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城西大学理学部研究報告

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# PART I ANNUAL REPORTS

# 1. Abstracts of Papers Published in Journals

## MATHEMATICS

### Nonregular 2-Simple Prehomogeneous Vector Spaces of Type I and Their relative Invariants

Takeyoshi Kogiso, Go Miyabe*, Miyuki Kobayashi* and Tatsuo Kimura* (* Institute of Mathematics, University of Tsukuba)
*Journal of Algebra* **251** (2002), No.1, 27–69

After the fundamental theorem for nonregular reductive prehomogeneous vector spaces was proved by A. Gyoja, the construction of the theory of nonregular prehomogeneous vector spaces, became as interesting problem. However, only ($Sp_n \times GL_2$, $\Lambda_1 \otimes 2\Lambda_1$, $M(2n, 3)$) is known as an interesting example of nonregular reductive prehomogeneous vector spaces. In this paper, we give some other interesting examples by constructing all relative invariants of nonregular 2-simple prehomogeneous vector spaces of type I.

### Construction of irreducible relative invariant of the prehomogeneous vector space ($\boldsymbol{SL}_5 \times \boldsymbol{GL}_4$, $\boldsymbol{\Lambda}^2(\boldsymbol{C}^5) \otimes \boldsymbol{C}^4$)

Katsutoshi Amano*, Masaki Fujigami* and Takeyoshi Kogiso (* Institute of Mathematics, University of Tsukuba)
*Linear Algebra Appl.* **355** (2002), 215–222

In this paper, we explicitly construct the irreducible relative invariant of the prehomogeneous vector space ($SL_5 \times GL_4$, $\Lambda^2(\boldsymbol{C}^5) \otimes \boldsymbol{C}^4$). This prehomogeneous vector space has been known as the most difficult case in irreducible prehomogeneous vector spaces.

### Relative invariants of some 2-simple prehomogeneous vector spaces

Takeyoshi Kogiso, Go Miyabe*, Miyuki Kobayashi* and Tatsuo Kimura* (* Institute of Mathematics, University of Tsukuba)
*Math. Comp.* **72** (2003), No.242, 865–889

In this paper, we construct explicitly irreducible relative invariants of 2-simple prehomogeneous vector spaces. Together with a preprint by the same authors, this completes the list of all relative invariants of regular 2-simple prehomogeneous vector spaces of type I.

**Spiral Traveling Wave Solutions of Nonlinear Diffusion Equations Related to a Model of Spiral Crystal Growth**

Toshiko Ogiwara and Ken-ichi Nakamura* (* Department of Computer Science, University of Electro-Communications)
*Publ. RIMS,* ***39*** (2003), 767–783

This paper is concerned with nonlinear diffusion equations related to a model of crystal growth by screw dislocation. We prove the existence, uniqueness and asymptotic stability of a rotating and growing solution with a time-independent profile, which we call a spiral traveling wave solution.

**Absolute Continuity of Analytic Measures**

Hiroshi Yamaguchi
*Hokkaido Math. J.* **32** (2003), 551–560

Asmar, Montgomery-Smith and Saeki obtained a new version of Bochner's generalization of the F. and M. Riesz theorem. We give an extension of their result. We also discuss the relation between the space $N(\sigma)$ and absolute continuity of analytic measures.

## CHEMISTRY

**Predissociation of Excited Acetylene in the $\tilde{A}^1A_u$ State around the Adiabatic Dissociation Threshold as Studied by LIF and H-atom Action Spectroscopy**

Nami Yamakita*, Sayoko Iwamoto* and Soji Tsuchiya (* Department of Chemical and Biological Science, Faculty of Science, Japan Women's University)
*J. Phys. Chem.* **A107,** 2597–2605 (2003)

The LIF and H-atom action spectra of the $\tilde{A}$-$\tilde{X}$ transition of acetylene in a supersonic jet were observed in the excitation energy range of 47000～50600 $cm^{-1}$, where 60 vibrational states were identified in the $\tilde{A}$ state through rotational analyses of respective bands. Most of these states are originated from anharmonic couplings of the Frank-Condon allowed $2^m3^n$ states with the $4^i6^j$ states where $i+j$ =even. This fact is consistent with the determined rotational constants of respective states, whose values are mostly between those of the $2^m3^n$ ($m \leq 1$, $n \leq 4$) and the $4^1$ or $6^1$ state. The line intensities of the H-atom action spectra increase in the higher excitation energies indicating more efficient preissociation. The lifetimes of respective excited states were evaluated from the observed spectral line widths. In a higher excitation energy region, the lifetime is shortened from 100 ps at 47000 $cm^{-1}$ to 25 ps at 50600 $cm^{-1}$ which exceeds the adiabatic dissociation threshold of the $\tilde{A}$

state by 933 $cm^{-1}$ and is the wavelength limit (197 nm) of the third harmonics of the dye laser. To excite acetylene in the higher excitation energies, vibrationally excited acetylene which was prepared by irradiation with an IR laser was excited further by the UV laser. Utilizing this IR-UV double resonance method, acetylene could be excited up to 53500 $cm^{-1}$ which corresponds to 187 nm. Beyond 50600 $cm^{-1}$, the lifetime of excited acetylene becomes longer to be around 100 ps at 51100 $cm^{-1}$. This sudden increase of the lifetime is interpreted as that the predissociation mechanism changes from the triplet state-mediated dissociation to the direct dissociation on the $\tilde{A}$ state surface. This fact is also supported by the observed average kinetic energies of H atoms estimated from the Doppler line widths of the REMPI spectral line of H atoms; below 50600 $cm^{-1}$ the kinetic energy is in proportion with the excitation energy, while beyond 50600 $cm^{-1}$ the observed average kinetic energies are around 1000～2000 $cm^{-1}$ which are a little smaller than the excess energy for production of $C_2H(\tilde{A})+H$. It was found that the predissociation mechanism or efficiency is not dependent on the vibrational parity, *gerade* or *ungerade*, of the initial excited state. This is attributed to the anharmonic coupling between the $\nu_3'$ and $\nu_4'/\nu_6'$ vibrational modes.

**New Vibrational Assignments in the $\tilde{A}^1A_u$-$\tilde{X}^1\Sigma_g^+$ Electronic Transition of Acetylene, $C_2H_2$: the $\nu_1'$ Frequency**

A. J. Merer*1, N. Yamakita*2, S. Tsuchiya, J. F. Stanton*3, Z. Duan*4 and R. W. Field*4 (*1 Department of Chemistry, University of British Columbia, *2 Department of Chemical and Biological Sciences, Japan Women's University, *3 Department of Chemistry and Biochemistry, University of Texas at Austin, *4 Department of Chemistry, Massachusetts Institute of Technology)
*Mol. Phys.* **101,** 663–673 (2003)

New laser-induced fluorescence spectra of supersonic jet cooled acetylene ($C_2H_2$) in the wavelength region 230-205 nm have led to an improved understanding of the vibrational structure of the $\tilde{A}^1A_u$ state. Among the new bands observed are two weak perturbed bands at 46008 $cm^{-1}$ and 46116 $cm^{-1}$. Rotational analyses of these bands, together with the corresponding 'hot' bands arising from the ground state $\nu_4$ fundamental, have shown that the upper states have asymmetric top K structure that is unaffected by *a* axis Coriolis coupling; this means that they do not involve overtones of the low frequency bending vibrations and therefore must be combinations of $a_g$ vibrational normal modes. From their positions in the manifold, their vibrational assignments can only be $2_0^2 3_0^1$ and $1_0^1 3_0^1$. These assignments lead to values of $x_{22}'$, $x_{13}'$, and a revised value for the asymmetric CH stretching frequency, but consistent with new *ab initio* calculations that we performed at the EOM-CCSD level using a TZ2P (triple-zeta plus double polarization) basis set.

**Photocatalytic Decomposition of the Sodium Dodecylbenzene Sulfonate Surfactant in Aqueous Titania Suspensions Exposed to Highly Concentrated Solar Radiation and Effects of Additives**

Tianyong Zhang*1, Toshiyuki Oyama*1,4, Satoshi Horikoshi*1, Jincai Zhao*2, Nick Serpone*3, and Hisao Hidaka*1 (*1 Frontier Research Center for the Global Environmental Protection, Meisei University, *2 Institute of Chemistry, Chinese Academy of Sciences, *3 Department of Chemistry and Biochemistry, Concordia University, *4 Lecturer)
*Appl. Catal. B: Environ.,* **42**, 13–24 (2003)

The sodium dodecylbenzene sulfonate (DBS) surfactant photodegrades in aqueous $TiO_2$ dispersions under highly concentrated solar light exposure (ca. 70 suns) via apparent first-order kinetics with accumulated light energy as the experimental variable. The choice of optimal experimental parameters for the photodegradation of DBS with a concentrated solar illumination device is explored: optimal circulation flow rate, 8.3 L $min^{-1}$; pH, 5.0; and $TiO_2$ loading, 5 g $L^{-1}$. Foaming action of the DBS-$TiO_2$ suspension increased with increased increments of the flow rate. The foam produced at the higher $TiO_2$ loadings exhibited greater stability than in the absence of $TiO_2$. The increase in surface tension is faster than the temporal decrease of the concentration of DBS, which followed the typical Langmuir-Hinshelwood (LH) model: LH apparent rate constant, $k_{LH} = 0.184$ mM $kJ^{-1}$; LH adsorption constant, $K_{LH} = 0.527$ $mM^{-1}$. The relative photonic efficiency ($\xi_{rel}$ ; against phenol; $k_{app}$) of DBS is 0.53. The rate of removal of total organic carbon (TOC) of DBS was improved by a combination of $TiO_2$ loading and added $K_2S_2O_8$ additive; that is, at pH 5.0 and $TiO_2$ loading of 0.2 g $L^{-1}$, or pH 8.4 and $TiO_2$ loading of 5.0 g $L^{-1}$. However, at pH 5.0 and $TiO_2$ loading 5.0 g $L^{-1}$, the rate of TOC removal was not enhanced in the presence of $K_2S_2O_8$ as the oxidizing agent and electron scavenger. The results are explained by contributions from the photochemical oxidation with $K_2S_2O_8$ and from the $K_2S_2O_8$-assisted photocatalytic oxidation of DBS.

**Molecular Structure and Absolute Configuration of 1-Benzyl-(+)-2-methylazetidine Hydrobromide**

Kimiko Kobayashi*1, Masashi Sassa*1, Keiji Yajima*1, Sei Tsuboyama*2, Kouichiro Enomoto, and Hiroshi Miyamae (*1 The Institute of Physical and Chemical Research, *2 Lecturer)
*Analytical Sciences,* **19**, 53–54 (2003)

3-Bromo-1-bezylaminobutane hydrobromide have been given by a thermal rearrangement reaction of (*R*)-1-bromo-2-bezylaminobutane hydrobromide. The process was confirmed by formation of a four-membered cyclic amine, the azetidine. After optical resolution of the racemic azetidine, the compound was analyzed by its hydrobromide being the absolute configuration as *S*. The azetidine ring is bent to have a dihedral angle of 153° at the diagonal through non-N atoms.

**Nucleotide Sequences of Pigeon Feather Keratin Genes**

Rieko Takahashi, Kiso Akahane and Kunio Arai
*DNA Sequence,* **14**, 205–210 (2003)

We conducted cloning of the keratin gene from the pigeon genomic library to solve the microheterogeneity in the amino acid sequence of the feather keratin, and analyzed two pigeon feather keratin clones. Each of the clones contained three feather keratin genes that had the same general structure: a 5′ non-coding region separated by an intron, a protein-coding region encoding a protein of 100 amino acids, and and a 3′ non-coding regin. Length and transcriptional organization of the genes were variable. The length variation, about 1.2-3.7 kb, was mainly due to the difference in the length of the 3′ non-coding region, and the longer genes had opposite transcriptional organization in contrast to the shorter genes. The nucleotide sequences of the coding region were very similar among the six genes but not the same.

**Effect of Endodontic Agents on Cytotoxicity Induction by Sodium Fluoride**

T. Kunaga*[1,3], S. Reza MD. M.*[2], S. Otsuki*[1] F. Takayama*[1], K. Hashimoto*[1], M. Kashimata*[3], Y. Nakamura*[4], H. Shikawa*[4], T. Yasui*[5], Y. Yokote, K. Akahane and H. Sakagami*[1] (*1 Department of Dental Pharmacology, *2 Meikai Pharmaco-Medical Laboratory (MPL), Meikai University School of Dentistry, *3 Oral Health and Preventive Dentistry and *4 Orthodontics and *5 Department of Dental Pharmacology, Asahi University School of Dentistry)
*In vivo* **17**, 583–592 (2003)

We investigated six endodontic agents for their ability to induce apoptosis, and modify the cytotoxic activity of NaF against human squamous sell carcinoma (HSC-2) and human promyelocytic leukemia (HL-60) cell lines. Four Group I agents (Form Cresol, Cam Phenic, Eucaly Soft, GC Fuji Varnish), but not two Group II agents (Caviton, Canals-N), induced internucleosomal DNA fragmentation and activated caspases 3, 8 and 9 in HL-60 cells. Only Cam Phenic among these agents additively enhanced the cytotoxic activity of NaF in HSC-2 and HL-60 cells. Form Cresol and Cam Phenic reduced the glucose consumption at early stage, possibly due to their toxic effect.

Amino acid analysis suggests that higher cytotoxicity of Form Cresol may be derived at least in part from its oxidizing action.

**Effect of Antioxidants, Oxidants, Metals and Saliva on Cytotoxicity Induction by Sodium Fluoride**

T. Kunaga*[1,3], S. Reza MD. M.*[2], S. Otsuki*[1] F. Takayama*[1], K. Hashimoto*[1], M. Kashimata*[3], Y. Nakamura*[4], H. Shikawa*[4], T. Yasui*[5], Y. Yokote, K. Akahane and H. Sakagami*[1] (*1

Department of Dental Pharmacology, *2 Meikai Pharmaco-Medical Laboratory (MPL), Meikai University School of Dentistry, *3 Oral Health and Preventive Dentistry and *4 Orthodontics and *5 Department of Dental Pharmacology, Asahi University School of Dentistry)
*Anticancer Res.,* **23,** 3719–3726 (2003)

We have recently found that millimolar concentrations of sodium fluoride (NaF) induced apoptotic cell death, characterized by caspase activation and DNA fragmentation, in tumor cell lines. This finding paved the way to investigate the interaction between NaF and oral environment. As an initial step, we investigated redox compounds, metals and saliva, which may modify the cytotoxic activity of NaF against human oral squamous cell carcinoma cell line (HSC-2). Minimum exposure time to NaF required for cytotoxicity induction was 8 hours. Noncytotoxic concentrations of antioxidants (sodium ascorbate, gallic acid, epigallocatechin gallate, chlorogenic acid, curcumin, superoxide dismutase, catalase), oxidants (hydrogen peroxide, sodium hypochlorite), metals (CuCl, $CuCl_2$, $FeCl_2$, $FeCl_3$, $CoCl_2$) or saliva neither rescued from, nor enhanced the cytotoxic activity of NaF. Cytotoxic concentrations of these compounds produced somewhat additive, but not synergistic effect on cytotoxicity of NaF. ESR analysis demonstrated that NaF did not apparently change the radical intensity of sodium ascorbate and gallic acid, measured under alkaline conditions. During the cell death induction in human promyelocytic leukemia HL-60 cells by NaF, the consumption of glucose rapidly declined, followed by the decline of the consumption of major amino acids. The present study suggests that cytotoxic activity of NaF is not regulated by redox mechanism, but rather linked to the rapid decline of glucose consumption at early stage.

**Molecular Cloning, Sequencing and Alternative Splicing of the Acid Phosphatase (*Acph*) Gene from *Drosophila virilis***

Hiroko T. Kitagawa
*DNA Sequence,* **14**, 135–139 (2003)

The *Acph* gene of *D. virilis* was isolated from a genomic library and sequenced. The gene was organized into 6 exons interrupted by 5 introns. This organization was partly different from that of the genes from other *Drosophila*. 5' and 3' RACE analyses identified 3 transcripts on account of alternative splicing. One of them coded for 435 amino acid residues; and the others, for 403 amino acids. The shorter ones lacked 34 residues at the C-terminus end encoded by exon 6, which has been implicated in anchoring the protein to the lysosomal membrane.

**Synthesis and Crystal Structure of Tristropocryptands**

Kimio Shindo, Hidetsugu Wakabayashi, Teruo Kurihara, Luo-Chenz Zhang, Keisuke

Ebata*1, Hideki Sakurai*1, and (the late) Tetsuo Nozoe*2 (*1 Department of Chemistry, Faculty of Science, Tohoku University, *2 Tokyo Research Laboratories, Kao Corporation)
*J. Chin. Chem. Soc.,* **50**, No.1, 47–50 (2003)

Treatment of benzo [*b*] cyclohepta [*e*] [1, 4]oxazines with 1.2 equiv. of tris(2-aminoethyl)amine in methanol at 80℃ gave 1,4,12,15,18,26,31,39-octaazapentacyclo[13.13.13.$0^{5,11}$.$0^{19,25}$.$0^{32,3}$]-pentetraconta-4,6,8,10,18,20,22,24,31,33,35,37-dodecacenes (1), armed tropocoronands, and tropopodands in a one-pot procedure. The structure of tristropocryptand 1 was determined by the X-ray crystallographic analysis.

**Cytotoxic and Multidrug Resistance Reversal Activity of a Vegetable, 'Anastasia Red', a Variety of Sweet Pepper**

Noboru Motohashi*1, Hidetsugu Wakabayashi, Teruo Kurihara, Yuko Takada, Shichiro Maruyama*2, Hiroshi Sakagami*2, Hideki Nakashima*3, Satoru Tani*4, Yoshiaki Shirataki*4, Masami Kawase*4, Kristina Wolfard*5, and Joseph Molnar*5 (*1 Meiji Pharmaceutical University, *2 Department of Endodontics, Meikai University School of Dentistry, *3 Department of Microbiology, St. Marianna University, *4 Faculty of Pharmaceutical Sciences, Josai University, *5 Institute of Microbiology, Albert Szent-Gyorgyi Medical University)
*Phytotherapy Res.,* **17**, 348–352 (2003)

The vegetable, Anastasia Red, Capsicum annuum L. var. angulosum Mill. (Solanaceae) was successively extracted with hexane, acetone, methanol and 70% methanol, and the extracts were further separated into a total of 21 fractions by silica gel or ODS column chromatography. The biological activities of extracts and fractions were determined. These extracts showed relatively higher cytotoxic activity against two human oral tumor cell lines than against normal human gingival fibroblasts, suggesting a tumor-specific cytotoxic activity. The cytotoxic activity of these extracts was enhanced by fractionation on silica gel [H2, A2, M1–M3] or ODS column chromatography [70M]. Several fractions [H2, H4, H5, A1, A2, A3, A5, A6, A7, M2] reversed the multidrug resistance phenotype with L5178 mouse lymphoma T cells, more efficiently than (±)-verapamil. The extracts and fractions did not show any detectable anti-human immunodeficiency virus or anti-Helicobacter pylori activity. Thus, this study suggests the effective and selective antitumor potential of 'Anastasia Red' of sweet pepper for further phytochemical and biological investigation.

**Inhibition of LPS-stimulated NO Production in Mouse Macrophage-like Cells by Barbados Cherry, a Fruit of Malpighia emarginate DC.**

Hidetsugu Wakabayashi, Hidetaka Fukushima, Tomoko Yamada, Masami Kawase*1, Yoshiaki Shirataki*1, Kazue Satoh*2,3, Takashi Tobe*2, Ken Hashimoto*3, Teruo Kurihara, Noboru Motohashi*4, and Hiroshi Sakagami*3 (*1 Faculty of Pharmaceutical Sciences, Josai

University, *2 Analysis Center, School of Pharmaceutical Sciences, Showa University, *3 Department of Endodontics, Meikai University School of Dentistry, *4 Meiji Pharmaceutical University)
*Anticancer Res.*, **23**, 3237–3241 (2003)

The extract of Barbados cherry (acerola fruit), a fruit of Malpighia emarginata DC., has been reported to display diverse biological activities such as prevention of age-related diseases. We investigated here the possible effect of Acerola fruit extract on nitric oxide (NO) production by activated macrophages. Acerola fruit was roughly separated into 4 or 5 fractions by two different methods, using various organic solvents such as hexane, acetone, methanol (70% and 100%) and water, and assayed for it ability to inhibit NO production by lipopolysaccharide-stimulated mouse macrophage-like cells Raw 264.7 cells. Among these fractions, ethylacetate extracts (AE0) in Method I and acetone extract (A0) in Method II showed the highest inhibitory activity of NO production (SI $>$ 20 and SI $=$ 31, respectively). When these fractions were subjected to silica gel column chromatography, higher inhibitory activity for NO production was concentrated in ethylacetate (AE6) (SI $=$ 64) and benzene-ethylacetate (1:4)(A10) fractions (SI $>$ 59). Western blot analysis demonstrated that AE6 and A10 fractions reduced the intracellular concentration of inducible NO synthase (iNOS) by approximately one-third. ESR spectroscopy showed that these fractions scavenged various radical species such as superoxide anion ($O_2^-$) and NO radicals. These data suggest that inhibitory effect on NO production by Barbados cherry extracts is partly due to the inhibition of iNOS expression, and scavenging $O_2^-$ and NO radicals.

**Cytotoxic Activity of Azulenes Against Human Oral Tumor Cell Lines**

Hidetsugu Wakabayashi, Kana Hashiba, Keiko Yokoyama, Ken Hashimoto*1, Hirotaka Kikuchi*2, Hirofumi Nishikawa*2, Teruo Kurihara, Kazue Satoh*3, Seiji Shioda*3, Susumu Saito*4, Shuichi Kusano*4, Hideki Nakashima*4, Noboru Motohashi*5, and Hiroshi Sakagami*1 (*1 Department of Dental Pharmacology, Meikai University School of Dentistry, *2 Department of Endodontics, Meikai University School of Dentistry, *3 Department of Anatomy, Showa University School of Medicine, *4 Department of Microbiology, St. Marianna University, *5 Meiji Pharmaceutical University)
*Anticancer Res.*, **23**, 4747–4756 (2003)

We investigated 27 azulene derivatives for their relative cytotoxicity against three human normal cells and three human oral tumor cell lines. 2–Acetylaminoazulene, diethyl 2–chloroazulene–1,3–dicarboxylate and methyl 7–isopropyl–2–methoxyazulene–1–carboxylate showed higher tumor specific cytotoxicity than azulene and guaiazulene. Four 1– and 3–halogenated compounds showed lower tumor specificity. The tumor specific cytotoxic activity seems not to be related to the position of functional groups. All compounds showed no anti-HIV activity. Methyl 7–isopropyl–2–methoxyazulene–1–carboxylate induced apoptotic

cell death (characterized by internucleosomal DNA fragmentation and caspase 3 activation) in HL-60 cells. ESR spectroscopy showed that methyl 7-isopropyl-2-methoxyazulene-1-carboxylate did not produce radical and less efficiently scavenged superoxide anion ($O_2^-$) (generated by HX-XOD reaction) and NO (generated from NOC-7). These data suggest that radical-mediated oxidation mechanism may not be involved in the apoptosis induction by methyl 7-isopropyl-2-methoxyazulene-1-carboxylate.

**Cytotoxic Activity of Tropolones Against Human Oral Tumor Cell Lines**

Hidetsugu Wakabayashi, Keiko Yokoyama, Kana Hashiba, Ken Hashimoto*1, Hirotaka Kikuchi*2, Hirofumi Nishikawa*2, Teruo Kurihara, Kazue Satoh*3, Seiji Shioda*3, Susumu Saito*4, Shuichi Kusano*4, Hideki Nakashima*4, Noboru Motohashi*5, and Hiroshi Sakagami*1 (*1 Department of Dental Pharmacology, Meikai University School of Dentistry, *2 Department of Endodontics, Meikai University School of Dentistry, *3 Department of Anatomy, Showa University School of Medicine, *4 Department of Microbiology, St. Marianna University, *5 Meiji Pharmaceutical University)
*Anticancer Res.*, **23**, 4757-4764 (2003)

27 tropolone derivatives were investigated for their tumor-specific cytotoxicity, using 3 normal human cells and 3 human oral tumor cell lines. Tropolone derivatives with phenolic OH group, hinokithiol, its tosylate and methyl ethers have relatively higher tumor specificity. 5-Aminotropolone showed the highest specificity, whereas 2-aminotropone and its derivatives showed little or no specificity. 5-Aminotropolone induced apoptotic cell death characterized by internucleosomal DNA fragmentation and caspase 3 activation in human promyelocytic leukemic HL-60 cell line. ESR spectroscopy showed that 5-aminotropolone produced radical under alkaline condition, and efficiently scavenged superoxide anion ($O_2^-$) and NO produced by HX-XOD reaction and NOC-7, respectively. These data suggest that 5-aminotropolone may induce cytotoxicity by radical-mediated redox reaction.

**Biological Activity of Persilnlnon (Diospyros kaki) Peel Extracts**

Masami Kawase*1, Noboru Motohashi*2, Kazue Satoh*3, Hiroshi Sakagami*4, Hideki Nakashima*5, Satoru Tani*1, Yoshiaki Shirataki*1, Teruo Kurihara, Gabriella Spengler*6, Krisztina Wolfard*6, and Joseph Molnar*6 (*1 Faculty of Pharmaceutical Sciences, Josai University, *2 Meiji Pharmaceutical University, *3 Department of Anatomy, Showa University School of Medicine, *4 Department of Endodontics, Meikai University School of Dentistry, *5 Department of Microbiology, St. Marianna University, *6 Institute of Microbiology, Albert Szent-Gyorgyi Medical University)
*Phytotherapy Res.*, **17**, 495-500 (2003)

Fractionated extracts of persimmon (Diospyros kaki) peels were studied for cytotoxic

activity, multidrug resistance reversal activity, anti-human immunodeficiency virus activity and anti-Helicobacter pylori activity. The potent cytotoxic activity against human oral squamous cell carcinoma cells (HSC-2) and human submandibular gland tumor (HSG) cells was found in the acetone fractions (A4 and A5) with $IC_{50}$ ranging from 21 to 59 $\mu$g/mL. However, the cytotoxic activity was not correlated with the radical intensity of the fractions. Three 70% MeOH extract fractions (70M2-4) produced radical and efficiently scavenged the $O_2^-$ produced by hypoxanthine and xanthine oxidase reaction. All of the fractions tested were not effective for anti-H. pylori and anti-HIV. Fractions H3 and H4 of hexane extract, and M2 and M3 of MeOH extract showed a remarkable MDR reversal activity comparable with that of (±)-verapamil (a positive control). These results indicate the therapeutic value of persimmon peel extracts as potential antitumor and MDR-reversing agents.

## BIOLOGY

### Gynandromorph in melanotic tumourous strain of *Drosophila melanogaster*

Kazuhiko Kosuda
*DIS,* **85**, 3-5 (2002)

The unique type of melanotic tumor was previously reported in the C-104 strain of *Drosophila melanogaster*, which derived from a natural population in Budapest, Hungary (Kosuda, 1990; 1992; 1996). The tumors develop at the adult stage, although most other melanotic tumors develop at the larval stages. The tumors develop exclusively in the vicinity of spermatheca and subsequently encapsulate them. That is, their expression is sex-limited and also organ-specific. Melanotic tumor formation is considered to be an aggregation of blood cells accompanied by melanization. Lots of gynandromorphs were found in this stain. The existence of gynandromorphs in the melanotic tumorous strain strongly suggests that hemocytes of male part aggregate and encapsulate spermatheca of female part, having recognized that spermatheca are foreign intruders to males.

## EARTH SCIENCE

### 石油の探鉱技術—特に衛星画像解析，地震探査および物理検層について—

齊藤　隆[*1,2]，山口　均[*1] (*1 Japan Oil Development Co., Ltd., *2 Lecturer)
検査技術，**7**，**5**，27-34 (2002)

石油探鉱は技術集約型の産業であり，関連技術も多岐にわたる。石油鉱床は地下 3,500 m 前後にあるものが多いが，現代のあらゆる技術を駆使しても，わずか数千 m の地下の状況を把握す

ることは極めて困難である。ここに未探鉱地域における試掘成功率の低さの原因がある。本論では，成功率を向上させるための技術のうち，人工衛星画像解析技術，地震探査技術および物理検層技術について紹介した。

# PHYSICAL EDUCATION

## A Study of Line-up Analysis by using AHP on International Women's Volleyball Matches—Analysis of '02 World Grand Prix—

Daisen Shimazu[*1], Kyoichi Izumikawa[*2], Sotonori Yamamoto[*3], Masakazu Akashi, Mitsuru Sakai[*4], Takehiko Tahara[*5], Satoshi Harada[*6] (*1 Japan Women's University, Department of Physical Education, *2 Kanagawa Institute of Technology, Department of Physical Education, *3 Kyorin University, Department of Physical Education, *4 Kyushu Women's Junior College, Department of Physical Education, *5 Nara University, Department of Physical Education, *6 Rishou University, Department of Physical Education)
*J. Phys. Ex. Sports Sci.,* **9**, 33–44 (2003)

The line-up analysis by AHP (Analytic Hierarchy Process) was applied to the international women's volleyball matches of the World Grand Prix in 2002. The analysis of the matches by the AHP was comparatively studied against that of the score checking method. The result revealed a very close correlation between the two methods in terms of the total index and the total ranking of each line-up. A very close correlation was also found between the total index and the winning ratio by the AHP. However, in the ranking of the total index of the individual teams, the result by the AHP and the one by the score checking method were not consistent with each other in both the high ranking groups and the low ranking groups.

# 2. Books, Reviews and Other Printings

## MATHEMATICS

**The *b*-function and the holonomy diagram of a regular simple prehomogeneous vector space ($GL_1 \times Spin_{10}$, (*half−spin rep.*)+(*vector rep.*))**

S. Kasai; *Journal of Algebra* 235 (2001), No.1, 1–14 by T. Kogiso in *Mathematical Reviews of American Math. Soc.* (2002)

**The *b*-functions of a regular simple prehomogeneous vector space ($GL_1 \times SL_{2m}$, $\Lambda_2$+($\Lambda_1+\Lambda_1$)$^{(*)}$)**

S. Kasai; *Japan J. Math.* 26 (2002), No.2, 355–379 by T. Kogiso in *Mathematical Reviews of American Math. Soc.* (2002)

**When is the Fourier transform of an elementary function elementary?**

Etingof, Pavel; Kazhdan, David; Polishchuk, Alexander; *Selecta Math.* (N.S.) 8 (2002), No.1, 27–66 by T. Kogiso in *Math. Sci. net of American Math. Soc.* (2003) (On line)

**Fourier transform over finite field and identities between Gauss sum**

Kazhdan, D.; Polishchuk, A. *Selecta Math.* (N.S.) 9 (2003), No.1, 63–100 by T. Kogiso in *Math. Sci. net of American Math. Soc.* (2003) (On line)

## CHEMISTRY

**はじめての化学反応論**

土屋荘次
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# PHYSICAL EDUCATION

**大学男子バレーボール選手における栄養素等摂取状況が筋力に与える影響**

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## MATHEMATICS

**Product of Involutions**

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**Nilpotent Endmorphisms and Semiinvolutions**

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**Spirals for a Model of Crystal Growth**

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**Asymptotic Behavior of Solutions to a Quasi-linear Parabolic Equation**

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**結晶成長モデルに現れるスパイラル**

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**結晶成長モデルに関係した曲線の発展方程式に現れるスパイラルの形状について**

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**Squeezing in Controlled *L*-theory**

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**Optimal Parameter Fit for Born-Oppenheimer Breakdown of CaH in $X^2\Sigma^+$ State**

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### 太陽光集光照射装置を用いた市販洗剤の光触媒分解

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**マイクロフリーフロー電気泳動モジュール　分取インターフェイス（mFFE-MFS）の性能**

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**関東山地四万十帯ホルンフェルスの鉱物・化学組成の特徴**

加賀美英雄，谷口英嗣*（*駒澤大学高等学校）
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## PHYSICAL EDUCATION

### 呼吸筋の持久力トレーニングが走パフォーマンスに与える影響

山本正彦[*1]，木村瑞生[*1]，古泉一久[*2]，前河洋一[*3]（*1 東京工芸大学，*2 非常勤講師，*3 国際武道大学）
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### 女子ランナーの月経状態と身体的コンディションの変化

中尾喜久子[*1]，鈴木尚人，相澤勝治[*2]，目崎　登[*3]（*1 非常勤講師，*2 筑波大学大学院体育科学研究科，*3 筑波大学体育科学系）
第 58 回日本体力医学会大会（静岡），2003 年 9 月

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島津大宣[*1]，泉川喬一[*2]，明石正和，坂井　充[*3]，田原武彦[*4]，原田　智[*5]（*1 日本女子大学，*2 神奈川工科大学，*3 九州女子大学，*4 奈良大学，*5 立正大学）
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青木義広[*1]，橋本吉登[*2]，山下俊紀[*3]，布村忠弘[*4]，明石正和（*1 防衛医学大学校，*2 横浜スポーツ医科学センター，*3 足柄上病院，*4 富山大学）
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