Efficient Diagnosis of Two Nosocomial Pathogen, *P. aeruginosa* and *A. baumannii* Using Oligonucleotide Microarray

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Nosocomial infections have affected 5% of all patients admitted to hospitals, resulting in 88,000 deaths and accounting for 4.5 billion dollars in health care costs annually. We have developed a diagnostic oligonucleotide microarray for the detection of two important nosocomial pathogens, *Pseudomonas aeruginosa* and *Acinetobacter baumannii*. The microarray contains the DNA probes designed based on the sequences of 23S ribosomal DNA. The microarray was evaluated using reference bacteria as well as various clinical specimens. All other 197 specimens that do not contain *A. baumannii* were negative in microarray, resulting in the sensitivity of 84.6%, the specificity of 100%, and the positive predictive value of 100%. The work was supported by Medigens Co. and Korean Systems Biology Research Program (M10309020000-03BS002-00000) of the Ministry of Science and Technology. Further supports by the LG Chem Chair Professorship, KOSEF through the CUPS, IBM-SUR program and BK21 program are appreciated.

Novel Bacteriophage that Can Reduce Virulence of *Salmonella*

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Bacteria resistant to most or all available antibiotics are causing increasingly serious problems, raising widespread fears of returning to a pre-antibiotic era of untreatable infections and epidemics. Increasing number of *Salmonella* from food animals that can contaminate various foods is becoming resistant to many antibiotics. Bacteriophage possesses attributes that are attractive to those searching for novel ways to control antibiotics-resistant pathogens. In this study, we have searched novel bacteriophages capable of lysing *Salmonella* from various environmental sources. Transmission electron microscopy of several phages isolated showed the phages resembled *Siphoviridae* with a head (20–70 nm in diameter) and a tail (100–300 nm in length) or *Podoviridae* with a head (20–30 nm in diameter) and a tail (45–90 nm in length). One of the phages was linear form with 1.6–3.8 nm in length. Phages were further characterized by host range, genome size, one-step growth curve, DNA restriction endonuclease digestion patterns, temperature, and pH sensitivity. We also found that invasion and intracellular survival of *Salmonella* to animal cells were decreased by lysogenization with some phages, suggesting that the phages can be useful for bacterial biocontrol.

Urea-induced Denaturation of Alpha-synuclein by Surface Plasmon Resonance Measurements

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Urea-driven denaturation and renaturation of surface-bound *α*-synuclein are monitored by surface plasmon resonance (SPR) spectroscopy. The differential SPR angle shift (∆θ) enables us to estimate the Gibbs free energy change (∆G°) for the denaturation of the supported *α*-synuclein. ∆G° for the denaturation of the supported *α*-synuclein, which is indirectly related to its biological activity can be increased significantly by the mixed self-assembled monolayers of 11-mercaptoundecanoic acid and 1,6-hexanedithiol. These SPR measurements of surface-bound biomolecules suggested herein can be further utilized to design effective biological scaffold for biosensor, biocatalyst, and possibly diagnosis.
Xanthophyll Cycle and Low Temperature Adaptation in Antarctic Algae, *C. neogracile*

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Antarctic microalga, *Chaetoceros neogracile* was investigated to dissect the mechanism of survival in the low temperature condition. The growth of *C. neogracile* was compared in different culture conditions. *C. neogracile* was actively growing in 4°C culture condition and the growth rate of *C. neogracile* under continuous light was significantly higher than the growth rate under light-dark culture condition. The pool size of the xanthophyll cycle pigment diadinoxanthin (DD) and diatoxanthin (DT) in *C. neogracile* relied on illumination conditions during culture. On exposure to high-light intensity, extensive de-epoxidation of DD to DT was observed in low temperature condition, which suggested that xanthophyll cycle plays a role in the prevention of photoinhibitory damage to the photosynthetic apparatus. *C. neogracile* which are normally grown in 4°C were put under stress in 10°C to observe the growth rate and the change in each pigments. The results were normalized using chlorophyll a and cell number. Further study will be carried out using segmented temperature ranges and high-light conditions.

Production, Formulation and Application of Aerial Conidia of Entomopathogenic Fungus for Aphid Control

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The virulent pathogenicity of 19 strains of entomopathogenic fungi such as *L. lecanii*, *P. farinosus*, *B. bassiana*, *M. anisopliae*, *C. neogracile* and *N. rileyi* were examined. Among the various fungi, *L. lecanii* showed the most virulent pathogenicity. The *L. lecanii* could grow and the aerial conidia also could germinate at 15-30°C. The production of aerial conidia of *L. lecanii* was examined using various industrial solid media including broken polished rice, polished rice, wheat bran, etc. The production of high amount of aerial conidia was accomplished by using steamed polished rice. The optimal submerison time of rice in water, optimal temperature, optimal pH, optimal ambient relative humidity and optimal draining time of rice for aerial conidia production was 3.5 hrs, 25±1°C, 5.8, 75±5% and 1.5hrs, respectively. Spore yields produced by *L. lecanii* on polished rice was 5.6x10^9 spores/gram of polished rice. Different spore formulations of *L. lecanii* to control aphids were tested in a greenhouse and appropriate formulation to improve efficacies of *L. lecanii* was found. The oil formulation of aerial conidia suppressed nearly 85% aphid after 19 days of application.

Development of Radiation-Resistant Strain of *Moraxella osloensis* and Effect of Penicillin G on Its Growth

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Ionizing radiation is known to initiate a chain of events leading to the impairment of structural or metabolic functions, such as fragmentation of DNA and the eventual death of microbial cells. In this study, a series of repeated exposures to γ-irradiation with intervening outgrowth of survivors was used to develop radioreistant cultures of *Moraxella osloensis*. *D_0* values of the wild type and the radiation-resistant strain were 1.637±0.004 and 5.903±0.006 kGy, respectively. Since most strains of *M. osloensis* are sensitive to penicillin G regardless of concentrations, whereas that of the resistant isolates increased slightly in the presence of 0.5 unit of penicillin G per ml. Interestingly, however, the numbers of viable cells were not different between both strains after the addition of penicillin G. In conclusion, γ-irradiation cannot change the sensitivity of *M. osloensis* to penicillin G.

Screening of Skin-Protective Effect of *Rosa davurica* Pall Extracts Against Ozone

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In modern society with high density of population, exhaust fumes from automobiles give rise to air pollution including nitrogen dioxide and ozone, affecting human health and environment. In particular, ozone induces skin aging as a powerful oxidant which reacts with cellular membrane components such as unsaturated fatty acids, resulting in the production of free radicals including •OH, H_2O_2, O_2-, ROO•, O_2(singlet oxygen). Therefore, the development of powerful natural anti-oxidants has been required to delete ozone-induced reactive oxygen species (ROS) or free radicals and to prevent skin aging. In the present study, the antioxidant effect of *Rosa davurica* Pall containing catechin, a antioxidant was identified by electron paramagnetic resonance (EPR). Moreover, its protective effect against ozone-induced skin damage was investigated, suggesting feasibility as a skin cream. The ethanol extract of *Rosa davurica* efficiently scavenged superoxide and hydroxyl radical. Lipid peroxidation by ozone was 77.4% and 56.2% in the presence of 100 ug and 200 ug of the ethanol extract, respectively, indicating prevention of lipid peroxidation. Furthermore, *Rosa davurica* extract inhibited the oxidation of ascorbic acid and a-tocopherol in skin epidermis by ozone treatment.
Disruption of *Saccharomyces cerevisiae* JUL3: Comparison of Mechanical and Non-mechanical Methods.

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Cell disruption can be grouped into two categories "mechanical" and "non-mechanical" method. Originally yeast cells were normally broken by grinding with Kieselauhr and sand, but different techniques have been developed to obtain both cell envelopes and intracellular materials. The disruption of cells is an important stage in the isolation and preparation for biopharmaceutical technologies. *Saccharomyces cerevisiae* JUL3 producing highly branched β-glucan was developed through UV mutagenesis and laminarinase resistance. The β-glucan from the yeast cell wall shows a variety of biological activities such as the enhancement of immune system. Various methods of cell disruption were compared by the release of proteins, scanning electron microscopy (SEM) and electron micrograph. Several factors were considered in selecting the optimal disruption method of *S. cerevisiae* JUL3. This study was supported by Biogreen 21 (200504010347981870300) through the Rural Development Administration.

Selection of Entomopathogenic Fungus with High Pathogenicity to Aphid at Broad Range of Temperature and Relative Humidity

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To select the entomopathogenic fungus with high pathogenicity to aphid at broad range of temperature and relative humidity (r.h.), the effects of different temperatures and different relative humidities on the pathogenicity of 19 different entomopathogenic fungi were examined. The optimal temperature range and optimal relative humidity range for the growth of *L. lecanii* was 25-30°C and 75-95% of r.h., respectively, and at these conditions the *L. lecanii* was also highly virulent to aphid. Moreover, at 30°C and 45% r. h., *L. lecanii* also showed high mortality of aphid with 1.3 days of LT50 while at 20°C and 45% r. h. *P. farinosus* was highly virulent to aphids with 2.25 days of LT50. Among all entomopathogenic fungi were examined, *L. lecanii* was the best candidate to control aphid with high virulent pathogenicity. At 25°C and 75±5% r.h., the mortality induced by *L. lecanii* was 100% after 5±1 and 3±1 days against *Myzus persicae* and *Aphis gossypii* with 1.8 and 1.4 days of LT50, respectively. The combinations of different entomopathogenic fungi were not likely to improve the suppression of *Myzus persicae* beyond what was expected from each single application of the entomopathogenic fungus.