

Visualization and Digital Imaging Lab

An Interdisciplinary Faculty Research Facility

Report

1999 through Spring 2003

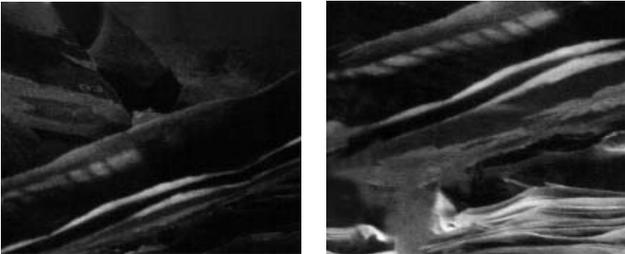


John Goodge (Geology) *Antarctic Ice Cave*

"Pursuing Excellence in Scientific Visualization and Artistic Imaging"

MissionStatement

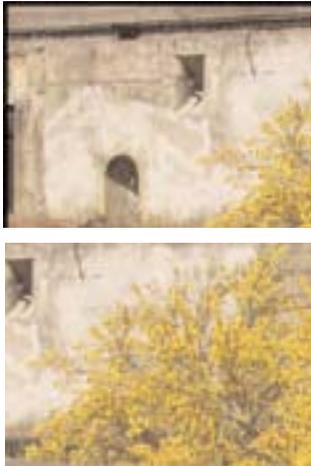
The Visualization and Digital Imaging Laboratory was conceived in 1999 through the vision of UMD Chancellor Kathryn Martin as a limited access facility, open to faculty members and their research associates and students whose primary interest is in high-end visualization projects. The laboratory is a collaborative facility of the School of Fine Arts and College of Science and Engineering. It provides a dynamic multi-media environment for design and scientific researchers to conduct original research in the areas of animation, visual imaging, and scientific visualization. The laboratory integrates design research in the areas of computer graphics, two-dimensional imaging, three dimensional imaging, virtual reality applications and sound/image control.



Gloria DeFilipps Brush (Art & Design) *Untitled*

Message from the Executive Committee

Since its inception in 1999, the Visualization and Digital Imaging Laboratory has developed into an extremely valuable resource for the faculty at UMD. It has become a place where artists, scientists, educators, and engineers can meet and collaborate, producing multimedia-based output for publication in scientific literature, display at a symposium or museum, or stage performances. Faculty get access to this state-of-the-art facility through application to the lab's Executive Committee, which is composed of the Dean of the College of Science and Engineering, the Dean of the School of Fine Arts, and the Director of Information Technology Systems and Services. The Executive Committee is always seeking ways to make the laboratory more useful for UMD students and faculty, encouraging input from all university stakeholders in digital imaging and advanced computation. A faculty advisory group composed of faculty from a wide variety of disciplines also meets regularly to review the status of hardware and software in this technologically-charged research environment.



Suzanne Szucs (Art & Design)
Fort Wordon

SummerGrants

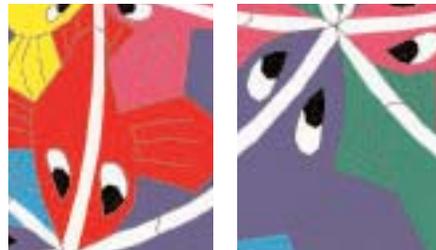
The purpose of this program is to encourage use of the Visualization and Digital Imaging Lab by research groups and individuals. Grants are intended to encourage researchers to learn how to use the hardware and software tools available in the Visualization and Digital Imaging Lab to enhance a specific research project. Participants are encouraged to share knowledge and skills with other users of the Visualization and Digital Imaging Lab. Up to 10 grants of \$2,000 per research project have been awarded each year since 2001. A grant can go to an individual principal investigator, to an individual graduate student working on the research project with a principal investigator, or can be split among members of a research team.

This program has been particularly successful in introducing new researchers to the lab and its capabilities. A significant number of publications and exhibits have resulted from the intensive summer work. (See *Exhibitions and Publications sections*)

Awards&Recognition

Prof. Douglas Dunham (Computer Science), together with **Prof. Joseph Gallian (Mathematics)** and **Abhijit Parsekar (Visualization and Digital Imaging Lab Research Assistant, Computer Science)** designed the math awareness month national poster for 2003 at the Visualization and Digital Imaging Lab. Over 14,000 copies of the poster were distributed nationwide.

"Blur," an experimental theatre piece with video backgrounds produced in the Visualization and Digital Imaging Lab by theatre director and researcher **William Payne (Theatre)**, was selected to perform at the ACTF Region V Festival in Cedar Falls, Iowa in January 2003.



Douglas Dunham (Computer Science)
Math Awareness

ResearchProjects

Currently there are over 80 active researchers in the lab, with 53 current projects (some researchers are collaborating on projects). The following is a sampling of some of the Visualization and Digital Imaging Lab projects, past and present.

Genetic Factors Controlling Mammalian Hibernation: Matthew T. Andrews, (Bio-Chemistry and Molecular Biology) This project encompasses the sequencing and characterization of active and hibernating *Spermophilus tridecemlineatus* heart cDNA libraries. The identification of the genes present in these cDNA libraries will characterize the genes that were being expressed during the active and hibernating states and will provide species-specific gene sequences in an organism that lacks a sequenced genome. The resources located in the Visualization and Digital Imaging Lab have been utilized to cut contaminant bases out of the raw data obtained from the original sequence reads. The automation of this task via the Lasergene software suite provides an efficient means in completing this otherwise time-consuming procedure, significantly propelling the timely completion of the project. A local BLAST alignment program has also been developed to align known gene sequences uploaded onto the GenBank database with the sequences generated from our cDNA libraries. This program indicates the level of homology these transcripts contain with sequenced genes from *Spermophilus* or other species, including those of humans. The program allows gene transcript identification to occur in at least 1/8 the time required to align sequences manually via website, and is completely automated, allowing for a much more efficient use of research time and resources.

Nun'dro: Cycles 1 (Refuge): Sarah Bauer (Art and Design) The project nun'dro: cycles 1 (Refuge) is based on a Tibetan Buddhist practice of Ngondro called refuge. 10,000 ritual actions were documented on digital video and audio to complete the first phase of the project. Exhibition components: 36' long floor-to-ceiling, site-specific wall mural with 1,254 selected representations of the 10,000 completed prostrations; a set of five framed pages from a handmade book; a digital video/audio projection.

Detection of small objects from high-resolution satellite images: Rocio Alba-Flores (Electronic and Computer Engineering) For many years satellite imagery has been used to predict regional and local weather conditions. With the advance of satellite technology and sensors, the resolution of this type of imagery has been improved, and satellite images are being used in other areas such as the study of deforestation and urban growth. In particular this project uses high-resolution images from the IKONOS sensor, which provides panchromatic data with 4 and 1 m ground sampling distance, close to the resolution of aerial imagery. Research towards the detection of man-made objects, (houses, streets, vehicles) has been typically based on aerial imagery and has been widely studied in the computer vision community for several years. The goal of this project is the development of an effective technique for the detection of small objects from high-resolution panchromatic satellite imagery. The main features of these objects will be their individual shape characteristics.



Rocio Alba-Flores (Electrical and Computer Engineering)
Highway satellite image

Projects continued

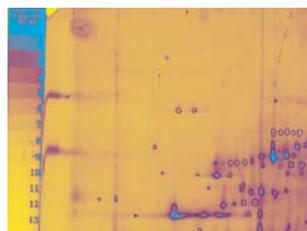
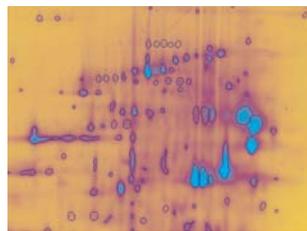
The basic technique for the extraction of these shapes will be image segmentation, primarily views of cities and highways. Possible application of the results will be in the research of urban growth and transportation planning.

Theoretical Study of Hypervalent Iodine Compounds: **Paul Kiprof (Chemistry)**
Hypervalent Iodine compounds have gained much interest in recent times as reagents in organic synthesis. However, only little is known about the stability and reactivity of these molecules. This project studies a series of hypervalent iodine compounds and simulate reactions related to rearrangement, self-assembly and reactivity with other molecules.

The Bacchae collaborative project: **Catherine Ishino (Art & Design), William Payne (Theatre), Justin Rubin (Music), Kim Nofsinger (Dance)** An interdisciplinary multimedia theatrical experiment to create invaluable educational access for undergraduate students to the Visualization and Digital Imaging Lab to learn and create a complex video set design project "The Bacchae" on high speed, high end, high resolution equipment. Marshall Performing Arts Center-staged performance 2/2001; 1st Readings National Conference-Interdisciplinary Studies; Educator's National Conference-Washington DC.

Functional-Structural Models of Tree Growths: **Harlan Stech (Math) George Host (NRRI)** Animation/visualization of light interception processes in tree canopies using the dual processing capabilities of the lab's beowulf cluster. Tree-physiological process models are combined to create a large-scale simulation code for predicting the growth of hybrid poplar trees, and the response of these trees to environmental change. Tree images and animations are generated with the ray-tracing software POVRAY both to understand simulation output and to test the accuracy of light interception submodels. The model is calibrated with data obtained from the US Forest Service Experimental Station in Rhinelander, WI. This data is analyzed with the lab's TECPLOT visualization software.

Curating National and International Exhibitions of Theatrical Design: **Arden Weaver (Theatre)** A large variety of paper, illustrating textures, embossments, and hues are used with state-of-the-art printers for archiving theatrical design. Research will culminate in two national exhibits for future publication. This project includes the development of an interactive CD Rom design catalogue, and reproduction of a number of hardcopy sample designs. These hardcopy samples replicate the same paper and colors, textures, etc. of the original work.



Matthew Andrews/Kevin Russeth
(Bio-chemistry)
Pseudo 2 Gels

Beyond the Leading Edge: Technology Resources

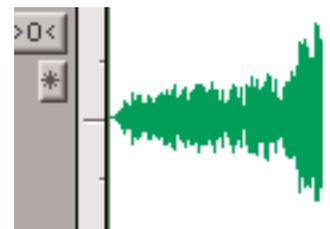
The Visualization and Digital Imaging Lab maintains a variety of workstations and specialized areas. Most workstations are named according to their functionality; for example, Fellini is a video-editing machine. The video editing suite boasts state-of-the-art software, from Final Cut Pro to Media 100, Combustion and Adobe After Effects, as well as Sony DHR-1000 mini dv deck, Panasonic DVC Pro and other video production equipment coordinated by a Furman patchbay. Cameras include Canon XL1 and GL1, Panasonic large format AJD-215, and a Palm IR250 infrared camera.

Scientific visualization workstations include remote access machines from a Sunblade 2K to a custom-built Linux box running Redhat as well as a variety of PCs (Dell, IBM Intellistation ZPro) and one Mac. Software includes Phoretix 2D, Sigma Scan Pro, SigmaPlot, Mathematica, MatLab, Fluent and TecPlot. The lab has a beowulf cluster, bwulf.d.umn.edu, which consists of a Linux Network 8 node, 1 master cluster of dual AMD athalon 1.67GHz processors and 512MB memory each. Each node has both a 10/100 network interface for administration bandwidth, and a 1Gb network interface for research bandwidth. Each of the work nodes also contains an ASUS NVIDIA GForce 4 video card for rendering OpenGL graphics and also has a single 80GB local disk drive. The master node also shares its own 80GB drive over the home directories of each of the compute/work nodes.

The sound room's dedicated ProTools/Mac G4 (Hendrix) running OSX is a 933MHz machine with 2MB L2 cache, 512MB SDRAM, 57GB hard drive, 75GB external storage. It receives input from a Tascam DA40 DAT player through the Digidesign 888 interface.

The 3D animation machine (Chuck Jones) is an IBM Intellistation M-Pro PIII Xeon with 1.5 GB of RAM and a 3x68.36 GB hard drive with Maya and World Construction Set.

The Printing Parlor consists of a 450MHz PowerPC Macintosh G4 (Gutenberg) with 1MB L2 cache, 1GB SDRAM, a 68GB hard drive and DVD-RAM drive. Peripherals include Lasergraphics slidemaker, Epson Perfection scanner, Nikon SuperCool 8000 slidescanner. The lab has a large-format Epson 9500 printer, which enables researchers to experiment with printing on a variety of formats, for example, polyester, canvas and matte. The Sony Vaio Pentaboard (Matisse) has a drawing tablet monitor for sketching images directly on the screen. Gallery lighting and a state-of-the-art drafting table complete the area.



Justin Rubin (Music)
ProTools Screenshot

VRWall

The lab staff have built a passive virtual reality wall, also known as GeoWall and Agave. This consists of a Macintosh G4 running OS 10.2, with Nvidia Gforce2 graphics card and two projectors with rack, video splitter, filters, glasses and silver polarized screen. Through the GeoWall consortium, which includes the University of Minnesota Twin Cities campus and the Electronic Visualization Lab in Chicago, the Visualization and Digital Imaging Lab shares information and pioneers research into 3D visualization of art and sciences. The lab sponsored a VR presentation at the Tweed museum of Art in conjunction with Andrea Hoelscher, guest artist lecturer, in May of 2002. In April 2003 the lab featured 3D geological visualizations, including 3D satellite photographs of the surface of the planet Venus by Vicki Hanson (Geological Sciences).

Viz LabPresentsSeries

The Viz Lab Presents Series highlights research in the lab, as well as guest lecturers and technology workshops. This high-tech, user-friendly series is free and open to the public. Past presentations include:

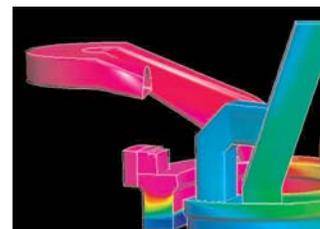
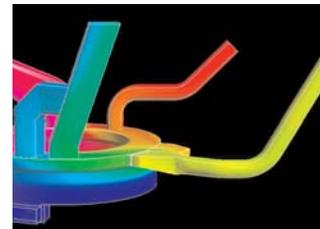
- Chuck Carter, game industry artist who worked on 11 successfully shipped titles such as: Myst, The Manhole, Karandia, Tiberian Sun, Red Alert 2, Yuri's Revenge, Dune: Emperor
- Daniel Sandin, Director of the Electronic Visualization Lab in Chicago and inventor of the first Virtual Reality Cave
- Victoria Interrante from Computer Science at the Twin Cities campus on Artistic Enhancement of Scientific Visualization
- Rob Wittig, of TANK20.com on Digital Literature and Design at a Crossroad
- Marty Weintraub of TerraAura.com on Protools audio manipulation
- Doug Dunham and AJ Parsekar (Computer Science) Mathematics and Art: Visualizing hyperbolic geometry, using the works of artist M.C. Escher
- George Host (NRRI) They flow downhill: landscape visualizations of Duluth streams
- Richard Davis (Chemical Engineering) Fluid Flow with Fluent: Dynamic Visualizations
- Ron Marchese (Sociology/Anthropology) Getting up Close: Use of Digital Technology for Analysis of Textile Objects
- Suz Szucs (Art & Design) Roadwork
- Mike McGraw (Apple) Navigating Mac OSX
- Andy Breckenridge, LLO Image Analysis of the Lake Superior Varve Record
- Sarah Bauer (Art & Design) Tibetan Buddhism and rituals
- Mark Harvey (Theatre), Digital Sound Design for 'Blur'Theatre Production, including backstage tour
- Cecilia Giulivi (Chemistry) Proteomics of mitochondrial proteins



Lisa Valdez (Visualization and Digital Imaging Lab)
VR Promo Poster

Viz Lab Presents Series continued

- Deb Adele (Yoga North), Yoga and Computer Ergonomics
- Catherine Jo Ishino (Art & Design) Video production "WW2: Spaces of Re-remembrances" Japanese internment project
- Tom Schoenhofer (Optech) ILRIS 3D imaging demo
- Steven Trogdon (Math) Fluent demo
- Alexis Pogorelskin (History) Karelian Fever
- Kevin Russeth (Biology) Differentially expressed brain and heart proteins in a hibernating mammal
- William Payne (Theatre) Video editing "The Bacchae"
- Mohammed A. Hasan (Electrical and Computer Engineering) Designing an automatic system for detection, recognition and model-based coding of faces
- Lyle Shannon (Biology) Development of an underwater photography system for characterizing freshwater zooplankton communities
- Michael P. Callahan (Biology) Documenting the time course and extent of nerve regeneration in walleye fish
- Eugene S. Ley (Health Physical Education & Recreation) Media capture, editing and exporting
- Paul Kiprof (Chemistry) Theoretical study of hypervalent iodine compounds
- Stephen Hilyard (Art & Design) Inconsolable and HMS Belfast: Use of digital tools as part of a conceptual art practice
- David Snider (Visiting Artist) Video art
- Cummings & Good (Visiting Artists) Concept and design in graphic design
- George Lee Zimmerman (Visiting Artist) Science, art and technology
- Keith Godard (Visiting Artist) Information design
- Andy Manteuffel (ITSS) PDA Madness
- Barb Johnson (ITSS) Gradekeeper
- Bob Bohannik (Apple) Video editing with Final Cut Pro
- Nirish Dhruv (Visualization and Digital Imaging Lab Research Assistant, Computer Science) Dreamweaver Ultra Dev
- Paul Morin (Geology at Twin Cities campus) GeoWall demonstration
- 9/11/2001 collaborative project



Richard Davis (Chemical Engineering)
Fluent fluid dynamics

National&InternationalExhibitions

Catherine Ishino (Art & Design) Three video pieces: "WW2: Spaces of Re-remembrances" exhibited at Tweed Museum of Art; on ABC, NBC affiliates; on Minnesota Public Radio; Private showings: Japanese American Citizen's League, Veterans of Foreign Wars; Bong Historical Museum; at UWS Multicultural Center presentation on Internment.

"Mind the Gap" Walker Museum screening, Minneapolis, MN.

"Victor Margolin: Graphic Design in the Russian Avant Garde," Rochester Institute of Technology archives, NY, Roger Remington, curator.

Gloria DeFilipps Brush (Art & Design) was one of the exhibitors in both the 2003 and 2001 art galleries at the SIGGRAPH computer graphics international conferences, in San Diego and Los Angeles, respectively. SIGGRAPH showcases the work of selected individuals working in emerging electronic technologies, and publishes a catalog, as well as sponsoring traveling exhibitions. Brush's photographs were shown in September, 2003, in the traveling exhibition opening presentation by Patrick St. Jean, Paris, France ACM SIGGRAPH chair, in the Auditorium of the Ecole du Louvre. Brush's extended body of creative work involves images about language. She is visually investigating "the photographic representation of the changing aura of language and in particular its relationships with the objects existing in real space. Objects await recognition and are enveloped by words, which form trajectories of both communication and miscommunication. Sometimes words are breaths without voice. They seek a secure syntactic position, but meaning constantly is devised, relocated, and recreated." Works from these series also have been exhibited at such sites at the University of London (D-Art 2002 and 2000), the Kellogg University Gallery at Cal Poly Pomona, the University Art Gallery at Indiana State University at Terre Haute (Extraordinary Things, 2002), SOMARTS Gallery in San Francisco, and The Print Center in Philadelphia.

Sara Bauer (Art & Design) exhibited "Nun'dro" produced in the Visualization and Digital Imaging Lab at WomanMade Gallery in Chicago, the Viridian Artists @ Chelsea Gallery in NYC and the Tweed Museum in Duluth (2003).

Stephen Hilyard (Art & Design) exhibited his work in a one man exhibition entitled "Inconsolable" at the Cherrydelosreyes Gallery in Los Angeles CA in November 2002. The exhibition included an installation of the same name, parts of which were made with the assistance of the Visualization and Digital Imaging Lab. These included a digital animation of synthetic landscapes created with Bryce.

Suzanne Szucs (Art & Design) was Artist-in-Residence at Centrum Center for Arts and Education at Fort Worden State Park, Port Townsend, WA. May 2002 Digital photographs taken there were manipulated, developed and printed at the lab. An image from her "Deer Project" (also created at the lab) won honorable mention and appeared in the Silver Eye Fellowship in Pittsburgh OH in 2001.



Stephen Hilyard (Art & Design)
"Inconsolable" animation still

Exhibitionscontinued

Steven Bardolph (Art & Design) and **Kenneth Fitzgerald (Art & Design)** coordinated, designed and printed "Adversary" at the Visualization and Digital Imaging Lab. "Adversary" is a nationally recognized and touring graphic design show, exhibited at AIGA National Conference, Old Dominion University, Monserratt College, and the Maine Gallery.

Robert Appleton (Art & Design) Art+Design Program poster for Alliance Graphique Internationale San Francisco conference, October 2002 - poster was accepted into the permanent collection of San Francisco Museum of Modern Art

John Goodge (Geology) exhibited his Antarctic photos at Carlton College in Northfield, MN. The photos were prepared and printed at the Visualization and Digital Imaging Lab on archival watercolor paper using the Epson 5500 printer.

Performances

Perrault, Jean "Rudy" (Music) "French Connection" CD. Recorded using Visualization and Digital Imaging Lab equipment. Edited in Visualization and Digital Imaging Lab using ProTools. Mastered, produced and prepared for publication in Visualization and Digital Imaging Lab. Performed in Weber Hall, February 25, 2003.

"B Minor Mass." Performance videotaped in Weber Hall using Visualization and Digital Imaging Lab recording equipment. Audio edited in the lab (Protools). Video and audio compiled in lab (Final Cut Pro). DVD mastered and prepared in lab for presentation at Minnesota Music Educators Association conference in Minneapolis. (2003)

Payne, William (Theatre) Digital video set design of "Top Girls"(2002), "Blur" (2003) and "The Bacchae." (2001)

Weaver, Arden (Theatre) Digitally-manipulated lighting design of "School for Scandal." (2003) Digitally-manipulated set design for "Pippin." (2002)

Visualization and Digital Imaging Lab microphones and recording equipment are used for recording theatre, orchestra, opera and chamber orchestra performances in Marshall Performing Arts Center and the Dudley Theatre. All orchestra and chamber orchestra concerts are edited in the lab using ProTools.



Arden Weaver (Theatre)
Set design for "Guys and Dolls"

Conference Presentations & Publications

Photophysical and Chiroptical Properties of Lanthanide Triple Helical Complexes with a Terdentate Chiral C₂ Symmetric Ligand; G. Muller, O. Mamula, D. Imbert, J.-C. G. Bünzli, H.-R. Mürner, J. P. Riehl, 226th ACS National Meeting, New York City, NY, USA, September 2003

American Geophysical Union Conference. San Francisco, CA December 2002. E.T. Brown, and T.C. Johnson; "Coeval Southward Migration of the ITCZ Over East Africa and South America During the Little Ice Age" Published in EOS, 83, no. 47, PP71A-0382, 2002

Third International Limnogeology Conference. Tucson, AZ April 2003. E.T. Brown, R. Bendick, D.L. Bourlès, V. Gaur, P. Molnar, G.M. Raisbeck, and F. Yiou. "Holocene Paleoclimate In Western Tibet Recorded In Geomorphological Surfaces And Lake Sediments"

Transforming Growth Factor-beta Induced Osteoclasts Survive by Activating Divergent Survival Pathways Gingery, A., G. Gorny, and M. Oursler. 24th Annual Meeting of the American Society for Bone and Mineral Research 2002 San Antonio, TX American Society for Bone and Mineral Research

Metastatic Breast Cancer And Osteolysis: The Role Of Transforming Growth Factor-Beta In Regulating Osteoclast Survival Gingery, A., G. Gorny, and M. Oursler The Department of Defense Breast Cancer Research Program Meeting 2002 Orlando Florida

C. Giulivi (2003) Characterization and Function of Mitochondrial Nitric-oxide Synthase. Free Radical Biology & Medicine. Vol. 34, No. 4, pp. 397-408

S. Elfering, T. Sarkela, C. Giulivi (2002) Biochemistry of Mitochondrial Nitric-oxide Synthase. The Journal of Biological Chemistry. Vol. 277, No.41, Issue of October 11, pp.38079-38086

Marchese, Ron. (2002) "Splendor and Spectacle" book "Sacred Textiles from the Armenian Church Collections of Istanbul" Logos. "Expressions in Silk Embroidered Miniatures on Historic Textiles" Silk Roads, Other Roads. Conference Papers "Expressions in Silk" Textile Society of America International Symposium, New York. "Digital Photography and Artifact Analysis," International Textile and Apparel Association Annual Meeting. Archeological publication: "Preliminary Analysis of the Ancient Town of Plataiai, Greece:1996-2001" Hesperia

Rock, Joellyn, (2002) Bare Bones. Marvels and Tales, Journal of Fairy-Tale Studies. Vol. 16, No. 2, pp. 233-263

Shaw, A.K.; Walker, C.M.; Watschke, C.; Tredrea, M.M.; Andrews, M.T. "Neuroendocrine control of hibernation in mammals: role of the HPA axis." The Power of Comparative Physiology: Evolution, Integration, and Applied Conference. August 24-28, 2002 San Diego, CA

Russeth, K.P.; Tredrea, M.M.; Walker, C.M.; Higgins, L.; Andrews, M.T. Proteomic analysis of heart and skeletal muscle tissue in a hibernating mammal. The Power of Comparative Physiology: Evolution, Integration, and Applied Conference. August 24-28, 2002. San Diego, CA

D Ghoshal & A Goyal (2002) DHAP-reductase(s) in plants and algae: Potential use of glycerol system for improving stress tolerance in plants. Reviews in Plant Biochem & Biotech. 1: 21-32

AS Rishi, ND Nelson & A Goyal (2002) DNA Microarrays: Gene expression profiling in plants. Reviews in Plant Biochem & Biotech. 1: 81-100

Finn, C., Goodge, J., Damaske, D., and Roland, N., Aeromagnetic and gravity survey of shield basement along the central Ross margin of East Antarctica: presented at 9th International Symposium on Antarctic Earth Sciences, Potsdam, Germany, 2003.



Joellyn Rock (Art & Design)
Big Wood

Conference Presentations & Publications Continued

Rubin, Justin, "Patima gorgo, a performance edition and analytical study of the newly discovered early piano work by Iannis Xenakis." Published: Moussikos Loghos. Nefeli Editions, Athens. (2003)

Weaver, Arden, The Scenic Designs of Karl Eigsti, a Retrospective, The United States Institute For Theatre Technology National Conference in New Orleans. (2002)



Sarah Bauer (Art & Design) *Nun'dro*