. The repeatability and reproducibility for intra- and inter-day measurements expressed as a relative standard deviation (RSD) was less than 10.7 and 8.3%, respectively. Therefore, our newly established analytical method for BAP residue in agricultural commodities was applicable to the nationwide pesticide residues monitoring program with the acceptable level of sensitivity, repeatability and reproducibility.

**Nam-Ho Kim, Seung-Hun Jung, Jaehan Kim, Su-Hee Kim, Hyun-Joo Ahn, Kyung Bin Song. Purification of an iron-chelating peptide from spirulina protein hydrolysates. J. Korean Soc. Appl. Biol. Chem. 57(1):91-95**

Iron-chelating peptide was purified from spirulina protein hydrolysates. Spirulina protein was hydrolyzed using Alcalase and Flavourzyme, and the degree of hydrolysis was determined using a trinitrobenzene sulfonic acid assay and sodium dodecyl sulfate polyacrylamide gel electrophoresis. The spirulina protein hydrolysates were ultra-filtered to isolate the components below 3 kDa, which were then fractionated by Q-[Sepharose](http://link.springer.com/search?dc.title=Sepharose&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) fast flow and [Sephadex](http://link.springer.com/search?dc.title=Sephadex&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) G-15 columns. The iron-chelating activity of each fraction was determined, and the peptide with the highest activity was isolated and identified by matrix-assisted laser desorption/ionization-time of flight/time of flight mass spectrometry. Amino acid sequence of the iron-chelating peptide was identified to be Thr-Asp-Pro-Ile(Leu)-Ala-Ala-Cys-Ile(Leu), which has a molecular weight of 802 Da. Moreover, due to its ability to chelate iron, the isolated peptide could be used as an iron supplement.

**Yujia Bai, Wenshu Huang, Yongxia Tao, Zuoshan Feng. Differential protein expression profiling in Pleurotus ferulae mycelium caused by asafoetida extracts using a proteomics approach. J. Korean Soc. Appl. Biol. Chem. 57(1):97-103**

The precise mechanism by which asafoetida extract influenced the growth of Pleurotus ferulae mycelium was investigated using a comparative proteomic analysis approach. Two types of asafoetida extracts were added to the medium of P. ferulae, and the effects of the extract on microstructure of P. ferulae mycelium were observed. Compared to the control group, the two asafoetida extracts played a significant role in promoting the growth of P. ferulae. Two-dimensional electrophoresis and [LC-MS](http://link.springer.com/search?dc.title=LC-MS&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)/MS were performed to examine changes in the expression of proteins in the mycelium of P. ferulae. A total of eight differentially expressed proteins were identified, including a heat shock protein, a flavin-containing monooxygenase, and a NADPH: quinone oxidoreductase type IV, as well as hypothetical and unknown proteins. Expression change of these proteins confirmed that asafoetida extracts significantly affected P. ferulae growth, metabolism, and secondary product metabolism. These results provide new insights into biochemical mechanisms underlying the relationship between P. ferulae and asafoetida.

**Joo-Heon Hong, Hee Kyoung Jung. Antioxidant and antitumor activities of β-glucan-rich exopolysaccharides with different molecular weight from Paenibacillus polymyxa JB115. J. Korean Soc. Appl. Biol. Chem. 57(1):105-112**

β-[Glucan](http://link.springer.com/search?dc.title=Glucan&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) isolated from cell wall of fungi not only has low purity and yield, but also causes adverse effects. Consequently, extracellular β-glucan produced by microorganisms is the focus of this study. β-[Glucan](http://link.springer.com/search?dc.title=Glucan&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-rich exopolysaccharides (G-EPSs) with different molecular weights from [*Paenibacillus*](http://link.springer.com/search?dc.title=Paenibacillus&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) polymyxa JB115 were prepared by ultrafiltration and spray-drying. The weight-average molecular masses of the G-EPSs, P-SD-1 (spray-dried G-EPSs powder prepared below 100 kDa) and P-SD-2 (spray-dried G-EPSs powder prepared above 100 kDa), were 7.084×104 and 9.235×105 g/mol, respectively. β-[Glucan](http://link.springer.com/search?dc.title=Glucan&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) content was 47.38% in P-SD-1 and 73.12% in P-SD-2. The hydroxyl radical- and superoxide radicalscavenging activities of P-SD-2 at 1 mg/mL (39.45 and 87.34%, respectively) were higher than those of P-SD-1 (30.32 and 53.06%, respectively). Maximal nitric oxide (22.24±1.34 μM) was generated in the presence of P-SD-2 (1 mg/mL) and the antitumor activity of P-SD-2 was higher than P-SD-1 in four tumor cell lines (HeLa, Sarcoma 180, A549, and Hep3B cells). Thus, antioxidant and antitumor activities could be enhanced by regulating the molecular weight of G-EPSs. We anticipate that the food and medicinal use of G-EPSs will follow further characterization of this class of exopolysaccharides.

**Heung Chan O, Jae Yun Hwang, Yoon Ae Lee, Min Song, Oh Kwang Kwon, Ju Hee Sim, Sunju Kim, Kyung-Sik Song, Sangkyu Lee. The inhibitory effects of the ethanolic extract of Pimpinella brachycarpa on cytochrome P450 enzymes in humans. J. Korean Soc. Appl. Biol. Chem. 57(1):113-116**

Pimpinella brachycarp is a widely distributed vegetable with known antibacterial, antitumor, antioxidant, antithrombotic, and anti-inflammatory effects. In the present study, a cocktail probe assay and [LC-MS](http://link.springer.com/search?dc.title=LC-MS&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)/MS were used to investigate the modulating effect of the ethanolic extract of P. brachycarp on CYP enzymes in human liver microsomes. The extract significantly inhibited CYP 1A2, 2B6, and 3A4 by mix-mode inhibition and CYP2C19 and 2D6 by competitive inhibition.

**Ji-Hoon Lee, Hor-Gil Hur. Intracellular uranium accumulation by Shewanella sp. HN-41 under the thiosulfate-reducing condition. J. Korean Soc. Appl. Biol. Chem. 57(1):117-121**

A strain of genus Shewanella, one of representative dissimilatory Fe(III)-reducing bacteria, HN-41 precipitated intraand extracellular needle-like uranium materials in the anaerobic incubation with uranyl acetate (U(VI)O2 2+) and sodium thiosulfate (S2O3 2−) as the possible electron acceptors. In the absence of thiosulfate, strain HN-41 generated only fine-grained extracellular U precipitates, presumably mineral uraninite (U(IV)O2). Electron microscopy showed that the needle-like U precipitates were associated with the inner and outer membranes of strain HN-41 cells incubated anaerobically with thiosulfate. Energy-dispersive X-ray spectroscopy and associated mapping analyses on a single intracellular needle-like particle indicated the compositions of U, P, and S, which lead to inference of the precipitates consisting of uraninite, phosphate, and sulfide. The results indicate that the presence of competing electron acceptors may significantly alter the forms and locations of U biomineralization products.

**Ji-Hoon Lee, Hor-Gil Hur. Microbially facilitated incorporation of As(III) into bioreduced Fe-(hydr)oxide minerals. J. Korean Soc. Appl. Biol. Chem. 57(1):123-128**

Ferric (oxyhydr)oxide minerals are widespread in the (sub)surface soils such as in agricultural fields, and arsenic compounds have been used widely in the production of pesticides, herbicides, and insecticides, which have caused potential As contaminations in the (sub)surface soils including Fe-(oxyhydr)oxides. Because one of the potential relationships between Fe-(oxyhydr)oxides and As was suggested above, scientists have been motivated to investigate the relationship between Fe-(oxyhydr)oxides and As. In the present study, a dissimilatory Fe(III)-reducing bacterium, Shewanella sp. HN-41 was employed to elucidate effect of microbial Fe(III) reduction on the relationship between Fe-(oxyhydr)oxides and As, and incubated with lactate and synthetic Fe(III)-oxyhydroxide as the electron donor and acceptor, respectively, in the presence of As(III). For comparison, abiotic incubations were performed under the same condition except for addition of the bacterial cells. By sequential chemical extraction of the incubation products, As(III) was determined to be incorporated into the bioreduced minerals at higher concentrations (∼14.4% of the total extracted As) than in the abiotic products (∼10.2%) that were aged for the same duration as the microbial incubation. The results of this study emphasized that bacterial Fe(III)-reduction of the initial synthetic Fe-oxyhydroxide, akaganéite, induced more As(III) incorporation into the structures of the final product minerals than the abiotic transformation of the initial As(III)-adsorbed Fe-oxyhydroxide in the control incubations. Thus, microbial Fe(III)-reduction-mediated incorporation of As(III) into biotransformed Fe-(oxy)(hydr)oxide minerals could be suggested as one of potential strategies for arsenic immobilization in anoxic soils and groundwater.

**Mi So Lee, Yeonjoong Yong, Jong Min Lee, Dongsoo Koh, Soon Young Shin, Young Han Lee. A novel methoxyflavonol derivative, 2-hydroxy-3-(2-methoxyphenyl)-1H-benzo[f]chromen-1-one (DK98), induces apoptosis in HCT116 human colon cancer cells. J. Korean Soc. Appl. Biol. Chem. 57(1):129-132**

A novel methoxyflavonol derivative, 2-hydroxy-3-(2-methoxyphenyl)-1H-benzo[f]chromen-1-one (designated DK98) was synthesized and its antitumor activity was evaluated in human HCT116 colon cancer cells. DK98 inhibited clonogenicity of HCT116 cells and induced apoptosis through a caspase-mediated pathway, suggesting that DK98 may have potential as a drug candidate for the treatment of human colon cancer.

**Ivonne Domínguez-Martínez, Ofelia Gabriela Meza-Márquez, Guillermo Osorio-Revilla, José Proal-Nájera, Tzayhrí Gallardo-Velázquez. Determination of capsaicin, ascorbic acid, total phenolic compounds and antioxidant activity of Capsicum annuum L. var. serrano by mid infrared spectroscopy (Mid-FTIR) and chemometric analysis**. **J. Korean Soc. Appl. Biol. Chem. 57(1):133-142**

Fourier transform mid-infrared (Mid-[FTIR](http://link.springer.com/search?dc.title=FTIR&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) spectroscopy in conjunction with multivariate analysis was used to predict the capsaicin content, ascorbic acid, total phenolic compounds, and antioxidant activity of Capsicum annuum L. variety serrano. Two multivariate calibrations, partial least square (PLS), and principal component regression (PCR) were optimized to construct the calibration models. The best models used to quantify the above mentioned compounds were obtained with the PLS algorithm and coefficients of determination (R2) greater than 0.998 as well as a standard error calibration less than 0.098. The results demonstrated that Mid-[FTIR](http://link.springer.com/search?dc.title=FTIR&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) spectroscopy in combination with multivariate analysis can be effectively used for to quantify the capsaicin, ascorbic acid, total phenol content, and antioxidant activity of Capsicum annuum var. serrano. Mid-[FTIR](http://link.springer.com/search?dc.title=FTIR&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) spectroscopy in combination with multivariate calibration offers rapid, easy sample preparation, is environmentally friendly, and is operationally uncomplicated, demonstrating the significant advantages of the chemometric models compared with conventional methods of analysis.

**Sunmin Park, Sun Young Park, Kwang Soo Kim, Geun Young Seo, Suna Kang. Rose hip alleviates pain and disease progression in rats with monoiodoacetate induced osteoarthritis. J. Korean Soc. Appl. Biol. Chem. 57(2):143-151**

Although rose hip administration reduces pain and stiffness in patients with osteoarthritis, the mechanism of rose hip to alleviate primary symptoms has not been investigated. We examined how two types of Rosa canina, grown in Denmark (I-Flex) and Coesam in Chile, attenuate the osteoarthritis symptoms in male rats with osteoarthritis. Therefore pain-related behaviors were evaluated, and histological changes and cytokine expression in the articular cartilage of right knee induced osteoarthritis were assessed via intra-articular monoiodoacetate (MIA) injection. The right knee induced swollen knee, limping legs, and disproportional weight distribution into the right hind paw, and reduced maximum velocity to run on a treadmill from day 3 after MIA injection. The symptoms were exacerbated up to about 2 weeks and remained steady until day 21. Overall the osteoarthritis symptoms in MIA-injected control rats did not significantly change over the experimental period. After 21 days, bone mineral density in right leg and knee had greatly decreased in rats injected with MIA. These symptoms were related to increased expression of matrix metalloprotinase (MMP)-3 and MMP-13 in articular cartilage that degraded collage and elevated the production of [TNF-α](http://link.springer.com/search?dc.title=TNF-%CE%B1&facet-content-type=ReferenceWorkEntry&sortOrder=relevance), IL-1β, and IL-6. However, both types of rose hip markedly attenuated all of the symptoms experienced by the control and overall symptoms from day 3 were improved at day 21. However, some symptoms of osteoarthrit remained and there was no difference between both rose hips for alleviating osteoarthritis symptoms. In conclusion, rose hips from Denmark and Coesam in Chile are potential therapeutic agents for the protection of articular cartilage against progression of osteoarthritis.

**Muhammad Yasin, Masood Sadiq Butt, Adeela Yasmin, Shahid Bashir. Chemical, antioxidant and sensory profiling of vitamin K-rich dietary sources. J. Korean Soc. Appl. Biol. Chem. 57(2):153-160**

In present research, vitamin K-rich dietary food products were prepared from spinach & soybean and evaluated for nutritional factors, phylloquinone and menaquinone-7 (MK-7) contents and sensory attributes. For the purpose, two spinach-based products (fresh cooked spinach (FCS), reconstituted spinach (RS), and fermented soybean (natto A; NA and Natto B; NB) were formulated. Nutritional composition indicated that natto were rich in protein and fat compared to spinach-based products. They also contained appreciable amount of mineral i.e. potassium, magnesium, calcium zinc, sodium cupper, and iron. High performance liquid chromatography revealed that FCS contained 368.81±13.96 μg/ 100 g of phylloquinone followed by 270.07±9.45 μg/100 g in RS, whereas minimum value 26.90±0.94 μg/100 g was observed in NA. However, maximum MK-7 concentration was recorded in NA at 803.82±21.14 μg/100 g trailed by NB 681.35±16.85 μg/100 g. On the contrary, MK-7 was not detected in the spinach-based products. Antioxidant indices of products indicated that spinach-based products contained higher amount of the total phenolic content, DPPH free radical-scavenging activity, ferric reducing antioxidant power ([FRAP](http://link.springer.com/search?dc.title=FRAP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)), and antioxidant activity compared to natto. Sensory response of the products showed that spinach-based products attained higher scores than those of natto A and B. Conclusively, FCS and NA contained sufficient amount of phylloquinone and MK-7 along with antioxidant activity and has higher potential to modulate the coagulation and bone related abnormalities.

**Ui-Jeong Yang, Sanghoon Ko, Soon-Mi Shim. Vitamin C from standardized water spinach extract on inhibition of cytotoxicity and oxidative stress induced by heavy metals in HepG2 cells. J. Korean Soc. Appl. Biol. Chem. 57(2):161-166**

Inhibitory effects of water extract of water spinach (WEWS) on cytotoxicity and oxidative stress induced by heavy metals were examined. Antioxidant activities of WEWS were expressed as vitamin C equivalent antioxidant capacity in 238 mg/100 g of water spinach using ABTS·− scavenging assay. Vitamin C was identified as a major bioactive component in WEWS by using UPLC/MS. The content of vitamin C was 42 mg from 100 g of dried powder. 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (a yellow tetrazole) assay and dichlorofluorescein assay were conducted to measure cytotoxicity and generation of reactive oxygen species (ROS) caused by heavy metals, respectively. Cytotoxicity was inhibited at the concentrations of 1.06, 1.06, 1.06, and 2.65 mg/L of WEWS for Cd, As, Pb, and Hg, respectively. Pretreatment of WEWS in HepG2 cell attenuated the generation of ROS in a dose-dependent manner. Results of present study suggest that WEWS mainly containing vitamin C could be effective dietary source for reducing cytotoxicity and oxidative stress-induced heavy metals in HepG2 cell.

**Gui Jie Li, Yu Qian, Peng Sun, Xia Feng, Kai Zhu, Xin Zhao. Preventive effect of polysaccharide of Larimichthys Crocea swimming bladder on activated carbon-induced constipation in mice. J. Korean Soc. Appl. Biol. Chem. 57(2):167-172**

Effects of polysaccharide of Larimichthys crocea swimming bladder (PLCSB) on activated carbon-induced constipation in ICR mice were investigated. ICR mice were subjected to oral administration with lactic acid bacteria for 9 days. Body weight, diet and drinking intake, defecation status, gastrointestinal transit, and defecation time, as well as motilin (MTL), gastrin (Gas), endothelin (ET), somatostatin (SS), acetylcholinesterase (AChE), substance P (SP), and vasoactive intestinal peptide (VIP) levels in serum were used to evaluate the preventive effects of PLCSB on constipation. Bisacodyl, a laxative drug, was used as a positive control. The time to the first black stool defecation for normal, control, bisacodyl-treated (100 mg/kg), 50 and 100 mg/kg PLCSB-treated mice were 88, 202, 126, 155, and 135 min, respectively. Following the consumption of oral administration of 50 and 100 mg/kg PLCSB or bisacodyl (100 mg/kg), the gastrointestinal transit was reduced to 62.6, 78.3, and 90.2%, respectively. The serum levels of MTL, Gas, ET, AChE, SP, and VIP were significantly increased, and the serum levels of SS were reduced in the mice treated with PLCSB compared with those in the untreated control mice (p <0.05). These results demonstrate that PLCSB has preventive effects on mouse constipation and high concentration of that demonstrated the better functional activity.

**Ju-Hyun Han, Min-Ji Kim, Han-Seung Shin. Evaluation of polycyclic aromatic hydrocarbon contents and risk assessment for infant formula in Korea. J. Korean Soc. Appl. Biol. Chem. 57(2):173-179**

The contents of eight polycyclic aromatic hydrocarbons ([PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)), including benzo[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, benzo[a]pyrene, dibenzo[a,h]anthracene, benzo[g,h,i]perylene], and indeno[1,2,3-c,d]pyrene were analyzed in 152 infant formulas in Korea as a risk assessment. To measure the eight [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance), all infant formulas were randomly acquired from a supermarket or website. The 152 infant formulas were divided into three categories such as infant formula, follow-up formula, and special formula. The contents of eight [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) were determined in the infant formulas by saponification, liquid-liquid extraction, purification, and high performance liquid chromatography with fluorescent detection. The concentrations of the eight [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) varied from 0.088 to 0.181 μg/kg. In addition, the benzo[a]pyrene content in all samples was <1 μg/kg, which is regulated by the commission regulations as the maximum tolerable level. Dietary exposure was supposed under four scenarios according to infant intake pattern for the exposure assessment and risk characterization. Dietary exposure was in the range of 0.012 to 0.020 ng-TEQBaP/kg/day, and the margin of exposure range was 5,368,549 to 10,169,950 which represents negligible concern. Therefore, these results demonstrate that the very low levels of [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) in infant formulas are of negligible concern.

**Saophuong Neung, Xuan Hoa Nguyen, Kyaw Wai Naing, Young Seong Lee, Kil Yong Kim. Insecticidal potential of Paenibacillus elgii HOA73 and its combination with organic sulfur pesticide on diamondback moth, Plutella xylostella. J. Korean Soc. Appl. Biol. Chem. 57(2):181-186**

Diamondback moth, Plutella xylostella, is one of the most destructive insect pests of several crops world-wide. Effects of [*Paenibacillus*](http://link.springer.com/search?dc.title=Paenibacillus&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) elgii HOA73 and its combined application with organic sulfur pesticide on Plutella xylostella were evaluated. Results showed that M3 medium composition indicated the best medium for optimization of bacterial colony growth, hydrolytic enzyme production, and insecticidal activity and was selected for culturing P. elgii HOA73 in further assays. The highest colony growth of P. elgii HOA73 was identified at 5 days after inoculation. Extracted crude enzyme and crude insecticidal compound from P. elgii HOA73 cultured in the optimized medium kill the second instar larvae of Diamondback moth in 40 and 50% at 220mg mL−1 of crude enzyme and 2% crude extract, respectively. Combined application of organic sulfur pesticide with bacterial suspension significantly killed 85% second instar larvae of Diamondback moth, when compared to use of single application: bacterial suspension (65%) and organic sulfur pesticide (38%), suggesting that P. elgii HOA73 combined with organic sulfur pesticide could be used to control P. xylostella.

**Noriko Yamabe, Ki Sung Kang, Ah Young Lee, Dahae Lee, Ji Myung Choi, Sullim Lee, Jun Yeon Park, Gwi Seo Hwang, Hyun Young Kim, Eun-Ju Cho, Sanghyun Lee. Identification of anti-cancer active components of Taraxacum coreanum on human gastric cancer AGS cells. J. Korean Soc. Appl. Biol. Chem. 57(2):187-190**

[Anti](http://link.springer.com/search?dc.title=Anti&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-cancer effects were compared amongst Taraxacum coreanum extract, its fractions, and 7 ingredients (β-sitosterol, daucosterol, taraxasteryl acetate, chrysoeriol, diosmetin, luteolin, and luteoloside). Exposure to the ethyl acetate fraction (50 and 100 μg/mL) of T. coreanum extract and luteolin (10 and 50 μM) for 24 h induced the cleavage of poly (ADP-ribose) polymerase ([PARP](http://link.springer.com/search?dc.title=PARP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)), caspase-3, and caspase-8, in a dose-dependent manner. These findings demonstrate that luteolin is the main active component of T. coreanum extract activating caspases-3 and -8 which contribute to apoptotic cell death.

**Bijinu Balakrishnan, Hyun-Ju Kim, Jae-Won Suh, Chien-Chi Chen, Kwang-Hyeon Liu, Si-Hyung Park, Hyung-Jin Kwon. Monascus azaphilone pigment biosynthesis employs a dedicated fatty acid synthase for short chain fatty acyl moieties. J. Korean Soc. Appl. Biol. Chem. 57(2):191-196**

The biosynthetic gene cluster of Monascus azaphilone pigments (MAzPs) encodes a canonical fatty acid synthase, MpFAS2. It is thus proposed that MpFAS2 plays a role in MAzP biosynthesis by supplying short chain (C8 and C10) fatty acyl moieties. Targeted gene inactivation of MpfasB2 in Monascus purpureus generated an F9 mutant, which developed white hyphae that discharged a yellow color on potato dextrose agar. High-performance liquid chromatography analysis demonstrated that F9 was incapable of producing MAzP and accumulated a wide array of chromophoric compounds instead. The main compound found in F9 was monascusone A, a hydrogenated azaphilone lacking a fatty acyl moiety. Gas chromatography analysis of the fatty acid methyl esters indicated that there was no significant difference in the cellular fatty acyl (C16 and C18) contents between WT and F9. The present study demonstrates that the dedicated fatty acid synthase is required to decorate the azaphilone polyketides in MAzP biosynthesis.

**Ju-Hyun Jeon, Min-Gi Kim, Hoi-Seon Lee. Phototactic behavior 4: Attractive effects of Trialeurodes vaporariorum adults to light-emitting diodes under laboratory conditions. J. Korean Soc. Appl. Biol. Chem. 57(2):197-200**

The phototactic action of the greenhouse whitefly, Trialeurodes vaporariorum (Hemiptera: [Aleyrodidae](http://link.springer.com/search?dc.title=Aleyrodidae&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)), adults to light-emitting diodes (LEDs) at various luminous intensities and light exposure times was investigated in a Y-maze bioassay chamber, and was compared with a standard luring lamp, which is used in commercial electric traps. Blue LED (97.3%) exhibited the highest potential attraction rate, followed by green LED (96.6%), white LED (93.7%), red LED (93.0%), UV LED (90.3%), yellow LED (89.3%), and IR LED (7.7%). Based on the relative efficiency values, the blue LED was approximately 1.2 times more effective than the luring lamp (84.3%). These results suggest that the blue LED was the most useful for monitoring of T. vaporariorum adults under optimal conditions.

**Wanida Petlamul, Poonsuk Prasertsan. Spore production of entomopathogenic fungus Beauveria bassiana BNBCRC for biocontrol: Response surface optimization of medium using decanter cake from palm oil mill. J. Korean Soc. Appl. Biol. Chem. 57(2):201-208**

[*Beauveria*](http://link.springer.com/search?dc.title=Beauveria&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) bassiana is an efficient entomopathogenic fungus for biological control. Optimization of medium composition for production of B. bassiana BNBCRC spores in decanter cake (DC)-based solid culture was performed using response surface methodology (RSM). Effects of inorganic and organic nitrogen sources, mineral salt, and incubation temperature in a DC-based composition were experimentally studied in two stages, first using a Taguchi design. Among the decision variables tested, urea, peptone, and MgSO4 significantly affected the spore concentration, and the maximal 1.89×108 spores g−1 was found at 30°C incubation temperature. In the second stage, these three selected decision variables were optimized by RSM, using a factorial central composite design. The maximum average spore concentration of B. bassiana BNBCRC increased to 4.80×108 spores g−1 in the optimal DC-based medium containing 0.80 g L−1 urea, 2.10 g L−1 peptone, and 0.75 g L−1 MgSO4. The coefficient of determination was R2=0.97 for the RSM model fit to data. Compared to the original DC-based medium, the performed optimization increased the spore production of B. bassiana BNBCRC by 2.5 fold. After optimization of moisture content, the DC -based medium containing 60% moisture gave the highest spore concentration of 4.71×108 spores g−1.

**A. K. M. Mydul Islam, Sung-Eun Lee, Jang-Eok Kim. Enhanced enzymatic transformation of 1-naphthol in the presence of catechol by peroxidase. J. Korean Soc. Appl. Biol. Chem. 57(2):209-215**

Effect of catechol on 1-naphthol transformation by horse radish peroxidase (HRP) was examined. The impact of catechol to 1-naphthol ratio, enzyme activity, pH, and reaction time in solution were studied. The results obtained indicated that, in the presence of catechol, 1-naphthol transformation by peroxidase shows enhancement greater than that in an equivalent catechol free system. Only 27% of 1-naphthol (0.3 mM) was able to transform when catechol was absent in solution, but reached 79% in its presence (3.0 mM) in 0.1M sodium phosphate buffer (pH 7.0), and 0.3 mM H2O2 by peroxidase (0.5 unit/mL) after 3 h. The 1-naphthol transformation rate was accelerated by increase of pH or HRP concentration. High-performance liquid chromatography analysis was performed to characterize transformation products based on their relative polarities, and molecular weights of products were identified by mass spectrometry. The transformation products were found to be (hydroxy) naphthoquinones, 1-naphthol: hydroxy-naphthoquinone, and 1-naphthol oligomers (dimer, trimer, tetramer) with the molecular weights (m/z) ranging 100–600. Liquid chromatography-tandem mass spectrometry technique, to the best of our knowledge, was used for the first time to elucidate the product structure at m/z 191. The study shows that 1-naphthol is transformed rapidly by peroxidase when catechol is present, which could be useful information for improving the efficiencies of decontamination techniques.

**Apinun Kanpiengjai, Saisamorn Lumyong, Wasu Pathom-aree, Chartchai Khanongnuch. Starchy effluent from rice noodle manufacturing process as feasible substrate for direct lactic acid production by Lactobacillus plantarum S21. J. Korean Soc. Appl. Biol. Chem. 57(2):217-220**

In utilization of both starch containing wastewater and gelatinized starchy waste, Lactobacillus plantarum S21 demonstrated the high capability of lactic acid production directly from starchy effluent and maintained its potency even at high concentration of initial starchy substrate of 40, 60 and 80 g/L by maximum yielding 1.00±0.06, 0.89±0.03, 0.90±0.07 g/g substrate, productivity of 0.79±0.06, 0.98±0.00, 1.23±0.07 g/L·h and production efficiency of 94.6, 78.8, and 74.3%, respectively, at 48 h fermentation. This is the first report on direct conversion of starchy wastes to lactic acid by amylolytic lactic acid bacterium using high concentration of starchy substrate.

**Jin-Hyeob Ryu, Ju-Ye Ro, Hwa-Jin Park, Hyun-Jeong Cho. Anti-platelet effect of ginkgolide a from Ginkgo biloba. J. Korean Soc. Appl. Biol. Chem. 57(2):221-228**

Effects of ginkgolide A (GA) from [*Ginkgo biloba*](http://link.springer.com/search?dc.title=Ginkgo+biloba&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) leaves in collagen (10 μg/mL)-stimulated platelet aggregation were investigated. Zymographic analysis confirmed that pro-matrix metalloproteinase-9 ([MMP-9](http://link.springer.com/search?dc.title=MMP-9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) (92 kDa) was activated by GA to form an activated [MMP-9](http://link.springer.com/search?dc.title=MMP-9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) (86-kDa) on gelatinolytic activities. GA concentration-dependently inhibited platelet aggregation, intracellular Ca2+ mobilization, and thromboxane A2 (TXA2) formation by inhibiting the cyclooxygenase-1 ([COX-1](http://link.springer.com/search?dc.title=COX-1&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) activity in collagen-stimulated platelets. In addition, GA increased the formation of cyclic adenosine monophosphate ([cAMP](http://link.springer.com/search?dc.title=cAMP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) and cyclic guanosine monophosphate ([cGMP](http://link.springer.com/search?dc.title=cGMP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)), which have an anti-platelet function in both resting and collagen-stimulated platelets. On the other hand, GA did not prolong prothrombin time (PT) and activated partial thromboplastin time ([aPTT](http://link.springer.com/search?dc.title=aPTT&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) associated with the extrinsic and intrinsic coagulation pathways on human plasma, respectively. Therefore, we suggest that the inhibitory effect of GA on platelet aggregation might involve the following pathway. GA may increase the [MMP-9](http://link.springer.com/search?dc.title=MMP-9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) activity and intracellular [cAMP](http://link.springer.com/search?dc.title=cAMP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) and [cGMP](http://link.springer.com/search?dc.title=cGMP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) production, inhibit intracellular Ca2+ mobilization, and decrease TXA2 production by down-regulating the [COX-1](http://link.springer.com/search?dc.title=COX-1&facet-content-type=ReferenceWorkEntry&sortOrder=relevance), thereby leading to inhibition of platelet aggregation without cytotoxicity. These results strongly indicate that GA is a potent inhibitor of collagen-stimulated platelet aggregation. It may play an important role as a negative regulator during platelet activation.

**Gun-Yeob Kim, Jessie Gutierrez, Hyun-Cheol Jeong, Jong-Sik Lee, M. D. Mozammel Haque, Pil Joo Kim. Effect of intermittent drainage on methane and nitrous oxide emissions under different fertilization in a temperate paddy soil during rice cultivation. J. Korean Soc. Appl. Biol. Chem. 57(2):229-236**

Although intermittent drainage is regarded as a key factor to reduce methane (CH4) emission from paddy soil during rice cultivation, it also could increase nitrous oxide (N2O) emission. However, the effects of intermittent drainage on CH4 and N2O emissions with different global warming potential (GWP) values have not been well examined. In the present study, the effect of a 26-day intermittent drainage from the 34th day after transplanting (DAT) to the 60th DAT on two greenhouse gas (GHG) fluxes and yield properties were compared with those of a continuous flooding system under different fertilization (NPK as control, PK, and NPK+straw) during rice cultivation. The effect of intermittent drainage on changing two GHG emissions was compared using the GWP value, calculated as CO2 equivalents by multiplying 25 and 298 to the seasonal CH4 and N2O fluxes, respectively. Under the same irrigation condition, addition of nitrogen to PK significantly increased seasonal CH4 and N2O fluxes, and addition of straw to NPK increased CH4 and N2O. Irrespective with fertilization background, the intermittent drainage significantly reduced the total GWP by ca. 41–70% as affected by the big reduction of seasonal CH4 fluxes by ca. 43–53% to that of the continuous flooding even with an increase of seasonal N2O emissions by ca. 16–43%. Rice productivity was not significantly different between the two different irrigation systems under same fertilization background. As a result, total GWP per grain yield was significantly lower in all fertilization treatments with intermittent drainage compared with continuous flooding.

**Jin-Sun Kim, Je-Hyuk Lee, Sanghyun Kim, Jeonghee Surh, Ki-Hyo Jang. Evaluation of Lactobacillus plantarum KCTC 3928 in fermentation of Korean soybean paste (Doenjang). J. Korean Soc. Appl. Biol. Chem. 57(2):237-243**

Lactobacillus plantarum KCTC 3928 was evaluated for use in Doenjang fermentation with four-fold approaches. Firstly, amino acids-profile of L. plantarum KCTC 3928 was investigated using MRS growth medium and found that this strain was the arginine pathway-deficient strain. Secondly, cell growth of L. plantarum KCTC 3928 in the sterilized Doenjang was carried out to determine susceptibility to inhibition by high concentration of salt (13.2%) in Doenjang. Thirdly, optimum addition ratio of L. plantarum KCTC 3928 and Doenjang upon investigation were 12.5 mg of cells and 10 g of Doenjang. Finally, conversion efficiency from glycoside isoflavone to aglycone isoflavone in Doenjang by L. plantarum KCTC 3928 was measured. The results indicate that L. plantarum KCTC 3928 can be used for low-salt Doenjang and Cheonggukjang fermentations.

**Jin Ah Ryuk, Hye Won Lee, Young Seong Ju, Byoung Seob Ko. Monitoring and identification of Cynanchum wilfordii and Cynanchum auriculatum by using molecular markers and real-time polymerase chain reaction. J. Korean Soc. Appl. Biol. Chem. 57(2):245-251**

Cynanchum wilfordii (Asclepiadaceae) is widely distributed throughout Korea, Japan, and China. Dried roots of this plant have been used as a tonic to promote renal function. Due to the morphological similarities of the dried roots of this plant to those of Cynanchum auriculatum, which is used as a substitute herbal medicine for C. wilfordii, distinguishing these two species is extremely difficult. The present study was conducted to develop molecular markers to distinguish C. wilfordii and C. auriculatum by using conventional polymerase chain reaction (PCR) and realtime PCR analyses. Comparative analysis based on the sequence of the trnL-trnF intergenic spacer revealed 4 base-pair variations, and the inter-individual sequences of the 2 species separately showed 100% homology. According to these results, the variations were divided into 2 groups. The 2 species were further distinguished using a sequence-characterized amplified region marker developed based on a randomly amplified polymorphic DNA-PCR product, and then a single nucleotide polymorphism marker was designed based on the trnL-trnF intergenic spacer for more efficient detection in real-time PCR. The results showed that speciesspecific molecular markers might allow accurate discrimination of C. wilfordii and C. auriculatum.

**Jae-Jun Ahn, Hafiz Muhammad Shahbaz, Ki-Hwan Park, Joong-Ho Kwon. Application of simple biological analyses to screen irradiated brown rice, soybean and sesame seeds. J. Korean Soc. Appl. Biol. Chem. 57(2):253-258**

The efficacy of biological screening assays such as germination test and direct epiuorescent lter technique (DEFT) and aerobic plate count (APC) was evaluated to detect the irradiation status of different seeds. DEFT/APC help to calculate the difference between dead and living microorganisms in a sample after a possible irradiation treatment. Likewise, the irradiation can significantly affect the physiological and biochemical processes in germinating seeds, which provides the basis for the germination test. In the present study, three different seeds (brown rice, soybean, and sesame) of Korean and Chinese origins were subjected to gamma-irradiation (0.5, 1, 2, and 4 kGy) and the effects on the germination characteristics were evaluated. The results revealed that the growth rate and shoot length decreased with increasing irradiation doses. Particularly, 4 kGy of irradiation had a pronounced effect on all the germination characteristics in all seed samples. The DEFT counts did not change, which were independent of the irradiation dose, whereas the APC counts gradually decreased with dose increment. The results showed the potential of the germination test and DEFT/APC as useful screening methods for irradiated seeds.

**Min-Gi Kim, Hoi-Seon Lee. Phototactic behavior 5: Attractive effects of the angoumois grain moth, Sitotroga cerealella, to light-emitting diodes. J. Korean Soc. Appl. Biol. Chem. 57(2):259-262**

Phototactic responses of Sitotroga cerealella adults to six light emitting diode (LED) monochromatic lights were investigated, and their responses were compared to that using a luring lamp (BLB). Based on the attraction rate under optimal light conditions, UV LED (365 nm) showed the highest attraction rate (67.7%), followed by blue LED (470±10 nm, 57.7%), green LED (520±5 nm, 44.0%), yellow LED (590±5 nm, 20.3%), red LED (625±10 nm, 18.7%), and infrared LED (730 nm, 11.3%). Moreover, the UV LED was 1.2 times more attractive to S. cerealella adults than that of the BLB (58.0%). These results suggest that UV LED could be more useful for mass trapping and monitoring of S. cerealella adults.

**Polashree Khaund, S. R. Joshi. Enzymatic profiling of wild edible mushrooms consumed by the ethnic tribes of India. J. Korean Soc. Appl. Biol. Chem. 57(2):263-271**

Wild edible macrofungi are known to produce a wide range of biologically active metabolites and enzymes. In the present study, macrofungi consumed by the mycophillic ethnic tribes of India were collected from the local markets and forest habitats and identified based on their morphology. They belonged to ten different species under nine genera and eight families. Amylase, cellulase, protease, tyrosinase and laccase enzymes of the macrofungi were investigated. Two strains of Lactarius showed higher activity of the enzyme laccase and were subjected to further purification and analysis. The partially purified laccases from these two strains showed efficient dye decolourization ability when tested against four different synthetic dyes. The present investigation suggests the potential of these wild edible macrofungi in the production of biotechnologically important enzymes for use in an array of applications from pharmaceuticals to treatment of chemical and biological effluents.

**Youngjoo Kwon. Curcumin as a cancer chemotherapy sensitizing agent. J. Korean Soc. Appl. Biol. Chem. 57(2):273-280**

The development of cancer chemotherapy made a significant progress in cancer treatment. However, most chemotherapeutic drugs are challenged by drug resistance and druginduced toxicity. Combination therapy has been suggested as an effective strategy to avoid drug resistance and reduce toxicity derived from drug, thereby enhancing clinical treatment of cancer. Many food-derived bioactive compounds have exhibited anticancer activity and can be good candidates for combination therapy with existing chemotherapeutic drugs. [Curcumin](http://link.springer.com/search?dc.title=Curcumin&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) is one of compounds that present anticancer activity in many types of cancer and has been extensively studied for its anticancer mechanisms including inhibition of nuclear factor kappa-light-chain-enhancer of activated B cells ([NF-κB](http://link.springer.com/search?dc.title=NF-%CE%BAB&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) activation. Combinational treatment of curcumin enhanced therapeutic efficacy of traditional chemotherapeutic drugs, cisplatin, doxorubicin, 5-fluorouracil, and gemcitabine. [NF-κB](http://link.springer.com/search?dc.title=NF-%CE%BAB&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) is a major downstream effector that leads to chemoresistance of many therapeutic drugs. Down-regulation of [NF-κB](http://link.springer.com/search?dc.title=NF-%CE%BAB&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) by curcumin is an effective mechanism to sensitize chemotherapeutic drugs and increase therapeutic efficacy. Therefore, combination use of curcumin and available anticancer drugs has great potential to enhance chemotherapy efficacy and improve clinical treatment of cancer. More studies will be required to elucidate cause effect relationship of curcumin-induced suppression of cell survival pathways and enhancement of drug efficacy by curcumin.

**Te Ha Kim, Dongbum Kim, Younghee Lee, Hyung-Joo Kwon. Expression of UNC93A induced by CpG-DNA-liposome complex in mice. J. Korean Soc. Appl. Biol. Chem. 57(3):281-287**

UNC93B1 is involved in the delivery of nucleotide-sensing [Toll-like receptors](http://link.springer.com/search?dc.title=Toll-like+receptors&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) (TLR) including [TLR9](http://link.springer.com/search?dc.title=TLR9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) to endolysosomes. However, possible functions of UNC93A, another member of the UNC-93 superfamily, have not been studied in the context of TLR signaling. Here, we injected naked [CpG](http://link.springer.com/search?dc.title=CpG&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-ODNs or liposome-encapsulated [CpG](http://link.springer.com/search?dc.title=CpG&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-ODN (Lipoplex(O)) into the BALB/c mouse peritoneal cavity and investigated expression of mouse UNC93B1 and UNC93A genes in the peritoneal cells. UNC93A [mRNA](http://link.springer.com/search?dc.title=mRNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) expression was increased by Lipoplex(O) in a time-dependent manner, whereas the expression level of UNC93B1 was not changed. To evaluate whether the expression of UNC93A involves [TLR9](http://link.springer.com/search?dc.title=TLR9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance), [TLR9](http://link.springer.com/search?dc.title=TLR9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) knock out (TLR-/-) mice were injected with Lipoplex(O) or LipoplexGC(O), and the peritoneal cells were analyzed. The expression of UNC93A was not induced by Lipoplex(O) in [TLR9](http://link.springer.com/search?dc.title=TLR9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-/- mice. These results suggest that UNC93A is closely associated with [TLR9](http://link.springer.com/search?dc.title=TLR9&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) signaling induced by Lipoplex(O) in the peritoneal cells in vivo. Primary cells including peritoneal cells stimulated with [CpG](http://link.springer.com/search?dc.title=CpG&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-ODNs, Lipoplex(O), and several cytokines in vitro were prepared. However, UNC93A expression was not induced by any stimulation. To identify cellular localization of UNC93A, human embryonic kidney 293 cells stably expressing UNC93A were established and analyzed by confocal microscopy. The human and mouse UNC93A proteins were detected in the cytoplasm. Further investigation of the UNC93A function related with the [CpG](http://link.springer.com/search?dc.title=CpG&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-DNA-mediated immune response may provide information to support efficient application of [CpG](http://link.springer.com/search?dc.title=CpG&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-DNA immunotherapeutics.

**Yong-Kyoung Kim, Yeon Bok Kim, Jae Kwang Kim, Soo-Un Kim, Sang Un Park. Molecular cloning and characterization of mevalonic acid (MVA) pathway genes and triterpene accumulation in Panax ginseng. J. Korean Soc. Appl. Biol. Chem. 57(3):289-295**

Panax ginseng Meyer is one of the most important medicinal plants in Asia, and ginseng has attracted considerable attention worldwide. Triterpene saponins (ginsenosides) are the main bioactive compounds in P. ginseng. The isoprene units of triterpene are derived from the mevalonic acid (MVA) pathway. We cloned four genes involved in MVA pathway using rapid amplification of [cDNA](http://link.springer.com/search?dc.title=cDNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) ends by polymerase chain reaction. Additionally, we investigated the transcript levels of 11 genes involved in the terpenoid pathway in different organs and cell suspension cultures of P. ginseng. The full-length [cDNA](http://link.springer.com/search?dc.title=cDNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) sequences were as follows: PgHMGS (1764 bp; 1407-bp ORF), PgHMGR (1992 bp; 1722-bp ORF), PgPMK (2170 bp; 1530-bp ORF), and PgMVD (1759 bp; 1263-bp ORF). The highest expression level of all genes was found in fine roots. The total ginsenoside contents in different organs were ranked in the following descending order: leaf > fine root > lateral root > red berry > main root > petiole > stem. Campesterol and stigmasterol were detected in all organs but at different concentrations. The total phytosterol content was highest in fine root (147.8 μg/100 mg dry weight (DW)), and was lowest in the stem (86.4 μg/100 mg DW). Four enzymes in the MVA pathway were cloned and characterized in P. ginseng. Such genes play important roles in terpenoid biosynthesis and may have applications in the metabolic engineering of ginsenoside production.

**Su-Myeong Hong, Oh-Kyung Kwon, Dal-Soon Choi, Jin-Hyo Kim, Geun-Hyoung Choi, Nam-Jun Cho. Diminution of mycotoxins from Fusarium sp. in barley and wheat through post-harvest processing methods. J. Korean Soc. Appl. Biol. Chem. 57(3):297-299**

The objective of this study was to analyze mycotoxin contents in Korean barley and wheat infected with Fusarium sp. The major contaminant was determine among deoxynivalenol, nivalenol (NIV), and zearalenone, as well as diminution rate of mycotoxin contents by milling, washing, and boiling processes. NIV was found as a major mycotoxin contaminant in Korean barley and wheat, and bran showed higher contamination level than the inner part in whole infected cereal. The results indicate that the milling process of the diseased barley and wheat showed dramatic diminution rate of 84.4%. Furthermore, the washing on barley reduced mycotoxin infection up to 81.0%, and boiling showed 82.7% diminution effect.

**Ramalingam Radhakrishnan, Suk-Bok Pae, Sang-Mo Kang, Byoung-Kyu Lee, In-Jung Lee, In-Youl Baek. An evaluation of amino acid, fatty acid and isoflavone composition in Korean peanut (Arachis hypogaea l.) seeds to improve the nutritional quality of breeding lines. J. Korean Soc. Appl. Biol. Chem. 57(3):301-305**

[Peanut](http://link.springer.com/search?dc.title=Peanut&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) is grown primarily for human consumption due to their favorable nutrient profile and functional compound such as isoflavone in seeds. The aim of this study was to evaluate the amino acid, fatty acid, and isoflavone profile in seeds of seven peanut cultivars (Suwon 88, Daewon, Daekwang, Seonan, Saedeul, Satonoka, and Pungan) grown in Korea. The protein and oil contents in peanut seeds varied at the range of 21.4 to 32.0% and 41.7 to 47.2%, respectively. The quantity of protein was relatively similar in all peanut cultivars except Pungan seeds. The result of amino acid analysis showed that Suwon 88, Daewon, and Seonan seeds had higher concentration of amino acid (Asp, Thr, Ser, Glu, Pro, Gly, Ala, Cys, Val, Met, Ile, Leu, Tyr, Phe, His, Lys, and [Arg](http://link.springer.com/search?dc.title=Arg&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) than other peanut cultivars. However, the quantity of oil was higher in Suwon 88, Daekwang, Seonan, and Satonoka seeds, whereas the fatty acid profile analysis revealed that higher levels of oleic acid, arachidic acid, gondoic acid, behenic acids, and lower levels of palmitic, stearic, and linoleic acids were found in Saedeul seeds. In addition, the isoflavones, daidzin, genistin, and daidzein were higher in Satonoka (97.96, 63.19, and 33.8 μg/g, respectively) followed by Daewon. The results of the present study suggest that the cross among identified peanut cultivars, Satonoka (high yielding isoflavones), Seadeul (high yielding oleic acid), Suwon 88, Daewon, and Seonan (high yielding amino acid) would improve the nutritional and functional compounds of breeding lines.

**Sangman Lee. Artificial induction of cadmium tolerance and its further enhancement via heterologous co-expression of SpHMT1 and AtPCS1 in the yeast cells. J. Korean Soc. Appl. Biol. Chem. 57(3):307-310**

Microorganisms can be used in the bioremediation of heavy metals. It is desirable if the microorganisms show a strong tolerance as well as the ability to accumulate (or biosorb) heavy metals. Yeast is well known for having a high capacity of biosorption of heavy metals. Therefore, the present study focused on developing a yeast mutant that has a strong tolerance to cadmium (Cd), a representative toxic metal. The Cd-resistant yeast mutant (CdR) was induced and isolated by growing yeast cells in media containing Cd and gradually increasing the concentration until reaching a possible maximum of 20 mM CdCl2, to which the cells adapted and survived. CdR cells showed stronger tolerance to Cd-induced stress than the control cells. To obtain even higher Cd tolerance in the yeast cells, both [*Schizosaccharomyces pombe*](http://link.springer.com/search?dc.title=Schizosaccharomyces+pombe&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) heavy metal tolerance factor 1 (SpHMT1) and [*Arabidopsis thaliana*](http://link.springer.com/search?dc.title=Arabidopsis+thaliana&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) phytochelatin synthase (AtPCS1) genes were introduced into the CdR cells to be expressed simultaneously. The transformed CdR cells showed higher Cd tolerance than the untransformed CdR cells.

**Nauman Khalid, Iftikhar Ahmed, Malik Shah Zaman Latif, Tariq Rafique, Sardar Atiq Fawad. Comparison of antimicrobial activity, phytochemical profile and minerals composition of garlic Allium sativum and Allium tuberosum. J. Korean Soc. Appl. Biol. Chem. 57(3):311-317**

Allium species are considered to be one of the world’s oldest cultivated vegetables. Most commonly used species of garlic in Pakistan and India is Allium sativum, while Allium tuberosum is mainly consumed and cultivated in China, Southeast Asia, and North-east part of India. The present study was conducted to compare the antimicrobial activity, nutritional value and antioxidant profile of Allium sativum and Allium tuberosum. The outcome indicates that Allium tuberosum have slightly higher antimicrobial activity, higher mineral profile, and enriched in antioxidants in comparison with Allium sativum. The highest antimicrobial activity of Allium tuberosum was noticed against Staphylococcus aureus and Bacillus subtilis with 43.9 and 40.7 mm zone of inhibition using 100% extract. Allium tuberosum contains high contents of calcium (28.662±.00mg/100 g), potassium (10.62±0.50) and zinc (59.00±1.00). Allium tuberosum also showed higher antioxidant activity (0.24±0.03 mg vitamin C equivalent (VCE)/g fresh weight in ferric reducing antioxidant power assay, 0.18±0.02 mg VCE/g fresh weight in 2,2-diphenyl-1-picrylhydrazyl assay and 1.09±0.12 mg VCE/g fresh weight in 2,2′-azino-bis(3-ethylbenzothiazoline-6-sulphonic acid) assay) in comparison with Allium sativum.

**Jung-Kul Lee, In-Won Kim, Tae-Su Kim, Joon-Ho Choi, Jung-Hoe Kim, Si-Hyung Park. Immunological activities of cationic methylan derivatives. J. Korean Soc. Appl. Biol. Chem. 57(3):319-321**

Methylan polysaccharide was aminated to add dialkylaminoethyl and free amino groups at hydroxyl sites in the methylan backbone, and these derivatives were quaternized to produce pH-independent cationic polyelectrolytes. The immunological activities of the resulting methylan derivatives were investigated. Diethylaminoethyl (DEAE)-methylan derivatives inhibited the classical pathway of the complement system in a dose-dependent way. Quaternized DEAE-methylan exhibited the highest anticomplementary activities among the all derivatives. Anticomplementary activities increased significantly as the cationic charge of the methylan derivatives increased via aminoderivatization followed by quaternization, indicating that there is an electrostatic interaction between the methylan derivatives and the negatively charged functional residues on the cell.

**Ji Young Choi, In Hee Cho, Young-Suk Kim, Hyong Joo Lee. Aroma-active compounds of Korean mugwort (Artemisia princeps orientalis). J. Korean Soc. Appl. Biol. Chem. 57(3):323-329**

This study revealed that monoterpene and sesquiterpene hydrocarbons, and their oxygenated derivatives were the major volatile compounds in Korean mugwort extracted by both simultaneous steam distillation and solvent extraction and headspace solid-phase microextraction. In particular, β-caryophyllene was the most predominant compound. Furthermore, 1,8-cineol, described as camphoraceous and minty notes, was found to be the most potent aroma-active compound of Korean mugwort, followed by (Z)-3-hexenal (described as green and apple-like notes), γ-terpinene (described as grassy note), and (E,Z)-2,6-nonadienal (described as cucumber-like and green notes). Moreover, ethyl 2-methylpropanoate, methyl 3-methylbutanoate, and ethyl 2-methylbutanoate could contribute to sweet and fruity notes of Korean mugwort with their characteristic odor properties.

**Byung Hyun Son, Yun Ju Lee, Hye Jin Jo, KwangWon Hong. New enzymatic time-temperature integrator (TTI) using porcine esterase for monitoring food quality. J. Korean Soc. Appl. Biol. Chem. 57(3):331-334**

An enzymatic time-temperature integrator (TTI) systembased on the reaction between porcine esterase and tripropionin, which causes a pH change, was developed. A pH decline in the esterase-based TTI system changed the color of the pH indicator from blue to light green. After calculating the response rate constant by measuring color changes in the TTI under different temperature conditions, an Arrhenius plot was prepared, and activation energy was estimated. The activation energy of the TTI measured at isothermal conditions (5, 10, 15, 20, and 30°C) was 53.6᾿4.6 kJ/mol. In addition, the TTI endpoint could be adjusted by modifying the amount of esterase consumed to fit different shelf lives of food. The results showed that the new esterase-based TTI could be used to indicate the time-temperature history of food.

**Sangbeum Cho, Hyung-In Moon, Go-Eun Hong, Chi-Ho Lee, Jeong-Mee Kim, Soo-Ki Kim. Biodegradation of capsaicin by Bacillus licheniformis SK1230. J. Korean Soc. Appl. Biol. Chem. 57(3):335-339**

Capsaicin is a major representative component in pepper and it has gained interest by its health beneficial effects. An enzymatic hydrolysate of capsaicin has also been of great interest, because it can be applied to the reduction pungency of pepper or production of natural flavor. We first developed a simple screening method to isolate capsaicin-degrading bacteria showing a clear zone. A cloudy solid medium was prepared by the addition of capsaicin as sole carbon and nitrogen sources to 3-(Nmorpholino) propanesulfonic acid (MOPS) minimal medium, and the bacteria showing clear zone around the colony was isolated from Korean traditional pickled pepper. The isolated strain was identified as Bacillus licheniformis using 16S [rRNA](http://link.springer.com/search?dc.title=rRNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) gene sequence analysis. B. licheniformis SK1230 was able to utilize capsaicin for both of carbon and nitrogen sources for its growth. The hydrolysis of capsaicin by B. licheniformis was verified using high-performance liquid chromatography, and capsaicin in medium was depleted depending on culture time. Capsaicin hydrolysate was composed of vanillylamine and capsiate (8-methyl-6-trans-nonenoic acid).

**Nazir Ahmad, Iftikhar Ahmed, Armghan Shahzad, Nauman Khalid, Farrakh Mehboob, Karam Ahad, Ghulam Muhammad Ali. Molecular identification and characterization of Pseudomonas sp. NCCP-407 for phenol degradation isolated from industrial waste. J. Korean Soc. Appl. Biol. Chem. 57(3):341-346**

Phenol is a toxic pollutant found in effluent of numerous industries and its elimination is a foremost challenge. The utilization of bacteria plays a crucial role in phenol bioremediation. For isolation of phenol degrading bacteria, sample was collected from industrial waste and enriched in mineral salt medium (MSM) contained 300 mg/L phenol. The strain was identified based on 16S [rRNA](http://link.springer.com/search?dc.title=rRNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) gene analysis as Pseudomonas species and the phylogenetic analysis affiliated the strain with Pseudomonas monteilii (AF064458) as the most closely related species. Phenol tolerance of the strain in MSM supplemented with various concentrations of phenol indicates that the strain NCCP-407 can grow best at 750 mg L−1 phenol. The strain showed complete degradation of 750 mg L−1 phenol in 56 hours when supplement as a sole source of carbon and energy with the average degradation rate of 28 mg L−1h−1. The doubling time was recorded approximately as 12.49 h−1. The present study suggests that this strain is efficient in phenol degradation and can be used in treatment of wastewater containing phenol.

**Jeong-In Hwang, Sung-Eun Lee, Jang-Eok Kim. Effects of lipids on analysis of residue pesticides in herbal medicines. J. Korean Soc. Appl. Biol. Chem. 57(3):347-354**

Serious problems in residue analysis of acetamipirid, chlorpyrifos, and bifenthrin caused by lipids present in herbal medicines, platycodon root, safflower, and persicae semen have been found during the pesticide residue analysis using a currently used analytical method. Particularly, recovery tests for artificially spiked pesticides showed poor recoveries for bifenthrin in persicae semen, which may be due to the low polarity of the pesticide and high lipid content in the matrix. An unclear layer separation between water and organic solvent, methylene chloride, has been also observed during the liquid-liquid partitioning process, which favors modification of the liquid-liquid partitioning by replacement with acetonitrile and a macroporous diatomaceous earth column, respectively. The effectiveness of newly modified methods was evaluated based on the recoveries of three pesticides in the herbal medicines at two fortification levels (1.0 and 4.0 mg/kg). The modified methods increased recoveries to 81.8–98.9%, suggesting those methods could be effective and feasible alternatives to determine acetamiprid, bifenthrin, and chlorpyrifos in lipidic samples.

**Soo-Yun Park, Su Ryun Choi, Sun-Hyung Lim, Yunsoo Yeo, Soon Jong Kweon, Yang-Seop Bae, Kil Won Kim, Kyung-Hoan Im, Soon Kil Ahn, Sun-Hwa Ha, Sang Un Park, Jae Kwang Kim. Identification and quantification of carotenoids in paprika fruits and cabbage, kale, and lettuce leaves. J. Korean Soc. Appl. Biol. Chem. 57(3):355-358**

Twelve carotenoids were identified in Korean leafy vegetables and paprikas. by high-performance liquid chromatography, Carotenoid contents varied greatly, with red paprika having a higher antheraxanthin and capsanthin contents than other paprikas. Orange paprika had higher levels of zeaxanthin, β-cryptoxanthin, lutein, and α-carotene compared to those of other paprikas. The results of Pearson’s correlation analysis using quantitative data of carotenoids revealed that significant positive relationships were apparent between capsanthin and antheraxanthin (r=0.9870, p <0.0001), zeaxanthin and α-cryptoxanthin (r=0.9951, p <0.0001), as well as lutein and α-carotene (r=0.9612, p <0.0001). Because the correlations between carotenoids levels have provided valuable information regarding metabolic associations, this technique will contribute to identifying metabolic links for carotenoid biosynthesis.

**Faisal Kabir, Shigeru Katayama, Noriko Tanji, Soichiro Nakamura. Antimicrobial effects of chlorogenic acid and related compounds. J. Korean Soc. Appl. Biol. Chem. 57(3):359-365**

Chlorogenic acid (CGA) is a natural chemical ester composed of caffeic acid and (-)-quinic acid, and is further metabolized into active compounds in the living body. Here, we aimed to provide fundamental information on the antimicrobial action of CGA and related compounds against the Gram-negative bacterium Escherichia coli IFO 3301. [Bacteriostatic](http://link.springer.com/search?dc.title=Bacteriostatic&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) effects were assessed by spectrophotometry, and bactericidal effects were determined by enumerating viable cells on MacConkey agar plates. CGA and related compounds exhibited specific antimicrobial activity and corresponding reduction in log survival ratio, in which ferulic, isoferulic, benzoic, and hydroxybenzoic acids exhibited obvious antimicrobial activity against E. coli. In a time-kill assay, it was observed that bactericidal effects were associated with treatment time, temperature, and dose. A reduction in log survival ratio was observed at low pH as well as under thermal stress condition. Thus, we demonstrated that CGA and related compounds have not only bacteriostatic effects but also bactericidal effects.

**Hyun Jung Kim, Minseon Koo, A-Ram Jeong, Seung-Youb Baek, Joon-Il Cho, Soon-Ho Lee, In-Gyun Hwang. Occurrence of pathogenic Escherichia coli in commercially available fresh vegetable products in Korea. J. Korean Soc. Appl. Biol. Chem. 57(3):367-370**

Pathogenic E. coli is a major foodborne pathogen associated with gastroenteritis worldwide. Fresh vegetable products as well as raw meat and meat products have been recognized as important modes of transmission within the foodborne route. The objective of the present study was to determine the presence of six virulence factors (stx 1, stx 2, lt, st, eaeA, and ial) in E. coli isolated from fresh vegetable products to provide information on risk assessment of pathogenic E. coli in Korea. From 416 collected samples, including vegetable salad mix, sprouts, baby leaf vegetables, and unpasteurized fruit and vegetable juices commercially available in Korea, a total of 30 samples were positive for E. coli strains, resulting in an overall prevalence of 7.2%. Of the 120 E. coli isolates, only one isolate (0.8%), which was obtained from unpasteurized fruit and vegetable juices, was confirmed to possess the eaeA gene, but lacked stx genes. This study showed that some fresh vegetable product samples were contaminated with enteropathogenic E. coli.

**Samia Siddique, Quratulain Syed, Runbina Nelofer, Ahmad Adnan, Habiba Mansoor, Fahim Ashraf Qureshi. Avermectin B1b production optimization from Streptomyces avermitilis 41445 UV 45(m)3 using response surface methodology and artificial neural network. J. Korean Soc. Appl. Biol. Chem. 57(3):371-378**

Present study was conducted to optimize avermectin B1b production from S.avermitilis 41445 UV45(m)3 using artificial neural network and response surface methodology. Three variables NaCl, KCl, and pH were used for optimization. Coefficient of determination and adjusted coefficient of determination have very poor values for RSM. Values predicted by RSM for experiments were also much different from the observed avermectin production. Comparatively predicted avermectin levels by ANN were very close to observed values with much higher R2 and adjusted R2. Optimum levels of NaCl, KCl, and pH predicted by ANN were 1.0 g/L, 0.5 g/L, and 7.46 respectively. Sensitivity analysis predicted highest effect being shown was by pH followed by NaCl and KCl. About 37.89 folds increase in avermectin B1b production was observed at optimum levels of three variables envisage by ANN. Optimum levels, ranking order of variables, and the predicted avermectin on the optimum levels by the RSM was much different from ANN values. Results revealed that ANN is a better optimization tool for given strain than RSM.

**Ye-Jin Jung, Ji-Hae Park, Kyeong-Hwa Seo, Sabina Shrestha, Dong-Sung Lee, Youn-Chul Kim, Hee-Cheol Kang, Jiyoung Kim, Nam-In Baek. Phenolic compounds from the stems of Zea mays and their pharmacological activity. J. Korean Soc. Appl. Biol. Chem. 57(3):379-385**

The extraction and solvent partition of cornstalks, and repeated column chromatography for EtOAc fraction yielded four phenolic compounds, methyl (Z)-p-coumarate (**1**), methyl (E)-p-coumarate (**2**), methyl ferulate (**3**), and 1,3-O-diferuloyl glycerol (**4**). The chemical structures were identified on the basis of spectroscopic data analyses including NMR, MS, and IR. All compounds were isolated for the first time from the cornstalks. Compounds **1, 2**, and **4** were evaluated for inhibition activity on NO production in lipopolysaccharide -induced RAW 264.7 cells, neuroprotective activity on glutamate-induced cell death in HT22 cells, and hepatoprotective activity on t-BHP-induced oxidative stress in HepG2 cells. Compounds **2** and **4** showed inhibitory effects on NO production with the IC50 values of 19.29 and 5.62 μM, respectively, and compound **4** showed protective effect on glutamate-induced cell death and t-BHP-induced oxidative stress with EC50 values of 19.51 and 71.29 μM, respectively.

**Kyung Min Park, Su Kyung Oh, Jeong-Ok Cha, Yoeng Seon Lee, Minseon Koo. Characterization of antibiotic resistant Staphylococcus aureus isolates from ready-to-eat foods in Korea. J. Korean Soc. Appl. Biol. Chem. 57(3):387-395**

Heat-stable enterotoxins and coagulase type are the most notable virulence factors associated with Staphylococcus aureus, a common pathogen associated with serious community- and hospital-acquired disease. Thus enterotoxin gene profiles and the [PFGE](http://link.springer.com/search?dc.title=PFGE&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) or coagulase patterns of antibiotic resistant S. aureus isolates from ready-to-eat foods in Korea were examined. Among 154 S. aureus isolates, antibiotic resistance to penicillin, gentamicin and tetracycline were 81.2% (125/154), 11.0% (17/154) and 11.7% (18/154), respectively. None of the strains were resistant to vancomycin. Two of three oxacillin-resistant strains were resistant to cephalothin and were mecA positive. Furthermore, 104 of 139 S. aureus isolates contained staphylococcal enterotoxin (SE) genes, and 13.5% of the SE strains were resistant to erythromycin and gentamicin. One oxacillin-resistant isolate had a pattern similar to NRS 123 (SCCmec IVa) according to pulsed-field gel electrophoresis ([PFGE](http://link.springer.com/search?dc.title=PFGE&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) using SmaI. Based on coagulase isotyping, type IV and VII were the most predominant, accounting for 30.9%, respectively. [Coagulase](http://link.springer.com/search?dc.title=Coagulase&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) type IV harbored the sea gene or the seg-sei-tst gene combination, and all of the type VII strains had the seh toxin gene. These data indicate that the enterotoxin gene profile correlates to coagulase type or antimicrobial resistance and can be used as a practical database for epidemiological purposes.

**Yong-Sang Lee, Joon-Kwan Moon, Kwang-Hyeon Liu, Eunhye Kim, Hoon Choi, Jeong-Han Kim. In vitro metabolism of flucetosulfuron by artificial gastrointestinal juices. J. Korean Soc. Appl. Biol. Chem. 57(3):397-405**

To investigate the metabolism of pesticides by gastrointestinal (GI) juices, artificial GI juices were incubated with threo- and erythro-isomers of flucetosulfuron. The metabolites produced in each reaction mixture of artificial GI juices were unambiguously identified using liquid chromatography-tandem mass spectrometry. Flucetosulfuron was observed to be stable in saliva. However, in the intestinal juices, approximately 18% of flucetosulfuron was degraded, producing N-(4,6-dimethoxypyrimidin-2-ylcarbomoyl)-2-(2-fluoro-1-hydroxypropyl)pyrimidine-3-sulfonamid (M1). In artificial gastric juices, about 85% of flucetosulfuron was rapidly degraded, producing the metabolites 2-(2-fluoro-1-hydroxypropyl) pyridine-3-sulfonamide (M2), 4,6-dimethoxypyrimidin-2-amine (M3), and 2-fluoro-1-(3-sulfamoylpyridin-2-yl)propyl 2-methoxyacetate (M4). These results indicate that the sulfonylurea bridge and ester bond of flucetosulfuron are hydrolyzed in artificial GI juices. No significant differences were noted in the degradation patterns between the two isomers of flucetosulfuron in the artificial GI juices that were tested. Considering the rapid degradation of flucetosulfuron in vitro by artificial GI juices, it is likely that there would be no significant absorption of flucetosulfuron from the GI tract into the blood stream after oral administration.

**Ji-Hae Park, Ye-Jin Jung, Sabina Shrestha, Sang Min Lee, Tae Hoon Lee, Chang-Ho Lee, Daeseok Han, Jiyoung Kim, Nam-In Baek. Inhibition of NO production in LPS-stimulated RAW264.7 macrophage cells with curcuminoids and xanthorrhizol from the rhizome of Curcuma xanthorrhiza Roxb. and quantitative analysis using HPLC. J. Korean Soc. Appl. Biol. Chem. 57(3):407-412**

Three diarylheptanoids, bisdemethoxycurcumin (**1**), curcumin (**2**), and demethoxycurcumin (**3**), two diarylpentanoids, 3,3′-bis(7,7′-hydroxy-6,6′-methoxyphenyl)-penta-(3E,2′E)-3,2′-dien-1-one (**4**) and 3,3′-bis(7,7′-hydroxy-6-methoxyphenyl)-penta-(3E,2′E)-3,2′-dien-1-one (**5**), and a bisabolane sesquiterpene, xanthorrhizol (**6**), were isolated from the rhizome of Curcuma xanthorrhiza through repeated column chromatography. Silica gel ([SiO](http://link.springer.com/search?dc.title=SiO&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)2), octadecyl silica gel (ODS), and [Sephadex](http://link.springer.com/search?dc.title=Sephadex&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) LH-20 resins were used. Compounds were identified by spectroscopic methods, including nuclear magnetic resonance, mass spectrometry, and infrared spectroscopy. Compounds **1** (IC50: 8.21 μM), **2** (IC50: 10.01 μM), **3** (IC50: 4.86 μM), and **4** (IC50: 2.20 μM) inhibited nitric oxide production in LPS-stimulated RAW264.7 macrophage cells. High performance liquid chromatography was used to determine the content of curcuminoids and xanthorrhizol in C. xanthorrhiza extract to be 0.46±0.08% (**1**), 10.69±0.18% (**2**), 2.35±0.06% (**3**), 0.18±0.05% (**4**), 0.03±0.01% (**5**), and 27.47±2.42% (**6**).

**Soon Young Shin, Yeonjoong Yong, Jongmin Lee, Seunghyun Ahn, Kang-Yeoun Jung, Dongsoo Koh, Young Han Lee, Yoongho Lim. A novel hydroxymethoxynaphthochalcone induces apoptosis through the p53-dependent caspase-mediated pathway in HCT116 human colon cancer cells. J. Korean Soc. Appl. Biol. Chem. 57(4):413-418**

[Flavonoids](http://link.springer.com/search?dc.title=Flavonoids&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) have always been studied in the context of therapies of human diseases. Among them, chalcone, an openchain flavonoid, has been used as a key precursor for synthetic lead compounds due to its diverse innate biological activity. Additionally, benzoflavone is known to induce xenobiotic-metabolizing enzyme activity, as well as have potent chemopreventive activity. Therefore, the combined structure of these two compounds should be useful for the discovery of new and/or increased biological activity. In this study, a chalcone derivative, 2′-hydroxy-2,4,6-trimethoxy-5′,6′-naphthochalcone (HMNC-74), was synthesized, and its anticancer activity was tested in the HCT116 human colon cancer cell line. An in silico docking study showed that HMNC-74 binds to tubulin. HMNC-74 exhibited the inhibition of clonogenicity of HCT116 cells and cell cycle arrest at the G2/M phase, followed by induction of apoptosis through, at least in part, p53-dependent caspase-7 activation. The results of this study show that HMNC-74 may be an effective chemotherapeutic agent.

**Ji-Hoon Lee, Bo-A Kim, Min-Gyu Ki. Construction of aligned database of dsrA, a gene encoding dissimilatory sulfite reductase alpha subunit, for metagenomic studies of sulfate-reducing bacteria. J. Korean Soc. Appl. Biol. Chem. 57(4):419-427**

A sulfite reductase gene sequence database, which could facilitate analysis of metagenomic data of a functional gene from sulfate-reducing bacteria, is described. The database contains 127 aligned nucleotide sequences of a gene (dsrA), encoding a dissimilatory sulfite reductase alpha subunit, retrieved from Reference Sequence of [GenBank](http://link.springer.com/search?dc.title=GenBank&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) that provides only well-annotated genome sequences. The dsrA gene sequences were screened for length and aligned using four multiple sequencing alignment programs, Mafft, Muscle, Mothur, and Clustal Omega. In addition to the dsrA gene sequences, 16S ribosomal RNA ([rRNA](http://link.springer.com/search?dc.title=rRNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) gene sequences for the bacterial species appearing in the database were also retrieved from the [GenBank](http://link.springer.com/search?dc.title=GenBank&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) and aligned by a public database of SILVA in Mothur to examine any potential relationship between taxonomy of the bacteria and distribution of a functional gene. The aligned dsrA and 16S [rRNA](http://link.springer.com/search?dc.title=rRNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) gene sequences were used to construct neighbor-joining phylogenetic trees for comparison of the alignments for relative agreement among the aligned sequence databases. This method of aligned reference database construction using public database can help provide better insight into microbial communities by suggesting an alternative approach of studying metagenomic analysis of functional genes involved in important ecological processes.

**Min-Gi Kim, Hoi-Seon Lee. 1,2-benzendiol isolated from persimmon roots and its structural analogues show antimicrobial activities against food-borne bacteria. J. Korean Soc. Appl. Biol. Chem. 57(4):429-433**

Antimicrobial activities of the five fractions obtained from the methanol extract of persimmon (Diospyros kaki) roots were evaluated against eight food-borne bacteria using the agar diffusion method. The chloroform fraction possessed strong antimicrobial activity against eight food-borne bacteria. 1,2-Benzenediol was isolated by chromatographic analyses. The structure-activity relationships of two isomers (1,3-benzendiol and 1,4-benzenediol) and seven structural analogs (3-methy-, 4-methyl-, 3-methoxy-, 4-chloro-, 4-nitro-, 4-tert-butyl-, and tetrabromo-1,2-benzenediol) were tested against food-borne bacteria. When various functional groups were added to 1,2-benzenediol, the 1,2-benzendiol analogs exerted potent activities against the eight food-borne bacteria. In the case of minimum inhibitory concentration, 1,2-benzendiol and its structural analogs showed significantly potent antimicrobial activity against the tested bacteria. Taken together, these findings indicate that D. kaki root-isolated 1,2-benzendiol and its structural analogs could be useful as eco-food supplemental agents.

**Jeong-Ju Baek, Suyong Lee. Functional characterization of brown rice flour in an extruded noodle system. J. Korean Soc. Appl. Biol. Chem. 57(4):435-440**

Brown rice flour has been utilized as a health-functional ingredient for extruded gluten-free noodles. Thus, its functional qualities were evaluated. Brown rice flour had greater resistance to dough mixing, whereas the thermo-mechanical values were reduced during heating and cooling. During extrusion, the presence of more non-starch components in brown rice flour led to a lower degree of gelatinization that could be related to the lower cold initial viscosity and expansion ratio of noodles. The structural matrix of the noodles seemed to be weakened by brown rice flour, thereby reducing the breaking strength and tensile properties of the noodles and increasing their cooking loss. However, brown rice noodles exhibited significantly higher 2,2-diphenyl-1-picrylhydrazyl radical scavenging activity, ferric reducing powder, and 2,2-azino-bis-3-ethylbenzothiazoline-6-sulfonic acid radical-scavenging activity by 21-, 28-, and 21-fold, respectively, than white rice noodles. Thus, extruded noodles with enhanced antioxidant activities were successfully produced with brown rice flour, probably encouraging food industry to develop a variety of brown rice products with health benefits.

**Hwa-Won Lee, Ji-Yeon Yang, Hoi-Seon Lee. Quinoline-2-carboxylic acid isolated from Ephedra pachyclada and its structural derivatives show inhibitory effects against α-glucosidase and α-amylase. J. Korean Soc. Appl. Biol. Chem. 57(4):441-444**

The aim of present study was to isolate a bioactive compound from the chloroform fraction of Ephedra pachyclada stems and to evaluate antidiabetic activities against α-glucosidase and α-amylase. According to various chromatographic and spectroscopic analyses, the bioactive compound of E. pachyclada was identified as quinoline-2-carboxylic acid. Based on the IC50 values of quinoline-2-carboxylic acid derivatives against α-glucosidase and α-amylase, quinoline-2-carboxylic acid (9.1 and 15.5 μg/mL) exhibited potent inhibitory activities, followed by quinoline-3-carboxylic acid (10.6 and 31.4 μg/mL), quinoline-4-carboxylic acid (60.2 and 152.4 μg/mL), and acarbose (66.5 and 180.6 μg/mL) against α-glucosidase and α-amylase, respectively. However, quinoline-2-carboxaldehyde, quinoline-3-carboxaldehyde, and quinoline-4-carboxaldehyde showed no inhibitory activities. Antidiabetic activity depended on the existence of a carboxyl group on quinoline for activities against α-glucosidase and α-amylase. Therefore, E. pachyclada and quinoline-2-carboxylic acid derivatives could be suitable as alternative synthetic antidiabetic agents.

**Jae Eun Ju, Yong Hoon Joo, Namhyun Chung, Soo Yeon Chung, Sung Hee Han, Yong Kwon Lee. Anti-diabetic effects of red rose flowers in streptozotocin-induced diabetic mice. J. Korean Soc. Appl. Biol. Chem. 57(4):445-448**

Diabetes mellitus is a common chronic metabolic disease that is of increasing concern, because it frequently leads to complications such as cardiovascular diseases and cancer. Plants have been studied as a potential source for anti-diabetics to supplement dietary modifications, insulin, and other medications. The components of green tea polyphenols can be changed by processes such as browning. This processing method was applied to the red rose flower to determine whether the processed or non-processed rose flower has an anti-diabetic effect on the streptozotocin-induced diabetic mouse. Aqueous extracts of processed and non-processed rose flowers were analyzed using liquid chromatography/mass spectrometry. The results show that the polyphenol content decreased with browning. The hemoglobin A1c level, an indicator of long-term diabetes, in diabetic mice after administration of extracts of browned rose flowers for 24 and 48 h were lower than those after administration of extracts of non-browned rose flowers. Moreover, the activity of aspartate transaminase, which is often high in diabetic patients, was low in all groups treated with rose flowers, whether they were non-browned or browned. Taken together, these results indicate that extracts from red rose flowers have long-term anti-diabetic effects, and that this effect is independent of the level of polyphenols in the extract.

**Eui Kyun Park, So Ra Ahn, Dong-Hee Kim, Eun-Woo Lee, Hyun Ju Kwon, Byung Woo Kim, Tae Hoon Kim. Effects of unripe apple polyphenols on the expression of matrix metalloproteinase-1 and type-1 procollagen in ultraviolet irradiated human skin fibroblasts. J. Korean Soc. Appl. Biol. Chem. 57(4):449-455**

Bioassay-guided isolation of an aqueous ethanolic extract from the unripe fruits of Malus pumila cv. Fuji using matrix metalloproteinase-1 (MMP-1) inhibition and type-1 procollagen inducing assays led to isolation of eight phenolic compounds, reynoutrin **(1)**, quercitrin **(2)**, isoquercitrin **(3)**, phloridzin **(4)**, phloretin-2′-O-xyloglucoside **(5)**, 5-O-p-courmaroylquinic acid **(6)**, chlorogenic acid methyl ester **(7)**, and chlorogenic acid **(8)**. The structures were established on the basis of nuclear magnetic resonance and mass spectroscopic data interpretations. All isolates were evaluated for their inhibitory effects on MMP-1, and compounds **1**, **2**, and **6** exhibited potent inhibitory effects on MMP-1 with IC50 values of 1.3±0.1, 1.4±0.1, and 3.2±0.6 μM, respectively. When evaluated for their effects on type I procollagen synthesis on human fibroblast cells, compounds **1** and **3** were respectively found to display potent activity for induction of type-1 procollagen by 78.5 and 78.6% at the tested concentration of 12.5 M.

**Hu-Zhe Zheng, In-Wook Hwang, Byoung-Kwan Kim, Young-Chan Kim, Shin-Kyo Chung. Phenolics enrichment process from unripe apples. J. Korean Soc. Appl. Biol. Chem. 57(4):457-461**

Unripe apples contain significant amount of phenolics with various health benefits. A pilot scale enrichment process of unripe apple phenolics with Viscozyme L extraction and XAD-7 sorption process, based on the total phenolic content (TPC), phenolics content by high-performance liquid chromatography analyses, and antioxidant activities were studied. Antioxidant activities were tested by measuring oxygen radical absorbing capacity (ORAC), 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging activity, and ferric-reducing antioxidant power ([FRAP](http://link.springer.com/search?dc.title=FRAP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)). The phenolics-rich final product, apple antioxidant phenolics (AAP) has 771-fold higher TPC and 600-fold higher antioxidant activity of unripe apples. Through XAD-7 sorption AAP showed 52, 87, 70 and 44-fold increases in TPC, ORAC, DPPH and [FRAP](http://link.springer.com/search?dc.title=FRAP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) values, respectively. AAP showed more than 95% stability at the temperature range of 20 to 120°… and pH range of 1.47 to 8.5. Apple phenolics extraction process of Viscozyme L extraction coupled with XAD-7 sorption could be applied to the production of health benefit antioxidants.

**Ga Young Seo, Sanggyu Park, Jung-Sik Huh, Moonjae Cho. The protective effect of glycitin on UV-induced skin photoaging in human primary dermal fibroblast. J. Korean Soc. Appl. Biol. Chem. 57(4):463-468**

Exposure of strong and repeated UV on the skin leads to skin aging, characterized with wrinkling, sagging, dyspigmentation, and laxity. Numerous studies revealed that Matrix metalloproteinases are related to skin aging and functions as degrading enzyme of various types of collagen. Here, we attempted to evaluate the effectiveness of glycitin (4′-hydroxy-6-methoxyisoflavone- 7-d-glucoside) on skin aging and mechanisms of action in UV-irradiated human dermal fibroblasts. Especially we focused on the expression of Matrix metalloproteinase-1 (MMP-1), which degrades procollagen type-I in dermis, by 3-(4,5-dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide assay, Western blot, and reverse transcription polymerase chain reaction in cell lysates or media. Our results showed that glycitin increased the viability of human dermal fibroblast and alleviated MMP-1 expression caused by UV irradiation. In addition, synthesis of type-I collagen was increased and UV-induced phosphorylation of ERK/JNK/p38 was decreased in dose-dependent manners. Taken together, we demonstrated that treatment with glycitein have a protective effect on skin aging by inhibiting of MMP-1 and increasing of collagen through ERK/JNK/P38 down-regulation, which may be mediated by the inhibition of ERK, JNK, and p38 mitogen-activated protein kinases. We suggest that glycitin is a potential agent for the treatment of skin ageing.

**Linh Thi Thao Nguyen, Yeon Woo Song, Thao Anh Tran, Ki-Seok Kim, Somi Kim Cho. Induction of apoptosis in anoikis-resistant breast cancer stem cells by supercritical CO2 extracts from Citrus hassaku Hort ex Tanaka. J. Korean Soc. Appl. Biol. Chem. 57(4):469-472**

[Anoikis](http://link.springer.com/search?dc.title=Anoikis&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) (or cell-detachment-induced apoptosis) is a special form of apoptosis in which cells loose contact with other cells or the extracellular matrix. In the present study, we have found that the breast cancer stem cell line MCF-7-SC, isolated from MCF-7 breast cancer cells, shows characteristics of anoikis resistance. Treatment of supercritical CO2 extract from Citrus hassaku Hort ex Tanaka, locally known as Phalsak, reduced the expression of ATP-binding cassette sub-family G member 2 [mRNA](http://link.springer.com/search?dc.title=mRNA&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) and induced apoptosis in MCF-7-SCs, as evidenced by an increase of apoptotic body formation, increased cell population in the sub-G1 phase, increase in the [Bax](http://link.springer.com/search?dc.title=Bax&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)/Bcl-2 ratio, proteolytic activation of caspase-9 and caspase-3, and the degradation of poly(ADP-ribose) polymerase ([PARP](http://link.springer.com/search?dc.title=PARP&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) protein. The effects of supercritical CO2 extract from Phalsak on anoikis-resistant breast cancer stem cells suggest the use of this extract as a potential therapeutic agent for breast cancer stem cell treatment.

**Dodan Kwon, Gyoung Deuck Kim, Wonseok Kang, Jeong-Eun Park, Song Hee Kim, Eunok Choe, Jung-In Kim, Joong-Hyuck Auh. Pinoresinol diglucoside is screened as a putative α-glucosidase inhibiting compound in Actinidia arguta leaves. J. Korean Soc. Appl. Biol. Chem. 57(4):473-479**

Actinidia arguta leaves are consumed as a popular food material in Korea and have been reported to exert beneficial effects on humans due to its constituent polyphenolic compounds. In this study, the α-glucosidase inhibitory compounds in A. arguta were screened and identified through α-glucosidase-guided fractionation and metabolomic analysis. The 50% ethanol extracts of A. arguta showed strong inhibitory effect (32.6%), which was comparable to acarbose as a positive control (30.0%). Through multiple steps of fractionation, pinoresinol diglucoside and fertaric acid were identified as the major potent compounds in A. arguta inhibiting α-glucosidase activity by liquid chromatography mass spectrometry analysis and metabolomic comparison. Particularly, because pinoresinol and its glycosides have been demonstrated as α-glucosidase inhibitory agents, pinoresinol diglucoside was proposed to be a putative key compound for α-glucosidase inhibition in A. arguta. This is the first study demonstrating the anti-diabetic effect of a pinoresinol-containing fraction of A. arguta and would be useful for its application as a natural α-glucosidase inhibitor.

**So Yeon Park, Sang Hee Shim. Characterization of metabolites from cultures of Cellulosimicrobium cellulans. J. Korean Soc. Appl. Biol. Chem. 57(4):481-484**

Chemical investigation of cultures of Cellulosimicrobium cellulans led to the isolation of six metabolites. They were identified as anthranilic acid **(1)**, cyclo-(dehydroala-l-Leu) **(2)**, cyclo-(l-Pro-l-Tyr) **(3)**, L-phenylalanine **(4)**, cyclo-(l-Pro-l-Leu) **(5)**, and cyclo-(l-Pro-l-Val) (6) based on spectroscopic methods such as MS, and NMR. To the best of our knowledge, this study represents the first chemical investigation of cultures of C. cellulans. The antifungal activities of **1**–**6** were evaluated against a variety of plant pathogens. The antifungal activities of **1** against plant fungal pathogens were evaluated for the first time in this work. Anthranilic acid **(1)** was found to possess the most potent antifungal activities against Pythium ultimum with an MIC of 1.25 μg/mL.

**Ju-Hyun Jeon, Jun-Hwan Park, Hoi-Seon Lee. 2-isopropyl-5-methylphenol isolated from Ruta graveolens and its structural analogs show antibacterial activity against food-borne bacteria. J. Korean Soc. Appl. Biol. Chem. 57(4):485-490**

The antimicrobial activities of the essential oil obtained from the aerial parts of Ruta graveolens and 2-isopropyl-5-methylphenol analogs were evaluated against six food-borne bacteria. The essential oil of R. graveolens aerial parts exhibited potent antimicrobial activity against six food-borne bacteria. 2-Isopropyl-5-methylphenol was isolated by chromatographic analyses. The structure-activity relationships of the 2-isopropyl-5-methylphenol analogs, 2-isopropyl-5-methylphenol, and its structural analogs (2-isopropylphenol, 2-methylphenol, phenol, and 2-isopropyl-5-methylbenzene) were determined against six food-borne bacteria. When employing the agar diffusion method, 2-isopropyl-5-methylphenol and 2-isopropylphenol had potent antimicrobial activities against the six food-borne bacteria. The minimum bactericidal concentration (MBC) and minimum inhibitory concentration (MIC) values of 2-isopropyl-5-methylphenol and its structural analogs were determined against the six food-borne bacteria. 2-Isopropyl-5-methylphenol exhibited the strongest activity (MIC, 5–6.25 μg/mL; MBC, 6.25–12.5 μg/mL) against the six food-borne bacteria. Therefore, the essential oil of R. graveolens and 2-isopropyl-5-methylphenol analogs should be useful as natural food preservatives.

**Hong-Seok Son, Kwang-Sei Lim, Hyun-Jung Chung, Soo-Jin Yang, Young-Shick Hong. Metabolic phenotyping of berries in different six grape (Vitis vinifera) cultivars. J. Korean Soc. Appl. Biol. Chem. 57(4):491-502**

Metabolic behaviors of different grapevine cultivars, grown in the same greenhouse, were characterized through a 1H NMR-based metabolomic approach. Pattern recognition, including the principal component analysis, revealed clear dependence of the grape metabolome on the grape cultivar. Interestingly, high accumulations of proline in the purebred grape cultivars of Cabernet Sauvignon, Merlot, and Chardonnay were found, whereas the proline levels were depleted in the crossbred grape cultivars of Steuben, Campbell Early (C. E.), and Seibel. Intrinsic levels of alanine, glutamine, and trans-feruloyl derivative were highest in C. E. cultivar, which grows easily in a wild vineyard, particularly in Korea, suggesting that their levels play important roles in the improvement of resistance or adaptation of the plant to environmental stress, such as freezing stress during the winter season in Korea. The present study highlights that metabolomics is a powerful approach for better understanding the differences of intrinsic metabolic variables of grape berries among various grape cultivars and their associations with the plant physiological mechanisms.

**Kyeong Mu Kim, Soon-Mi Shim. Nicotine detoxification of rutin, quercitrin, and chlorogenic acid isolated from Houttuynia cordata by reducing reactive oxygen species and inducing conversion from nicotine to cotinine. J. Korean Soc. Appl. Biol. Chem. 57(4):503-509**

The hypothesis of the present study is that methanol extract of Houttuynia cordata Thunb (MEH) and its targeted bioactive components including rutin, quercitrin, and chlorogenic acid can be effective in reducing reactive oxygen species (ROS) caused by nicotine and promoting nicotine to cotinine in HepG2 cell. Oxygen radical absorbance capacity (ORAC) of bioactive components and MEH was measured to assess free radical scavenging capacity. ROS inhibition ability of bioactive components and MEH was measured by 2′,7′-dichlorodihydrofluorescein diacetate assay. The conversion rate of nicotine to cotinine by bioactive components and MEH was determined by the direct barbiturate assay method. ORAC value confirmed that MEH and its bioactive components provided an antioxidant capacity ranging from 126 to 138 μMtrolox equivalents/100 g. Compared to nicotine only, pretreatment of MEH, rutin, and quercitrin was revealed to effectively inhibit ROS production in HepG2 cell by up to 9, 7.4, and 14%, respectively. Nicotine conversion to cotinine after 120 min incubation was 1.7 and 1.4 times higher in rutin and chlorogenic acid pretreatment than the control, respectively. H. cordata and its targeted bioactive components could be a valuable natural ingredient for inhibiting ROS formation by nicotine as well as enhancing the rate of nicotine to cotinine turnover.

**Jae Kyeom Kim, Dong-Hoon Shin, Hui Gyu Park, Eui-Cheol Shin. Cruciferous vegetables, glutathione S-transferases, and implications of their interaction to colorectal cancer risk: A review.** **J. Korean Soc. Appl. Biol. Chem. 57(4):511-517**

Globally, colorectal cancer is the third most common type of cancer in men and the second most common in women. As the rate of this cancer increases with the degree of industrialization and urbanization, many researchers emphasize the importance of diets as a decisive factor in the etiology of this cancer. To be specific, the hypothesis that fruit and vegetable intake would act as preventive measurement against colorectal cancer has gained much interest for the general population as well as medical professionals. However, results of epidemiological studies were somewhat inconsistent and showed weak associations in this regard. One possible explanation regarding these controversial results could be due to limited understanding of the interaction between genetic variations and nutrients and their ability to impede cancer development. The objective of this review was to introduce the chemopreventive mechanisms of cruciferous vegetables as well as their active compounds. Furthermore, existing evidence regarding interactions between genetic variations in the key biotransformation enzyme (i.e., glutathione S-transferase) and the effect of the intake of cruciferous vegetables against the risk of colorectal cancer were critically discussed.

**Soon Young Shin, Aman Dekebo, Worku Dinku, Akalu Terfa, Young Han Lee, Yoongho Lim, Yeonjoong Yong. Identification of an anticancer compound contained in seeds of Maesa lanceolata, a medicinal plant in Ethiopia. J. Korean Soc. Appl. Biol. Chem. 57(4):519-522**

Maesa lanceolata is an ethno-medicinal plant distributed in Central and East Africa, especially Ethiopia and Kenya. It has been used as a traditional medicine against bacterial infections in the small intestine and viral infections in the liver and throat, as well as treatment for rheumatic arthritis. Even though the activity of M. lanceolata leaves has been studied in angiogenesis, which is significantly related to cancer and tumorigenesis, tangible evidence for cancer inhibiting activity of M. lanceolata seeds has not yet been obtained. To the best of our knowledge, this is the first study in which an anti-cancer compound has been identified from the seeds of M. lanceolata and its anti-tumor activity evaluated in HCT116 human colon cancer cells.

**Ji-Ho Lee, Eun-Tae Oh, Se-Chul Chun, Young-Soo Keum. Biotransformation of isoflavones by Aspergillus niger and Cunninghamella elegans. J. Korean Soc. Appl. Biol. Chem. 57(4):523-527**

[Isoflavones](http://link.springer.com/search?dc.title=Isoflavones&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) are well-known flavonoids in many Legumes. Numerous biological activities are reported, including antioxidant, anti-inflamatory, anti-cancer, and antifungal activities. Their metabolic fates of natural isoflavones were studied in mammalians and several microorganisms. However, no detailed analyses have been reported on the isoflavone and its synthetic analogues. Recently, application of microorganism on natural products bioconversion has gained strong attentions due to their advantages over plants and animals. The metabolism of isoflavone and 4′-fluoroisoflavone were tested with Aspergillus niger and Cunninghamella elegans. The structures of selected metabolites were confirmed by synthetic standards. Both fungi rapidly transformed isoflavone into several metabolites. The half-lives of isoflavone (40 mg/L) were 1.6 and 4.2 days for A. niger and C. elegans, respectively. Overall, A. niger gave much more complex metabolite profiles. Approximately 23 metabolites were tentatively identified. The major metabolites were mono- and di-hydroxylated isoflavones at initial period, whereas those of 10 days were di- and tri-hydroxy-isoflavones. Hydroxylation usually occurred in B-ring of isoflavone, confirmed by authentic standards. Among dihydroxyisoflavones, 3′,4′-dihydroxy analogue was the most abundant metabolite, followed by daidzein (4′,7′-dihydroxyisoflavone). Methoxylated metabolites slowly accumulated during culturing. In addition, several glycosides were found, including hexose conjugates of mono-/di-hydroxyisoflavone and minor amount of pentose conjugates during culturing. However, 4′-fluoroisoflavone was not transformed during the culturing period, indicating the region-selective hydroxylation on initial metabolism of isoflavones.

**Manh Tin Ho, Young Mee Kim, Dae-Yeul Yu, Dae Ho Lee, Moonjae Cho, Changlim Hyun. TGF-β secreted from activated hepatic stellate cells may induce the transdifferentiation of hepatocytes into hepatocarcinoma in HBx-expressing livers. J. Korean Soc. Appl. Biol. Chem. 57(4):529-538**

Hepatic stellate cells (HSCs) are the main extra cellular matrix-producing cells in the liver. Several reports have indicated that activated HSCs are involved in hepatic carcinogenesis by way of transforming growth factor β ([TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) secretion. This study aimed to investigate the effects of [TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance), derived from HSCs activated by the chronic hepatitis B virus x protein (HBx), on the transdifferentiation of hepatocytes into hepatocarcinoma cells. Normal hepatocytes (the Chang liver cell line) were treated with a low concentration of [TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) for 2 weeks, after which cell cycle- and cell signaling- related protein expression was analyzed. [Lon](http://link.springer.com/search?dc.title=Lon&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-term treatment of [TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) clearly induced the proliferation and the expression of cancer signaling proteins in the Chang cell line. [TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) treatment also increased the expression of [c-Jun](http://link.springer.com/search?dc.title=c-Jun&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) N-terminal kinase (JNK) and [c-Myc](http://link.springer.com/search?dc.title=c-Myc&facet-content-type=ReferenceWorkEntry&sortOrder=relevance), indicating that induction of the JNK/pSmad3/[c-Myc](http://link.springer.com/search?dc.title=c-Myc&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) oncogenic signaling pathway is involved in hepatocyte transformation. Similar results were observed after culturing Chang cells with conditioned media derived from the activated LX-2 hepatic stellate cell line, suggesting that [TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) paracrine effects are involved in the transformation of hepatocyte cells into hepatocarcinoma cells. Immunohistochemical results showed that the livers from HBx transgenic mice were composed of more activated HSCs and produced more [TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) compared with those from normal mice. The [TGF-β](http://link.springer.com/search?dc.title=TGF-%CE%B2&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) secreted from HBx-infected HSCs might induce transdifferentiation of hepatocytes into hepatocarcinoma, which is the fact that suggested a potential knowledge on liver cancer inhibition.

**Chi-Yeol Kim, Muho Han, Chang-Jin Park, Jong-Seong Jeon. Differential role for BiP3 in rice immune receptor-mediated resistance. J. Korean Soc. Appl. Biol. Chem. 57(4):539-542**

Endoplasmic reticulum-bound chaperone luminal-binding protein 3 (BiP3) has been found to regulate the immunity mediated by the membrane-bound extracellular immune receptors Xa3/Xa26 and Xa21, that encode non-arginine-aspartate (non-RD) kinases, against the bacterial pathogen Xanthomonas oryzae pathovar oryzae (Xoo). In contrast, BiP3 appeared not to regulate the immunity mediated by the intracellular immune receptor Pi5, which encodes a nucleotide-binding domain and leucine-rich repeat (NB-LRR) protein, against the fungal pathogen Magnaporthe oryzae. To further examine this differential role for BiP3 in rice immunity, we generated transgenic rice plants overexpressing BiP3 in the background of the NB-LRR intracellular immune receptor Xa1 that confers resistance to Xoo. Our molecular genetic and phenotype analyses revealed that BiP3 overexpression does not affect Xa1-mediated rice resistance to Xoo. Our current results thus provide evidence that BiP3 regulates membrane-bound non-RD kinase-mediated, but not the intracellular NB-LRR-mediated, rice immune responses and that its function does not depend on the type of pathogen.

**Sangman Lee. Characterization of artificially induced cadmium-tolerant yeast mutants. J. Korean Soc. Appl. Biol. Chem. 57(5):545-549**

Bioremediation of heavy metals by using microorganisms is an effective strategy in regions that have low and wide-ranging metal concentrations and in situations where physical and chemical techniques are not suitable. Because of their higher capacity to remove a wide range of metals by biosorption, yeasts are useful for the bioremediation of heavy metals. In this study, identification of yeast mutants (CdRs) was focused, which have strong resistance to cadmium (Cd), a representative heavy metal. Yeast cells were sequentially adapted to gradually increasing the Cd concentration up to 30 mM. The resultant mutant, CdR30 cells survived a final Cd concentration of 30 mM, while the control cells failed to survive at 0.5 mM in 7 d. It was analyzed whether the increased Cd tolerance of the mutants was associated with sensitivity toward other metals. Compared to control cells, CdR20 cells showed increased tolerance to Cu, decreased tolerance to Ni, and comparable tolerance to Zn. However, these tolerances were not reproducible, because CdRs isolated in a second round of induction showed different metal sensitivities. The increase in Ni sensitivity in CdR20 cells was overcome by performing a second adaptation to Ni stress. Thus, CdR20 cells that were tolerant to both Cd and Ni were generated. These data presented in this study may be useful for the application of microorganisms to the bioremediation of heavy metals.

**Mohammad Sayed Alam, Sanjit Saha, Dong-Ung Lee. Antibacterial and In vivo cytotoxic activities of the leaves of Leucas aspera. J. Korean Soc. Appl. Biol. Chem. 57(5):551-554**

Antimicrobial and cytotoxic activities of the leaves of Leucas aspera, a medicinal plant found in Bangladesh, were evaluated. In vitro bactericidal activity was screened against ten pathogenic or food poisoning bacteria using the disc diffusion method. In vivo cytotoxicity was examined against Artemia salina (brine shrimp nauplii). The dichloromethane fraction of the methanol extract of the leaves of Leucas aspera had strong antibacterial and cytotoxic effects, whereas the ethyl acetate fraction exhibited significant bactericidal activity against only Gram-positive bacterial strains. The active constituents, α-amyrin and α-tocopherol, were isolated for the first time from the dichloromethane fraction and their cytotoxic effects against A. salina were significant with LC50 values of 241 and 195 ppm, respectively.

**Kyung Hee Roh, Soo Bok Choi, Han-Chul Kang, Jong-Bum Kim, Hyun Uk Kim, Kyeong-Ryeol Lee, Sun Hee Kim. Isolation and functional characterization of the Brassica napus cruciferin gene cru4 promoter. J. Korean Soc. Appl. Biol. Chem. 57(5):555-560**

The 12S globulin protein cruciferin is main seed storage protein in Brassica napus. To gain a better understanding of the Bncru4 promoter function, we conducted the promoter 5′ deletion analysis in transgenic Arabidopsis. In the β-glucuronidase (GUS) expression assay, Bncru4 promoter was strongly active in transgenic seeds. In addition, deletion of RY-elements (−236 bp region) dramatically decreased the promoter activity in seed embryos; however, the GUS expression could be observed in seed coat. Further deletion up to −113 bp region (removed up to the CAAT and TATA box), GUS expression was completely abolished in all tissues. These results were consistent with that of the GUS activity in transgenic seeds. Therefore, we consider that RYelement is crucial to the seed-specific expression of Bncru4 promoter

**Yeonjoong Yong, Soon Young Shin, Doseok Hwang, Seunghyun Ahn, Dongsoo Koh, Yoongho Lim. Conversion of flavonoids and their conformation by NMR and DFT. J. Korean Soc. Appl. Biol. Chem. 57(5):561-564**

Wide range of various biological activities of chalcones motivated the syntheses of three chalcone derivatives. The conversion to flavanones was confirmed by 1H- nuclear magnetic resonance (NMR) spectral data. The reason for the aforesaid conversion was elucidated based on the potential energy values of the derivatives, calculated using the density functional theory based on the Hatree-Fock method with B3LYP functional and the 6–31G\* basis set. The rate constants of the derivatives were obtained from the NMR data, and the relevant transition states were considered to explain the relationship between the rate constants and the potential energy differences. These findings can help us predict the molecular stabilities of flavonoids, including chalcones and flavanones, using density functional theory calculations.

**Kook-Han Kim, Won-Kyu Lee, Kyung-Jae Choi, Eunice EunKyeong Kim. Structures of actinonin-bound peptide deformylases from Enterococcus faecalis and Streptococcus pyogenes. J. Korean Soc. Appl. Biol. Chem. 57(5):565-571**

Bacterial resistance to many existing antibiotics is a growing health concern worldwide. There is an urgent need to identify new antibiotics with unexploited modes of action. Peptide deformylase (PDF) is an essential enzyme involved in N-terminal protein processing in eubacteria but not in higher organisms. Therefore, PDF is considered an attractive target for the development of novel antibiotics. Here, we report the structures of the PDFs from Enterococcus faecalis (EfPDF) and Streptococcus pyogenes (SpyPDF) complexed with actinonin at 1.4 and 2.1 Å resolutions, respectively. Actinonin, a naturally occurring, highly potent inhibitor, is bound tightly at the active site. The conformation of actinonin in the EfPDF and SpyPDF complexes was similar to those of all others. The detailed information from this study will facilitate the development of novel antibacterial molecules.

**Bui Thi Thuy Luyen, Bui Huu Tai, Nguyen Phuong Thao, Sang Hyun Lee, Hae Dong Jang, Young Mi Lee, Young Ho Kim. Evaluation of the anti-osteoporosis and antioxidant activities of phenolic compounds from Euphorbia maculata. J. Korean Soc. Appl. Biol. Chem. 57(5):573-579**

Antioxidant and anti-osteoporosis activities of extracts and chemical constituents from the whole plant of Euphorbia maculata were investigated. The MeOH extract, as well as EtOAc and H2O fractions (10.0 μg/mL), exhibited potent antioxidant activities. Their oxygen radical absorbance capacity and cupric ion reducing antioxidant capacity values were 27.07±0.31 to 28.47±0.36 and 43.86±0.26 to 46.67±0.34 fold higher than those of 1.0 μM Trolox, respectively. The MeOH extract and EtOAc fraction (at 10.0 μg/mL) also significantly suppressed excessive bone resorption by osteoclasts with tartrate-resistant acid phosphatase (TRAP) activity values of 154.90±4.25 and 163.95±9.77%, respectively. Bioassay guided isolation of the EtOAc and H2O fractions afforded 19 known compounds (**1**–**19**). Of these, compounds **18**, and **13**–**15** showed good antioxidant activity based on peroxyl radical-scavenging and reducing capacity assays, whereas compounds **1**, **4**, **7**, and **14** showed the most significant inhibitory effect with TRAP activity values ranging from 121.31±1.41 to 110.00±3.74% relative to the control.

**Jae Kwon Son, Byung Yeoup Chung, Jeongryeol Jang, Jae Young Cho. Occurrence, distribution, and risk assessment of polycyclic aromatic hydrocarbons in the surface water of the Dongjin River, Republic of Korea. J. Korean Soc. Appl. Biol. Chem. 57(5):581-589**

The occurrence, distribution, and ecological risk assessment of 15 polycyclic aromatic hydrocarbons ([PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)) were investigated in the Dongjin River water system from December 2010 to October 2012. Among the detected [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance), the mean concentration of acenaphthylene was the highest. Other [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) were detected at very low concentrations. The detection frequencies and concentrations of the 15 [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) were generally higher in the winter season, indicating low water flow conditions and low temperature. The results of a survey of the origin of the [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) using the Phe/Ant ratio and Fla/Pyr ratio clearly indicated a pyrogenic source. The risk quotient (RQ) values for the 15 [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) in the Dongjin River water system were below 0.01–0.1, indicating little risk to the relevant sensitive aquatic organisms, including green algae and daphnids, by the target compounds. In particular, the RQ values of most of [PAHs](http://link.springer.com/search?dc.title=PAHs&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) exceeded 0.1 for fish in all of the seasons at most of the sampling sites, which indicated that the fish were exposed to medium risk.

**Du-Yeong Kim, Byoung-Min Lee, Jin-Young Lee, Phil-Hyun Kang, Joon-Pyo Jeun. Electron beam irradiation and dilute alkali pretreatment for improving saccharification of rice straw. J. Korean Soc. Appl. Biol. Chem. 57(5):591-595**

Rice straw is one of the most abundant and low-cost biomasses available in the world. Thus, the rice straw as a potential candidate for future energy and chemical resource has been intensively studied in order to use as the current fossil fuels. However, the structure of rice straw makes it difficult to hydrolyze into fermentable sugars owing to the cellulose in rice straw being tightly surrounded by hemicellulose and lignin, thus pretreatment of rice straw is needed for this process. In the present study, an alkali pretreatment method assisted by electron beam irradiation was investigated to improve the saccharification in an enzymatic hydrolysis yield. After pretreatment, cellulose in rice straw was increased from 39.5 to 71.1%, and lignin decreased from 19.5 to 6.4%. The sugar yield of the pretreated rice straw increased with an increase in irradiation dose. The results of XRD and Fourier transform infrared spectroscopy analyses showed that the properties of the straw were changed by this pretreatment, which favored the following enzymatic hydrolysis.

**Hong-Man Hou, Dong-Qi Guo, Gong-Liang Zhang, Li-Ming Sun, Yu-Na Cui. Characteristics of cholesterol-lowering Lactobacillus casei subsp. casei strain GL-03 isolated from cheese. J. Korean Soc. Appl. Biol. Chem. 57(5):597-603**

Cholesterol-lowering effect of lactic acid bacteria is well-known. In the present study, nine cholesterol-lowering Lactobacillus strains from Chinese traditional cheese, pickle, and yoghurt were screened and characterized for their potential use. The microbial contents of all strains significantly decreased at pH 1.5; however, the residual counts of Lactobacillus casei subsp. casei GL-03, L. plantarum ZP-Z, L. plantarum ZP-05, and L. brevis ZP-04 were more than 107 CFU/mL after incubation for 6 h. All nine strains of Lactobacillus indicated good tolerance to bile at concentration less than 0.2% after incubation for 2 to 6 h. L. plantarum ZP-W had maximum hydrophobicity towards xylene, whereas GL-03 strain possessed maximum hydrophobicity for both hexadecane and octane. ZP-05 strain had more effective inhibitory activity against both Staphylococcus aureus and Bacillus subtilis than other eight strains. Furthermore, GL-03 strain significantly reduced cholesterol TC and TG levels in hyperlipidemia mice fed high-cholesterol diet. The growth of GL-03 strain was promoted by five kinds of Chinese herbal medicines, and the Chinese hawthorn at concentration of 0.0125% showed the highest promoting effect. These results suggest that L. casei subsp. casei GL-03 may be effective as a probiotic with cholesterollowing activities.

**Young-Ok Kim, In-Suk Park, Dae-Jung Kim, Bo-Hye Nam, Dong-Gyun Kim, Young-Ju Jee, Cheul-Min An. Identification and characterization of a bacteriocin produced by an isolated Bacillus sp. SW1-1 that exhibits antibacterial activity against fish pathogens. J. Korean Soc. Appl. Biol. Chem. 57(5):605-612**

The selected isolate, Bacillus sp. SW1-1 showed antibacterial activity against both Gram-positive and Gram-negative bacteria involved in fish diseases, including Edwardsiella tarda, Streptococcus iniae, S. parauberis, Vibrio anguillarum, and V. harveyi. The Maximum bacteriocin production was observed at 30°C after 24 h with brain heart infusion medium (pH 7.0). The bacteriocin SW1-1 was purified by 50% ammonium sulfate precipitation, followed by HiPrep diethylaminoethyl 16/10 FF and Sephacryl S-100 High resolution column chromatography. The substance was characterized as a bacteriocin-like inhibitory substance with a molecular mass of 38 kDa. Bacteriocin SW1-1 was sensitive to the proteolytic action of pepsin, trypsin, chymotrypsin, and protease types I and XIV, and relatively heat labile, despite the fact that bacteriocin activity was still detected after heating at 100°C for 30 min. The activity of bacteriocin SW1-1 was stable in the pH range of 2.0–11.0, and relatively unaffected by organic chemicals. The bacteriocin SW1-1 had a bacteriolytic mechanism, resulting in cell wall degradation of E. tarda. These characteristics indicate that this bacteriocin may be a potential candidate for alternative agent to control important pathogens of fish diseases in aquaculture.

**Mohammad Sayed Alam, Dong-Ung Lee, Md. Latiful Bari. Antibacterial and cytotoxic activities of Schiff base analogues of 4-aminoantipyrine. J. Korean Soc. Appl. Biol. Chem. 57(5):613-619**

Schiff base is the class of compounds showing wide range of biological activities having the azomethine (-N=CH-) active pharmacophore, which play major roles in their significant bio-activities. A series of Schiff base analogues of 4-aminoantipyrine analogues have been tested for bactericidal and cytotoxic activities against selected bacterial strains and brine shrimp (Artemia salina) nauplii, respectively. Of the compounds tested, two compounds showed a good inhibition of bacterial growth against E. coli and C. sakazakii, whereas three compounds demonstrated high cytotoxicity with LC50 values of 225, 480, and 581 ppm, in a short term bioassay using A. salina. Qualitative structure-cytotoxic activity relationships were studied using physicochemical parameters; a good correlation between clogP and cytotoxic activity was observed.

**Sung-Mee Lim. Anti-Helicobacter pylori activity of antimicrobial substances produced by lactic acid bacteria isolated from Baikkimchi. J. Korean Soc. Appl. Biol. Chem. 57(5):621-630**

The purpose of the present study was to determine the antagonistic activity of the 13 lactic acid bacteria strains isolated from Baikkimchi made with (Brassica rapa, subspecies pekinensis and chinensis) against Helicobacter pylori [ATCC](http://link.springer.com/search?dc.title=ATCC&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) 43504 in vitro. Relatively good growth properties were found for Lactobacillus brevis BK11, Lactobacillus acidophilus BK13, and Leuconostoc mesenteroides BK26 strains with residual numbers of >106 CFU/mL after incubation for 2 h in artificial gastric juice. In co-culturing experiments, Lactobacillus plantarum BK10, L. brevis BK11, L. acidophilus BK13, Pediococcus pentosaceus BK34, Lactobacillus paracasei BK57, Enterococcus faecalis BK61, and Lactococcus lactis BK65 showed significant antimicrobial ability against H. pylori. The cell-free culture supernatants (CFCSs) obtained from L. brevis BK11, L. acidophilus BK13, P. pentosaceus BK34, L. paracasei BK57, and L. lactis BK65 strains producing very high levels of lactic acid dramatically decreased the viability of H. pylori. In addition, the bactericidal activity of L. plantarum BK10, L. brevis BK11, L. acidophilus BK13, L. paracasei BK57, and E. faecalis BK61 strains was significantly correlated with the bacteriocin production. The CFCS and bacteriocin solutions produced from the strains except for E. faecalis BK61 were effective in inhibiting the adhesion of H. pylori to human stomach adenocarcinoma cells and their urease activity.

**Jae-Hyun Yoon, Young-Min Bae, Soon-Young Jung, Myeong-Hwa Cha, Kyung Ryu, Ki-Hwan Park, Sun-Young Lee. Predictive modeling for the growth of Listeria monocytogenes and Salmonella Typhimurium on fresh-cut cabbage at various temperatures. J. Korean Soc. Appl. Biol. Chem. 57(5):631-638**

The growth of Listeria monocytogenes and Salmonella Typhimurium on fresh-cut cabbage at between 15 and 35°C before and after treatment with water washing, chlorine dipping, and chlorine dipping followed by water washing were investigated. It is apparent that these pathogens could grow faster at higher temperature. Chlorine treatments reduced L. monocytogenes and S. Typhimurium on cabbage by 1.04–1.15 log CFU/g and 1.35–1.51 log CFU/g, respectively. Gompertz model and polynomial equation were used to describe the behaviors of L. monocytogenes and S. Typhimurium on cabbage before and after treatment with water washing, chlorine dipping, and chlorine dipping followed by water washing as a function of temperature. The lag times of L. monocytogenes and S. Typhimurium were the longest when treated with chlorine dipping followed by water washing at 15°C. The growth rates of L. monocytogenes and S. Typhimurium were the lowest when treated with water washing at 15°C, indicating that the growth of pathogen was more affected by storage temperature than chlorine treatment. Validation was also performed to evaluate the reliability of developed predictive models. The Bf values of the growth rate and lag time for L. monocytogenes and S. Typhimurium ranged from 0.90 to 1.25, indicating that they were mostly in the acceptable level, whereas Af values ranged from 1.07 to 1.80, showing that they were over-predicted.

**Hyun-Joo Lee, Ah-Ra Kim, Jae-Joon Lee. Effects of ramie leaf extract on blood glucose and lipid metabolism in db/db mice. J. Korean Soc. Appl. Biol. Chem. 57(5):639-645**

Hypoglycemic and hypolipidemic effects of ramie leaf ethanol extract (RLE) on C75BL/KsJ-db/db mice were determined. The db/db mice were divided into diabetic control group (C), two experimental groups orally treated with low dose (200 mg/k, RLEL) and high dose (400 mg/kg, RLEH) of RLE. After 6 weeks, fasting blood glucose, serum insulin, and glycosylated hemoglobin levels decreased in RLE groups compared to those in the control group. The glucose levels in the oral glucose tolerance test and area under the curve for glucose in the RLE groups were also significantly lower than those in the control group (p <0.05). The serum total cholesterol and low-density lipoprotein cholesterol levels were significantly decreased in the RLEH group, whereas the serum HDL-cholesterol level was significantly increased in the RLEH group (p <0.05). These data suggest that RLE may improve blood glucose and lipid metabolism in mice with type 2 diabetes.

**Chenxi Wang, Yuping Li, Lihua Yao, Guangjie Wu, Jun Chang, Chengchuang Shu, Meiqin Chen. Optimization of ultrasonic-assisted extraction of flavonoid from Portulaca oleracea L. by response surface methodology and chemical composition analysis. J. Korean Soc. Appl. Biol. Chem. 57(5):647-653**

Optimization of ultrasonic extraction of Portulaca oleracea L. flavonoids (POF) was investigated using single-factor experimentation combined with response surface methodology. The optimal conditions for the highest yield (16.25 mg RE/g DW) of POF was 39.01% ethanol, 55.25°C extraction temperature, 15 min extraction time, and 23.92 (v/m) liquid-to-solid ratio. The crude extract of POF was purified on the polyamide resin. 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide, a yellow tetrazole assays of the flavonoids were evaluated, which suggested the concentrations of the flavonoids (0–1 mg/mL) and quercetin (0–1 mg/mL). [Quercetin](http://link.springer.com/search?dc.title=Quercetin&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) was identified in the extract by comparing relative retention time of the reference standard.

**Mi-Hee Woo, Min Soo Kim, Namhyun Chung, Joong-Su Kim. Expression and characterization of a novel 2-deoxyribose-5-phosphate aldolase from Haemophilus influenzae Rd KW20. J. Korean Soc. Appl. Biol. Chem. 57(5):655-660**

A codon-optimized 2-deoxyṟibose-5-phosphate aldolase (DERA) gene from Haemophilus influenzae Rd KW20 was synthesized and expressed in Escherichia coli, and the biochemical properties of its product were investigated. DERA was purified using affinity chromatography and characterized using 2-deoxyribose-5-phosphate as the substrate. Specific activity of the recombinant DERA was 34.1 Umg−1. The pH and temperature optima were 7.5 and 40°C, respectively. Additionally, the recombinant enzyme retained stability up to temperatures below 50°C. Maximal enzyme activity was observed in presence of 300 mM of acetaldehyde. The apparent K m and V max of purified enzyme towards 2-deoxyribose-5-phosphate were 0.14 mM and 70.42 μmol min−1 mg−1 and towards 2-deoxy-D-ribose were 24.77 mM and 1.94 μmol min−1 mg−1, respectively. For synthesis of statin intermediates, the bioconversion process for production of (3R, 5S)-6-chloro-2,4,6-trideoxy-erythro-hexose from chloroacetaldehyde and acetaldehyde using the recombinant DERA was studied and this process took 3 h for maximal conversion. This recombinant DERA could be potentially applied in the production of (3R, 5S)-6-chloro-2,4,6-trideoxy-erythro-hexose.

**Sojin Moon, Euiyoung Bae. Crystal structures of thermally stable adenylate kinase mutants designed by local structural entropy optimization and structure-guided mutagenesis. J. Korean Soc. Appl. Biol. Chem. 57(5):661-665**

Thermally stable proteins are desirable in many industrial and laboratory settings, and numerous approaches have been developed to redesign proteins for higher thermal stability. Here, we report the crystal structures of two thermally stable adenylate kinase (AK) mutants that were designed by applying a combination of local structural entropy (LSE) optimization and structure-guided mutagenesis. Structure-guided mutagenesis resulted in stabilizing interactions connecting distant regions of the LSEoptimized AK sequence. This demonstrates the feasibility and importance of simultaneous optimization of local and global features in protein thermal stabilization. An additional AK mutant showed that small changes in side-chain configuration can greatly impact thermal stability.

**Byoung Kwon Park, Dongbum Kim, Guang Wu, Song Hee Choi, Doo-Sik Kim, Younghee Lee, Hyung-Joo Kwon. Effect of epitope-CpG-DNA-liposome complex without carriers on vaccination of respiratory syncytial virus infection. J. Korean Soc. Appl. Biol. Chem. 57(5):667-676**

Respiratory syncytial virus (RSV) is a common virus related to disease in the lung epithelium of young children and infants. However, RSV vaccine has not yet been developed. Thus it is difficult to develop a whole-RSV vaccine due to induction of Th2-type hyper-immune responses. To overcome this limitation, we used [CpG](http://link.springer.com/search?dc.title=CpG&facet-content-type=ReferenceWorkEntry&sortOrder=relevance)-DNA encapsulated within liposome complex (Lipoplex(O)) as an adjuvant for the induction of a Th1-dominated humoral response in animal experiments. However, vaccination with a complex of UV-irradiated RSV and Lipoplex(O) had no effect against RSV infection. To improve the efficacy of the RSV vaccine, we performed peptide-based epitope screening and evaluated the efficacy of the vaccine using a complex of epitope and Lipoplex(O). Two efficient B-cell epitopes were identified in nine candidate epitopes from the RSV-F protein. The vaccination with a complex of RSV-F protein epitope (F7 and F9) and Lipoplex(O), induced a prophylactic effect on the RSVinfection based on lung histopathology and mucus clearance from the lungs. Thus, further studies on the effect of the peptide vaccine against infection by multiple RSV strains, may allow fine-tuning of a potential vaccine, and improvement of the vaccine program against RSV.

**Samia Siddique, Rubina Nelofer, Quratulain Syed, Ahmad Adnan, Fahim Ashraf Qureshi. Optimization for the enhanced production of avermectin B1b from Streptomyces avermitilis DSM 41445 using artificial neural network. J. Korean Soc. Appl. Biol. Chem. 57(5):677-683**

Avermectin is an environment friendly bio-insecticide. Optimization of the culture conditions for avermectin B1b production has not been carried out before using [Artificial Neural Network](http://link.springer.com/search?dc.title=Artificial+Neural+Network&facet-content-type=ReferenceWorkEntry&sortOrder=relevance) (ANN) method. The present work is therefore conducted to optimize some important factors including yeast extract, MgSO4.7H2O, and temperature for the avermectin B1b production using ANN methodology from Streptomyces avermitilis DSM 41445. The optimum levels for the yeast extract, MgSO4.7H–O, and temperature were 16.0 (g/L), 5.0 (g/L) and 32°C respectively. Maximum effect was observed by yeast extract. Avermectin B1b yield was increased up to 150% after optimization. ANN was found to be a powerful technique for the optimization and prediction of avermectin B1b production from Streptomyces avermitilis DSM 41445.

**Hyun Jung Bae, Catherine W. Rico, Su Noh Ryu, Mi Young Kang. Hypolipidemic, hypoglycemic, and antioxidative effects of a new pigmented rice cultivar “Superjami” in high fat-fed mice. J. Korean Soc. Appl. Biol. Chem. 57(5):685-691**

Effects of newly-developed pigmented rice Superjami, in comparison with those of its parental cultivars (Heugjinjubyeo and Suweon 425) and ordinary brown rice, on the lipid and glucose metabolisms and antioxidative defense status in high fatfed mice were investigated. The animals were randomly divided and given experimental diets for eight weeks: normal control, high fat, and high fat supplemented with ordinary brown, Heugjinjubyeo, Suweon 425 or Superjami rice powder. Their body weight, plasma lipid profile, blood glucose level, and lipid peroxidation were measured. The enzymes and hormones involved in the lipid and glucose metabolisms were also analyzed. High fat feeding significantly increased the body weight, total cholesterol, triglyceride, blood glucose, and lipid peroxidation in mice. On the other hand, diet supplementation of the rice samples, particularly Superjami, markedly reduced the body weight gain, improved the lipid and glucose profiles, and suppressed oxidative stress through regulation of hepatic lipogenesis and adipokine production, inhibition of glucose-regulating enzymes, and enhancement of antioxidant enzyme activities. Superjami has greater hypolipidemic, hypoglycemic, and antioxidant status-improving effects than its parental cultivars. This study provides the first evidence of the physiological effect of Superjami, which may be useful in the prevention and management of high fat diet-induced hyperlipidemia, hyperglycemia, and oxidative stress.

**Yeonjoong Yong, Soon Young Shin, Hyeryoung Jung, Seunghyun Ahn, Young Han Lee, Dongsoo Koh, Yoongho Lim. Investigation of 2-Hydroxy-4-methoxy-2',3'-benzochalcone Binding to Tubulin by Using NMR and in silico Docking. J. Korean Soc. Appl. Biol. Chem. 57(6):693-698**

Hydroxychalcones act as autophagy inducers and methoxy chalcones induce apoptosis. Additionally, benzoflavones inhibit the hepatitis C virus. Based on these findings, a chalcone

derivative, 2-hydroxy-4-methoxy-2',3'-benzochalcone, was prepared. It showed antimitotic activity through its inhibitory effect on tubulin polymerization. Its molecular binding mode with tubulin

was elucidated using *in silico* docking and nuclear magnetic resonance spectroscopy. In addition, the three-dimensional structure of 2-hydroxy-4-methoxy-2',3'-benzochalcone was determined by

X-ray crystallography.

**Jun-Hwan Park, Kwan Seob Shim, Hoi-Seon Lee. Antimicrobial Activities of 2,6-Dimethoxy-1,4-benzoquinone and Its Structurally Related Analogues against Seven Food-borne Bacteria. J. Korean Soc. Appl. Biol. Chem. 57(6):699-701**

Antimicrobial activities of 2,6-dimethoxy-1,4-benzoquinone and its structurally related analogues (2,6-dichloro-, 2,6-dimethyl-,2,5-dichloro-, and 2,5-dimethyl-) were evaluated at 0.5 mg/disc

against seven food-borne bacteria. 2,6-Dimethoxy-1,4-benzoquinone showed antimicrobial activity against Staphylococcus intermedius (22.0 mm), Staphlococcus epidermidis (19.5 mm), Shigella sonnei (16.0 mm), and Listeria monocytogenes (15.0 mm). Furthermore, these structural analogues exhibited antimicrobial activity against all tested food-borne bacteria except 2,6-dichloro-1,4-benzoquinone. In conclusion, 2,6-dimethoxy-1,4-benzoquinone and its structural analogues are useful as a source of food supplemental agents.

**Nam Yeun Kim, Geun Eog Ji. Characterization of Soybean Fermented by Aflatoxin Non-producing *Aspergillus oryzae* and γ-Aminobutyric Acid Producing *Lactobacillus brevis*. J. Korean Soc. Appl. Biol. Chem. 57(6):703-708**

Fermented soybean products may contain aflatoxins due to the contamination of the aflatoxin producing mold during natural fermentation or as a result of un-prudential use of starter

strain. The aim of the present study was to develop and characterize fermented soybean products with enhanced safety and bioactive compound using aflatoxin non-producing *Aspergillus oryzae* FMB S46471 and γ-aminobutyric acid (GABA) producing *Lactobacillus brevis* GABA 100. For fermentation, steam-processed soybeans were inoculated with A. oryzae FMB S46471. The scaled-up fermentation product was fermented for 17 days, including 12 days fermentation with *A. oryzae* and 5 days with *L. brevis*, and contained 6.5±0.3 g/kg of GABA and 45.7±0.3 g/kg of total free amino acids. After ripening for 90 days, the fermented soybean contained about 11.6±0.3 g/kg of GABA and 72.7±1.8 g/kg of total free amino acids. Furthermore, aflatoxins were not detected in both mature and immature soybean products. The soybean product that fermented by an aflatoxin non-producer and a powerful GABA producer will contribute to the development of fermented foods with enhanced safety levels and functional benefits of GABA.

**Dalrae Ahn, Eun Byeol Lee, Ban Ji Kim, So Yeon Lee, Tae Gwan Lee, Min-Sil Ahn, Hye Won Lim, Dong Seok Cha, Hoon Jeon, Dae Keun Kim. Antioxidant and Lifespan Extending Property of Quercetin-3-Odirhamnoside from *Curcuma longa* L. in *Caenorhabditis elegans.* J. Korean Soc. Appl. Biol. Chem. 57(6):709-714**

Quercetin-3-O-α-L-rhamnopyranosyl(1→2)-O-α-L-rhamnopyranoside (QDR) was isolated from the remaining underground parts of Curcuma longa after harvesting the medicinal parts, and

the antioxidant activities *in vitro* and lifespan-extending effect of QDR were elucidated using the *Caenorhabditis elegans* model system. The 1,1-diphenyl-2-picrylhydrazyl (DPPH) radical scavenging effect of QDR showed similar potent activities in comparison with vitamin C. QDR also showed strong superoxide quenching activities as measured by the riboflavin- and xanthineoriginated superoxide quenching activities. QDR demonstrated potent lifespan extension of worms under normal culture condition. Subsequently, the protective effect of QDR on the stress

conditions such as thermal and oxidative stresses was determined. In the case of heat stress, QDR-treated worms exhibited enhanced survival rate, as compared to control worms. In addition, QDR-fed worms lived longer than control worms under oxidative stress induced by paraquat. To verify the possible mechanism of QDRmediated increased lifespan and stress resistance of worms, we investigated whether QDR might alter superoxide dismutase (SOD) activity and intracellular reactive oxygen species (ROS) levels. Our results showed that QDR was able to elevate SOD

activity of worms and reduce intracellular ROS accumulation in a dose-dependent manner.

**Tianyi Yang, Jiaojiao Li, Liangzhi Li, Haiyang Zhang, Jing Ma, Zhi Chen, Cuiying Hu, Xin Ju, Jiaolong Fu. Improvement of FK506 Production by Selection of 4-Aminobutyric Acid-tolerant Mutant and Optimization of its Fermentation Using Response Surface Methodology. J. Korean Soc. Appl. Biol. Chem. 57(6):715-722**

Tacrolimus (FK506), a 23-membered polyketide macrolide with immunosuppressant activity, can be produced by *Streptomyces tsukubaensis*. We studied a variety of mutant strains of S. *tsukubaensis* for the microbial production of FK506. The best strain (CZ-19) was obtained from the parent strain LLZ-1 by nitrosoguanidine mutation and 4-Aminobutyric acid (FK506 precursor structure analogs) adaption. In the shake-flask experiments, titer of FK506 by CZ-19 was 532.44 mg/L, increased by 65.13% compared to that of the parent strain. Through single factor experiments and response surface methodology, we further optimized the medium for improved FK506 production by CZ-19

in shake flask culture. The optimal medium for enhanced FK506 production was as follows: 17.19 g/L corn starch, 21.78 g/L glucose, 8.06 g/L peptone, and 18.98 mg/L 4-aminobutyric acid.

The predicted FK506 titer was 906.49 mg/L, and the experimental data confirmed the validity of the model. The present study demonstrates that S. *tsukubaensis* CZ-19 is a promising strain for

industrial production of FK506.

**Xiangpeng Meng, Saehoon Kim, Pradeep Puligundla, Sanghoon Ko. Carbon Dioxide and Oxygen Gas Sensors-Possible Application for Monitoring Quality, Freshness, and Safety of Agricultural and Food Products with Emphasis on Importance of Analytical Signals and Their Transformation. J. Korean Soc. Appl. Biol. Chem. 57(6):723-733**

Intelligent packaging technologies are rapidly gaining interest in the agriculture and food industries. Intelligent packaging for agricultural and food products has great potential to improve

the shelf life and safety of agricultural and food products apart from its basic functions of keeping the products clean and protecting against unwanted physical and chemical changes.

Intelligent packaging components are not limited to radio frequency identification (RFID) sensors, time-temperature indicators, ripeness indicators, and biosensors. Carbon dioxide, oxygen gas

sensors and nanobiosensor can be used for real-time monitoring of freshness or quality for agricultural and food products. In this review, details of different sensors that are primarily used for carbon dioxide or oxygen gas sensing and their possible potential to be incorporated into agricultural and food packaging for product quality monitoring are discussed. In addition, special

emphasis is placed on detailing the importance of analytical signals and their transformation, because these aspects play crucial role in monitoring the quality and freshness of agricultural and

food products via intelligent packaging systems. Signal transducers contribute to the establishment of communication between the product quality sensor and the communication components such as RFID sensors in smart packaging systems by converting a signal in one form of energy to another form.

**Sang Keun Han, Yun Gi Kim, Hee Cheol Kang, Jeong Ran Huh, Ji Yeoung Kim, Nam-In Baek, Dong-Kyu Lee, Dong-Geol Lee. Oleanolic Acid from Fragaria ananassa calyx Leads to Inhibition of α-MSH-induced Melanogenesis in B16-F10 Melanoma Cells. J. Korean Soc. Appl. Biol. Chem. 57(6):735-742**

Natural products with non-toxic and environmentally friendly properties are good sources for skin-whitening and brightening cosmetic agents. Strawberries (*Fragaria ananassa*), and their parts are used as cosmetic agents, because they contain high levels of bioactive substances. We isolated and identified compounds from *F. ananassa* calyx. Oleanolic acid has multiple biological activities, including anti-tumor, anti-angiogenic, antiinflammatory, anti-oxidant, and pro-apoptotic effects. However, no study has investigated the influence of oleanolic acid on melanin synthesis in B16-F10 melanoma cells. In the present study, we investigated the effect of oleanolic acid on melanin biosynthesis in B16-F10 melanoma cells stimulated with α-melanocyte stimulating hormone (α-MSH). Oleanolic acid-mediated melanogenesis inhibition was studied by measuring intracellular and secreted melanin levels and by using Western blot and semiquantitative

reverse transcriptase-polymerase chain reaction analyses. Oleanolic acid suppressed melanin release and expression, resulting in a significant dose-dependent decrease in secreted and intracellular melanin levels and cellular tyrosinase activity. Furthermore, it inhibited the expression of melanogenesis-associated factors, including tyrosinase, tyrosinase-related proteins-1 and -2, and microphthalmia-associated transcription factor, in α-MSH-stimulated B16-F10 melanoma cells. The results of the present study can contribute to the development of cosmetic agents utilizing the skin whitening and brightening effect of oleanolic acid, which will likely have a wide range of applications in the cosmetic industry and/or clinical practice in the future.

**Su Jin Kim, Bong Keun Song, Young Je Yoo, Yong Hwan Kim. Peroxidase Inactivation by Covalent Modification with Phenoxyl Radical during Phenol Oxidation. J. Korean Soc. Appl. Biol. Chem. 57(6):743-747**

The mechanism-based inactivation of peroxidases limits the usefulness of these versatile enzymes. In this study, we propose a dominant inactivation mechanism for peroxidase during phenol oxidation. Two peroxidases, *Coprinus cinereus* peroxidase (CiP) and horseradish peroxidase isozyme C (HRPC) showed much higher inactivation rates after simultaneous addition of

phenol and hydrogen peroxide, whereas addition of hydrogen peroxide alone or polymeric products had relatively little impact on peroxidase activity. During the oxidation of a phenol substrate, the molecular weights of polypeptides originating from inactivated peroxidases were slightly increased, and a large fraction of CiP and HRPC hemes remained intact even after phenoxyl radical coupling. Our study strongly supports the hypothesis that the inactivation of a peroxidase during the oxidation of phenolic compounds occurs by a covalent modification of the peroxidase polypeptide chain with a phenoxyl radical. These findings will elucidate the method of inactivation for peroxidase and other heme proteins.

**Yus Azila Yahaya, Mashitah Mat Don. Flavonoid Production by T. lactinea: Screening of Culture Conditions Via OFAT and Optimization Using Response Surface Methodology (RSM). J. Korean Soc. Appl. Biol. Chem. 57(6):749-757**

The culture conditions for flavonoid production by the fungus Trametes lactinea was screened using one-factor-at-a-time (OFAT) and optimized with response surface methodology. *T. Lactinea* was found to grow well in Medium 3, and the highest flavonoid was produced in Medium 2. Medium 2 contains yeast extract, glucose, KH2PO4, Na2HPO4 · 12H2O, MgSO4 · 7H2O, and

(NH4)2 · SO4, whereas Medium 3 contains yeast extract, glucose and peptone. Four selected parameters in OFAT were further optimized for flavonoid production by *T. lactinea* using response

surface methodology via Box Behnken design (BBD). Interactions of culture conditions and optimization of the system were then studied using BBD with four levels of the four variables in a batch flask culture. Experimentation showed that the model developed based on BBD had predicted flavonoid production with R2=0.9983. The predicted flavonoid production was optimum (20.02 μg/mL) when the culture conditions were at 8.1 days of incubation period, 5.2 mL of inoculum, incubation temperature at 34.6oC, and the production medium with initial pH 6. The results indicated that BBD method was effective in optimizing the culture conditions of flavonoid production by *T.lactinea*.

**Kyung Hee Roh, Soo Bok Choi, Han-Chul Kang, Jong-Bum Kim, Hyun Uk Kim, Kyeong-Ryeol Lee, Sun Hee Kim. Isolation and Functional Characterization of a *PISTILLATA*-1 Gene Promoter from *Brassica napus.* J. Korean Soc. Appl. Biol. Chem. 57(6):759-768**

The *PISTILLATA* is a floral organ identity gene required for the flower development. To gain a better understanding of the *BnPI*-1 promoter function, the promoter 5' deletion analysis was

conducted, both in transgenic *Brassica napus* and transgenic *Arabidopsis*. In the β-glucuronidase (GUS) expression assay of transgenic B. *napus*, most of the 5' deletion constructs of the *BnPI*-1 promoter expressed the GUS gene strongly in all organs of the flower except the style, and deletion up to −326 bp region (removed up to the G-box located near the TATA-box) reduced

dramatically the GUS expression, and deletion up to −150 bp region (removed up to the TATA-box) abolished the GUS expression. In the GUS fluorometric assay, GUS activity in the flower was about 4-fold higher than that in seed or silique, and GUS activity in the leaf was not detected. The GUS expression patterns in transgenic *Arabidopsis* were similar to those in transgenic *B. napus*. These results suggest that the *BnPI*-1 promoter can lead the foreign gene expression mainly in the floral-tissue, which is shown to be regulated by the G-box element responsive to basic

leucine-zipper transcription factors.

**Mi So Lee, Seunghyun Ahn, Da Hyun Lee, Da Young Lee, Dongsoo Koh, Soon Young Shin. A Synthetic Naphthochalcone, 2-Hydroxy-2,3,4-trimethoxy-5,6-naphthochalcone, Triggers Caspase-dependent Apoptosis in HCT116 Human Colon Cancer Cells. J. Korean Soc. Appl. Biol. Chem. 57(6):769-773**

A novel synthetic naphthochalcone, 2'-hydroxy-2,3,4-trimethoxy-5',6'-naphthochalcone (HTN), was evaluated for its antitumor activity. The clonogenicity of both Capan-1 pancreatic and HCT116 colon cancer cells was reduced by HTN treatment. Flow cytometry assay showed that HTN induced cell cycle arrest at the G2/M phase at 24 h of treatment and then accumulated sub-

G0/G1 phase population at 48 h post-treatment in HCT116 cells. Furthermore, HTN stimulated the cleavages of caspase-9, caspase-7, and poly(ADP-ribose) polymerase (PARP), suggesting

that HTN triggers apoptotic cell death through a mitochondriamediated caspase-dependent pathway. These results suggest that methoxylated naphthochalcone may have a potential as a drug candidate for the treatment of human colon cancer.

**Seong-Kon Lee, Sung-Han Park, Jeong-Won Lee, Hae-Min Lim, Sun-Young Jung, In-Cheol Park, Soo-Chul Park. A Putative Cold Shock Protein-encoding Gene Isolated from *Arthrobacter* sp. A2-5 Confers Cold Stress Tolerance in Yeast and Plants. J. Korean Soc. Appl. Biol. Chem. 57(6):775-782**

A putative cold shock protein gene, designated as *ArCspA*, was isolated from *Arthrobacter* sp. A2-5 extracted from soil at the South Pole. The *ArCspA* gene is 873 nucleotide bp long and includes a 207-bp short open reading frame (ORF) with 49.3–92% amino acid identity to peptide sequences of other bacterial cold shock proteins. Northern blot analysis revealed that *ArCspA*

was highly expressed at low temperatures. Bio-functional analysis using *ArCspA*-overexpressed transgenic *Saccharomyces cerevisiae* showed that *ArCspA* conferred cold tolerance on yeast at low

temperatures (15oC). We then developed an *ArCspA*-overexpressed transgenic tobacco line to determine whether *ArCspA* is also functional in plants. After cold treatment at −25oC for 90 min

followed by recovery for 4 weeks at 25oC, 17 transgenic lines survived at a high rate (60.0%), whereas under the same treatment conditions, wild-type plants did not survive. We also found that progeny of transgenic tobacco plants subjected to freezing stress at −20oC had significantly higher seed germination ability than wild-type plants. These results clearly indicate that the ArCspA protein plays an important role in cold tolerance in both yeast and plants.

**Sung-Woo Kim, A. M. Abd El-Aty, Jeong-Heui Choi, Md. Musfiqur Rahman, Su Myeong Hong,**

**Geon-Jae Im, Jae-Han Shim. Analysis of Abamectin Residues in Green Tea Using QuEChERS Method and Liquid Chromatography-tandem Mass Spectrometry. J. Korean Soc. Appl. Biol. Chem. 57(6):783-787**

The present study estimated the residue levels of abamectin (B1a) in green tea leaves and tea infusion. Samples were hydrated with water prior to extraction by using the quick, easy,

cheap, effective, rugged, safe method and was analyzed with liquid chromatography-tandem mass spectrometry in positive ion mode. The matrix-matched calibration was linear over the concentration range of 0.01–2mg/kg with determination coefficients (R2) >0.995. Recovery rates at two spiking levels (0.1 and 0.5 mg/kg) ranged between 80.5–99.7% with a relative standard deviation <11%. The compound was stable at 20oC for 174 days with a recovery estimate of 109.9%. Although the maximum residue limit was not established by the Ministry of Food and Drug Safety, Republic of Korea, the limit of quantitation was very low at 0.01 mg/kg. The method was successfully applied to field incurred samples and detected residue of 0.02 mg/kg in green tea samples sprayed twice (7-3 days). Abamectin was not transferred to tea infusion.

**Su Jeong Kim, Tae Joung Ha, Jongyun Kim, Dong Chil Chang, Ki Sun Kim. Classification of Korean *Chrysanthemum* Species based on Volatile Compounds Using Cluster Analysis and Principal Component Analysis. J. Korean Soc. Appl. Biol. Chem. 57(6):789-796**

In the analysis of chemotype relationship among Korean *Chrysanthemum* species, the volatile compounds in the leaves of 15 taxa were analyzed and identified by gas chromatograph/mass

spectrometry. Principal component analysis and cluster analysis used for the grouping based on the volatile compounds. Fifteen taxa of *Charysanthemum* species were categorized into three

groups. Groups I and II included higher ketones than Group III. Group I had five *C. zawadskii* subspecies: *acutilobum, acutilobum* var. *tenuisectum, acutilobum var. alpinum, lucidum, and coreanum*. Five *C. zawadskii* subspecies were analyzed with main volatile compounds of D-limonene and *m*-thymol. Group II consisted of four *C. zawadskii* subspecies including *naktongense, yezoense*, latilobum, and *latilobum* var. *leiophyllum*, and one species *C. makinoi*. They consisted of main compounds of linalool, *cis*-chrysanthenol, eugenol, and chrysanthenone. Group III included

five *C. indicum* species and related species: *C. indicum*, var. *albescens*, var. *acuta, C. boreale*, and *C. lineare*. The present study was able to classify volatile compounds of Korean *Chrysanthemum*

species attributable to major compounds, such as hydrocarbons (sabinene, cymene, β-selinene), alcohols (1-octen-3-ol, *cis*-chrysanthenol, hinesol), ketones (chrysanthenone, camphor), and

esters (*cis*-sabiene hydrate, *trans*-chrysanthenyl acetate).

**Bae Jin Kim, Joo-Heon Hong, Yoo Seok Jeong, Hee Kyoung Jung. Evaluation of Two *Bacillus subtilis* Strains Isolated from Korean Fermented Food as Probiotics against Loperamide-induced Constipation in Mice. J. Korean Soc. Appl. Biol. Chem. 57(6):797-806**

Probiotics are live microbes that confer health benefits on the host when administered in adequate amounts. To evaluate the probiotic potential of *Bacillus subtilis* isolated from Korean

fermented foods, we investigated the resistance to biological barriers and improvement of loperamide-induced constipation. The values of resistance to gastric acidity of *B. subtilis* CBD2 and

KMKW4 strains were 55.34±2.12 and 64.58±2.95%, respectively, whereas the survival rate of B. subtilis KMKW4 (31.17±5.78%) in bile acids was superior to that of CBD2 (8.62±2.09%). These

strains also demonstrated adhesiveness to intestinal epithelial HT-29 cells and an inhibitory activity against pathogenic microflora. Furthermore, B. subtilis CBD2 and KMKW4 strains improved

gastrointestinal activity when tested in a loperamide-induced mouse model of constipation. Pre-treatment with CBD2 and KMKW4 strains before the onset of constipation improved fecal output and gastrointestinal transit in loperamide-treated mice. These strains also showed inhibitory effects on the activity of β-glucosidase and tryptophanase, harmful enzymes of intestinal microflora. Taken together, these finding show that *B. subtilis* CBD2 and KMKW4 have high adaptability to gastrointestinal environment, and the ability to inhibit pathogenic microflora and prevent constipation, suggesting their activity as potential probiotics.

**Cho Rong Kim, Jae Kyeom Kim, Eui-Cheol Shin, Soo Jung Choi, Yoon Kyung Kwon, Youn-Jung Kim, Chang-Ju Kim, Gwi Gun Park, Cheung-Seog Park, Dong-Hoon Shin. Application of Response Surface Methodology to Optimize the Extraction of Acetylcholinesterase Inhibitors from *Rhodiola sachalinensis.* J. Korean Soc. Appl. Biol. Chem. 57(6):807-811**

Response surface methodology (RSM) was utilized to optimize extraction conditions for the acetylcholinesterase inhibitor from *Rhodiola sachalinensis*. Optimized values for AChE inhibition

and extraction yield were 19.41 and 13.35%, respectively, and these were in good agreement with the experimental values from validation, suggesting that RSM is a useful tool.

**Zhong-Liu Zhou, Wen-Qing Yin, Xiao-Peng Zou, Dan-Ying Huang, Cui-Liu Zhou, Lian-Mei Li,**

**Ke-Cheng Chen, Zi-Ying Guo, San-Qing Lin. Flavonoid Glycosides and Potential Antivirus Activity of Isolated Compounds from the Leaves of *Eucalyptus citriodora.* J. Korean Soc. Appl. Biol. Chem. 57(6):813-817**

The extraction and solvent partition of the leaves of *Eucalyptus citriodora*, and repeated column chromatography for *n-*BuOH fraction yielded a new flavonoid glycoside, citrioside C (1),

along with three known flavonoid glycosides (2-4). The latter were identified with kaempferol-3-O-β-D-glucopyranosyl (12)-α-L-rhamnoside (2), kaempferol-3-O-α-L-rhamnoside (3), and quercetin-3-O-α-Lrhamnoside (4). Their chemical structures were identified on the basis of spectroscopic data analyses including NMR, MS, UV, and IR. All constitutents were isolated for the first time from the leaves of *Eucalyptus citriodora*. The potential antivirus activity of all the isolated compounds was evaluated. Compound 4 showed potent antiviral activity against respiratory syncytial virus with 50% inhibition concentration (IC50) value of 1.9 μg/mL and selective index value of 9.8.

**You Jin Kang, Jin-Won Kang, Jung-Hwa Choi, Soo Yeon Park, A. T. M. Mijanur Rahman,**

**Seung Won Jung, Seung Ju Lee. A Feasibility Study of Application of Laccase-based Time-Temperature Indicator to Kimchi Quality Control on Fermentation Process. J. Korean Soc. Appl. Biol. Chem. 57(6):819-825**

Kimchi, in factories or during transportation, is usually stacked on shelves at different heights, which affects temperature and thus kimchi quality. In this study, a time-temperature indicator

(TTI) was used to control such quality variations. A case study was conducted to evaluate the validity of using the TTI; one group of small packages of young kimchi had the TTI attached whereas the other group did not. They were stored on shelves of different heights (i.e., top, middle, and bottom) in a laboratory fermentor. The samples with TTIs were individually fermented until the color of the TTIs reached a threshold level, whereas the samples without TTIs were collectively fermented for a predetermined time at a given temperature. The qualities of fermented samples including pH, acidity, microbial counts, and reducing sugars were analyzed. The samples with TTIs had more uniform qualities that were closer to the targets than those without TTIs. These results suggest that TTIs are practical tools to control kimchi quality in

terms of temperature variation.

**Jin-Young Lee. Down-Regulation of MITF, TRP-1, TRP-2, and Tyrosinase Expressions by Compounds Isolated from Pruni persicae Flos in Murine B16F10 Melanoma. J. Korean Soc. Appl. Biol. Chem. 57(6):827-834**

Three single compounds were isolated by the fractionation from Pruni persicae Flos, and its chemical structure was analyzed using 1H-, 13C-nuclear magnetic resonance, fast atom bombardment-Mass, and fourier transform infrared spectrometer analyses. The compounds were determined as quercetin 3-O-rhamnoside, kaempferol 3-O-β-neohesperidoside, and kaempferol 3-O-β-Dglucoside. To prove the whitening effect of these compounds, B16F10 melanoma was treated with quercetin-3-O-rhamnoside, kamferol-3-O-β-neohesperidoside or kaemferol-3-O-β-D-glucoside to confirm cell cytotoxicity using 3-[4,5-dimethylthiazol-2yl]-2,5-diphenyl-tetrazolium-bromide assay. As a result, cell cytotoxicity was examined at more than 20% in 20 μg/mL of compounds isolated from Pruni persicae Flos. Tyrosinase activity and melanin production were examined at 10 μg/mL of each compounds. Results showed quercetin-3-O-rhamnoside, kamferol-3-O-β-neohesperidoside or kaemferol-3-O-β-D-glucoside reduced tyrosinase activity in a dose-dependent manner. Moreover, quercetin-3-Orhamnoside showed reduction of tyrosinase activity by 37.6% at 10 μg/mL of quercetin-3-O-rhamnoside as well as the reduction of melanin contents by 58.8%. In addition, quercetin-3-Orhamnoside, kamferol-3-O-β-neohesperidoside, and kaemferol-3-O-β-D-glucoside reduced tyrosinase, tyrosinase-related proteins 1, and 2, microphthalmia associated transcription factor expressions, which were related to whitening effect, as well as both of mRNA and protein level of cyclic adenosine monophosphate as upstream

signals. More interestingly, quercetin-3-O-rhamnoside strongly reduced both mRNA and protein expressions than other compounds. Therefore, we determined the whitening effect from isolated

compound fractionated from Pruni persicae Flos. Moreover, strong whitening activity of quercetin-3-O-rhamnoside was examined, which suggested the potential application of this compound in

functional cosmetic development.

**Manh Tin Ho, Dongsoo Koh, Moonjae Cho. The Mixture of Glycitin and TDB (3-(2,4,6-trimethoxyphenyl)-2,3-dihydro-1H-benzo[f]chromen-1-one) Could Ameliorate Skin Ageing by**

**Anti-wrinkle and Anti-melanogenesis Effects in Dermal Fibroblasts and Melanocytes. J. Korean Soc. Appl. Biol. Chem. 57(6):835-842**

Ultraviolet (UV) radiation in sunlight can induce skin ageing and photo-carcinogenesis. UV may also induce melanin production and wrinkle formation. Recently, natural secondary compounds have been reported to have protective effects against UV light. In this study, the effects of two different compounds, glycitin and 3-(2,4,6-trimethoxyphenyl)-2,3-dihydro-1H-benzo[f] chromen-1-one (TDB), on human dermal fibroblasts and melanocytes were investigated. At first, only TDB was used on melanocyte cells to test whether it inhibited the proliferation of these cells. Then, a mixture of glycitin and TDB was tested on human dermal fibroblasts for 48 h in order to investigate its effect on proliferation, collagen production, and metalloproteinase family expression. The TDB treatment alone not only inhibited the proliferation of melanocytes but also increased extra cellular matrix production in dermal fibroblasts and cell viability. The mixture of glycitin and TDB markedly increased fibroblast proliferation and helped to maintain fibroblast viability in the face of UV-induced and H2O2-induced damages. This co-treatment also significantly promoted collagen IV expression and accelerated total collagen secretion. In addition, the metalloproteinase (MMPs) family such as MMP1, MMP2, and MMP7 were down-regulated at the transcriptional level. In conclusion, the mixture of glycitin and TDB induced fibroblast proliferation even when these

fibroblasts were damaged by UV exposure and H2O2, whereas augmented collagen production and the inhibition of MMPs reduced wrinkle formation and decreased melanocyte proliferation,

suggesting a potential use in UV-protective therapy.