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WINCHELL POSTER SESSIONS

AGRICULTURE

A COMPARISON OF ECONOMICS AND ENERGY CONSUMPTION BETWEEN SUSTAINABLE AND CONVENTIONAL AGRICULTURAL SYSTEMS

Jan Nicholls, Biology Department, St. Olaf College, Northfield, MN 55057-1098

Farmers, environmentalists, and the public are beginning to look towards more environmentally sound, alternative methods to conventional farming. In 1993, 48 acres of Saint Olaf College farmland were converted from a conventional crop rotation (corn-corn-soybeans) to a five-year rotation system (corn-soybeans-oats/alfalfa-alfalfa-alfalfa). Economic and biological parameters, as well as energy consumption in sustainable agriculture have been compared to two types of conventional systems (corn-corn-corn) and (corn-corn-soybeans) for the 1994 growing season. The sustainable system was more labor intensive, whereas the conventional systems had higher energy consumption. The sustainable and conventional systems had comparable production value, however the conventional systems had higher operational costs due to fertilizer and pesticide use. Weed abundance and soil organic matter were within the same range for both conventional and sustainable agriculture. In conclusion, sustainable agriculture had comparable yields, lower costs, and lower energy demands for the 1994 growing season than conventional agriculture, although conventional agriculture involved less labor.

ASTRONOMY

STELLAR PHOTOMETRY

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Measuring the properties of light is the predominant method by which astronomers can examine distant objects. The purpose of this paper is to describe the equipment and procedures utilized by the St. Cloud State University Observatory for accurately determining radiant optical energy outputs of remote stellar systems. The two pieces of equipment primarily employed are a Charged Coupled Device (CCD) camera and silicon photodiode detector each with its respective photometer head. These apparatuses, both computer-interfaced, are then mounted at the focus of a computer-controlled Schmidt-Cassegrain telescope. A significant portion of this paper is devoted to data acquisition, reduction, and analysis techniques. Resultant photometric data, through the use of these rigorous techniques, can produce an assemblage of information key to our understanding of the physical processes and mechanisms responsible for the generation, perpetuation, and evolution of various observed phenomena in the vast expanses of the cosmos.

BIOCHEMISTRY

EGG PHOSPHATIDYLCHOLINE VESICLE DISSOLUTION WITH DODECANOYLSUCROSE

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The behavior of phospholipid vesicles in the presence of various concentrations of surfactant (biological detergents) has a wide variety of applications, ranging from understanding biological membranes to the packaging of pharmaceuticals. In this study, we examined the biophysical behavior of phosphatidylcholine vesicles undergoing continuous addition of the surfactant dodecanoylsucrose. Previous studies have indicated that phospholipids in solution undergo a transformation from bilayer vesicles to densely packed micellar structures at increasing surfactant concentrations. Egg phosphatidylcholine vesicles were prepared containing 0.7 mol % NBD-PE and Rhodamine B-PE (resonance energy pair). These vesicles were monitored continuously using fluorescence spectroscopy as 50 mM dodecanoylsucrose was added at 1 μ L/minute. It was discovered that the initial vesicles increased in size (consistent with either enlarged vesicles or aggregates of smaller vesicles) reaching a maximum at a dodecanoylsucrose:EPC ratio of 2.9 followed by a rapid transition to smaller structures (i.e., lamellar sheets and micelles). In addition, an experiment designed to observe lipid exchange indicates that maximum fluorescence of the energy transfer pair is attained approximately 33% faster with a 9:1 mixture of fluorescently unlabeled:labeled vesicles than with all labeled vesicles, suggesting that substantial lipid exchange occurs between the structures prior to solubilization to micelles.

VESICLE-MICELLE TRANSITION OF EGG PHOSPHATIDYLCHOLINE AND DODECYL MALTOSE

John Ridge, St. Olaf College, Biology Department, Northfield, MN 55057

The "rules" by which lipid vesicles are solubilized by various surfactants provides information about the properties of biological membranes and how more effective synthetic membranes can be constructed for use in protein research, drug packaging and delivery, and a variety of other commercial endeavors. Previous solubilization studies have described a general solubilization paradigm consisting of a vesicle growth stage, a bilayer stage, a mixed micelle stage, and finally a spherical micelle stage. The current study focuses on the solubilization of large (0.1 μ m) unilamellar egg phosphatidylcholine vesicles by the surfactant dodecylmaltoside. Resonance energy transfer (RET) between two fluorescent lipid probes (NBD-PE and RHO-PE) and light scattering data were obtained over a range of surfactant concentrations at three lipid concentrations (0.1mM, 0.5mM, and 1.0mM). Analysis of this data and data from two other experiments designed to detect vesicle leakage and lipid exchange between vesicles suggests that the solubilization process for this lipid-detergent pair consists of five or more

phases including a two-stage growth/aggregation/fusion phase and a micellar phase that appears to consist of very large micelles. Future assays utilizing fluorescence spectroscopy and microscopy will focus on understanding these interesting phenomenon.

A HYDROPHOBIC PEPTIDE PROMOTES FUSION IN A PHOSPHATIDYLSELINE LARGE UNILAMELLAR VESICLE SYSTEM

Ruth A. Pyle, Biology Department, St. Olaf College, Northfield, MN 55057

We examined the effect of a hydrophobic peptide on the rate of calcium-induced fusion between phosphatidylserine (PS) large unilamellar vesicles (LUVs). The synthetic peptide, L₂₄ (Lys₂-Leu₂₄-Lys₂-amide), is expected to orient itself parallel to the acyl chains in a phospholipid bilayer. It may lower energy barriers to fusion by destabilizing lipid bilayers so that bilayer rupture is more energetically favorable or by reducing the entropic cost of localized increases in bilayer thickness during fusion. Vesicle aggregation and fusion were initiated by 1:1 volume stopped-flow mixing of lipid and calcium ion solutions. Fusion was monitored by following NBD-PE fluorescence dequenching as vesicles labeled with NBD-PE and Rho-PE fused with unlabeled vesicles. PS vesicles containing ~1.6 mol% L₂₄ showed a 53% increase in the initial rate of fusion compared to control vesicles. Although vesicle aggregation appeared to be rate-limiting under the conditions studied, aggregation of vesicles containing L₂₄ was slower than for control vesicles, eliminating the possibility that an increased aggregation rate was responsible for the increased rate of fusion in systems containing L₂₄. The results suggest that incorporation of L₂₄ into PS LUVs enhances the initial rate of vesicle fusion.

CELLULAR BIOLOGY

DOES UBIQUITIN TARGETING CONTRIBUTE TO APOPTOSIS?

Justin Kane, St. Olaf College, 1520 St. Olaf Avenue, Northfield, MN 55057

We have been studying apoptosis by working with some of the *ced* (programmed cell death) mutants of *Caenorhabditis elegans* isolated by Ellis, et al. In these mutants, cells which have been programmed to die are not engulfed and destroyed as in normal *C.elegans*. We decided to see if there were any defects in the ubiquitin targeting mechanism in these mutants and began by examining the ubiquitin gene itself. Ubiquitin is a highly conserved protein, 76 amino acids long, which functions in protein degradation by targeting proteins for subsequent digestion. Using probes based on the sequence of Ubi A published by Graham et al., we found a RFLP detected by these probes in each of several *ced* mutants when compared with the wildtype N2 strain. We are considering the possibility that a mutation in the ubiquitin gene could affect the protein targeting to the extent that cells programmed to die can no longer be adequately degraded and reabsorbed by the animal.

References: Ellis, R.E., Jacobson, D.M. and Horvitz, H.R., *Genetics* 129, 79-94 (1 991); Graham, R.W., Jones, D. and Candido, E.P.M., *Mol. Cell. Bio.* 9,268-277 (1 989). The *ced* mutants of *C. elegans* were obtained from the *Caenorhabditis* Genetics Center at the University of Minnesota.

CHARACTERIZATION OF VMA 25 AND VMA 26, VACUOLAR MEMBRANE ATPASE MUTANTS IN THE YEAST *SACCHAROMYCES CEREVISIAE*

Valerie M. Vadnais, Hamline University, 1536 Hewitt Avenue, St. Paul, MN 55104

The vacuolar proton-translocating ATPases are a class of multi-subunit enzymes responsible for the acidification of the vacuolar network, composed of an integral membrane V₀ sector, and a peripherally associated V₁ sector, including a 100-, 69-, 42-, 36-, 32-, 27-, and 7kDa species. A deficiency in any one of these subunits appears to abolish function of the H⁺-ATPase in vacuolar acidification. Novel *vma* mutants have been identified by screening mutagenized cells for their inability to grow on medium buffered to pH 7.5. We used Western immunoblot analysis to monitor steady state levels of five of the subunits(69-, 60-, -42, 36-, 27-kDa polypeptides) in two ATPase mutants, *vma 25* and *vma 26*. In addition, growth curve studies were conducted to examine more carefully the pH sensitivity of these mutants. While both *vma 25* and *vma 26* displayed a general reduction in steady state levels of all subunits examined, culture growth in media buffered to different pH values did not display the characteristic pH sensitivity reported for other *vma* mutants. These results raise questions about the function of vacuolar ATPase in pH regulation in yeast.

C3H-BT1 TRANSFORMATION IS NOT DUE TO A COMPLETE LACK OF P53 MRNA

Jennifer Deeb, Biology Department, Bemidji State University 1500 Birchmont Drive Bemidji, MN 56601

Mutations that inactivate the p53 tumor suppressor gene are frequently found in transformed cell lines and cells isolated from tumors in vivo. Consequently, we wanted to determine if p53 gene transcription is altered in the C3H-BT1 transformed murine cell line. mRNA was isolated from C3H/He (control) and C3H-BT1 (transformed) embryonic fibroblast cells for Reverse Transcriptase-Polymerase Chain Reaction analysis. p53 mRNA was present in both cell lines, although the relative levels of p53 mRNA appeared to be somewhat lower in C3H-BT1 cells. These findings indicate that the transformed phenotype of C3H-BT1 cells is not due to a complete loss of p53 mRNA transcription.

SEQUENCE HOMLOGY STUDIES OF THE YEAST VMA6 GENE PRODUCT

Chris J. B. Frandrup, Hamline University, Department of Biology, 1536 Hewitt Ave., Box #681, St. Paul, MN 55104

For abstract, see Winchell Papers, page 15.

Poster Sessions

8:30 YEAST VMA MUTANTS LOSE GROWTH ABILITY AS PH EXCEEDS 6.4

Rob Gilkerson, Dept. of Biology, Hamline University 1536 Hewitt Ave., St. Paul, MN 55104

For abstract, see Winchell Papers, page 15.

CHEMISTRY

A NON-DEGENERATE PERTURBATION THEORY STUDY OF LINEAR AND CUBIC PERTURBED DOUBLE WELL POTENTIALS: A PREPARATION FOR A COMPARISON OF VARIOUS QUASIDEGENERATE PERTURBATION THEORIES.

Gregory S. Tschumper, Mark R. Hoffmann, C.B. William Ng, Department of Chemistry, Winona State University, 8th & Johnson, Winona, MN 55987

In preparation of a comparison of various Quasidegenerate Perturbation Theories (QDPT), a Raleigh-Schrodinger type non-degenerate Perturbation Theory (NDPT) was applied to two asymmetric variations of a double well potential. These potentials were of the form

$$V = -(1/2)x^2 + \lambda x^4 + \gamma x \quad , \quad V = -(1/2)x^2 + \lambda x^4 + \gamma x^3$$

The perturbation parameters λ and γ were varied to determine where the NDPT began to fail. (Decreasing these parameters increases the perturbation of the system.) NDPT began to break down at $\lambda = \gamma = 0.1$ for the linear potential and much earlier at $\lambda = \gamma = 1.0$ for the cubic potential. The coupling of adjacent roots was evident as the system became more perturbed. These points where NDPT begins to fail are ideal areas for application and comparison of various formulations of QDPT.

EFFECT OF LOW STRENGTH MAGNETIC FIELDS ON LIPID PEROXIDATION

Pat Carl and Bruce A. Svingen, Department of Chemistry, Winona State University, Winona, MN 55987

Low magnetic field strengths, such as those occurring under high voltage transmission lines, have been proposed to promote numerous types of toxicity. These types of toxicities include those mediated by free radical mechanisms, such as lipid peroxidation, the free radical oxidative destruction of polyunsaturated fatty acids of membrane phospholipids. In addition to the inherent toxicity of membrane destruction, the products of lipid peroxidation, such as malondialdehyde, have been implicated in aging, mutagenesis, and carcinogenesis. Our investigations have been undertaken to determine the effects of low strength magnetic fields, 1-10G, on lipid peroxidation. The model system utilized in our investigations was nonenzymatic. Nonenzymatic lipid peroxidation has been studied in liposomes prepared from total lipid extracts of porcine microsomes. Our initial results indicated that low magnetic field strengths increase in vitro lipid peroxidation by 16% at a time of 10 minutes. Future

investigations will be carried out to delineate the mechanism behind the enhancement of this potentially toxic effect.

TISSUE MACERATION: KOH VERSUS NAOH IN CORROSION CASTING UNDER THE SCANNING ELECTRON MICROSCOPE

Joan M. Kennedy and Jillian L. Sharpe, Department of Biology, North Hennepin Community College, Brooklyn Park, Minnesota 55445

For abstract, see Winchell Papers, page 17.

ECOLOGY

LOW-LEVEL POPULATION STUDY OF THE GYPSY MOTH, *LYMANTRIA DISPAR*, IN MINNESOTA.

Kaisa Johnson, Hamline University, 1562 Albany, St. Paul, MN, 55108

A population of gypsy moths was monitored from June 6, 1994 to Sept. 23, 1994 as a part of a project sponsored by the USDA and the Minnesota Department of Agriculture. A total of 707 standard and delimiting traps were set in the Minnesota counties of Hennepin, Dakota, Ramsey, Washington, Anoka. All of the standard traps were checked once in the summer and the delimiting traps were checked three times. The total number and location of moths caught was monitored and recorded. The population was checked at the end of the study to determine the level of gypsy moths and propose population controls for the 1995 summer in Minnesota. The 1994 population was found to be significantly higher compared to the preceding summers.

EVALUATION OF NEST FOUNDING STRATEGIES OF *POLISTES FUSCATUS* IN CENTRAL MINNESOTA

Holly Gackle, College of Saint Benedict, Box 326, St. Joseph, MN 56374

There were three major nest founding strategies in *Polistes fuscatus*: Solitary foundresses, cooperative foundress associations, and usurpation. All three strategies were monitored by marking queens and observing foundress activity. Each nest in the study area was monitored daily to document foundress strategy, and the relative success of those strategies.

Daily monitoring included marking and observing queens, determining nest growth, determining reproduction, and determining the life stage of the immatures. Marking queens allowed me to identify and follow the activity of specific individuals and determine the foundress strategy for each nest. The relative frequency of the three strategies was calculated.

By monitoring individual nest growth I was able to determine the average colony growth rate for each of the founding strategies during the pre-worker phase. The differential success of each strategy was determined by monitoring nests

after worker emergence to document total colony reproductive success.

FEMALE DOMINANCE HIERARCHY IN THE TROOP OF JAPANESE MACAQUES AT THE MINNESOTA ZOO

Gretchen Fowles

Traditionally, the study of primate troop structure has centered around the adult males who are "dominant to animals of all age/sex classes" (Dittus 1980). However, there is sufficient evidence to indicate that females actively participate in group dynamics, and the existence of independent female hierarchies within male/female mixed troops has been discovered (Gouzoules 1980). It has been suggested in the literature that the acquisition and maintenance of female rank depends mainly on asymmetries in alliance power: the most significant allies are female kin, high ranking female nonkin, and the alpha male. Intrinsic physical qualities such as size and strength play a supporting role. In the present study, I determined the dominance relations between the three reportedly highest ranking females (MZG #1003, #379, #3010), in a troop of 32 monkeys, including 24 female Japanese macaques, *Macaca fuscata*, at the Minnesota Zoo. I predicted that MZG #379 would be the highest ranking female due to large kin support and connections to the alpha male, followed by MZG #3010 who had strong kin support and intrinsic qualities but no connection to the alpha male, and then MZG #1003 who had less kin support and no obvious connections to the alpha male. Rank was determined by comparing the number of aggressive behaviors emitted (attacks/threats) and the number of submissive behaviors (displacements, cautious approaches) received by each of the focal females. The data showed MZG #1003 to be the most dominant female, followed by MZG #379, and then MZG #3010. The results indicate that intrinsic qualities and affiliative relations with the alpha male play a critical role in the female hierarchy. An interesting exploratory study examined the correlation between a female's overall troop rank and her familial rank.

THE RELATIONSHIP BETWEEN STOMATE DENSITY AND SOIL MOISTURE ALONG A WETLAND-UPLAND GRADIENT

Elizabeth Clysdale, Victoria Garcia and Shannon Welch, College of St. Benedict, #160, St. Joseph, MN 56374

The density of stomata has been shown to be related to the quantity of moisture in the soil. We examined the relationship between soil moisture and stomate density of *Zanthoxylum americanum* (prickly ash) along a moisture gradient, from a wetland to an oak savannah. We collected leaves from twenty plants and soil samples at the base of each plant along a 100m transect. We measured soil water content gravimetrically. We counted the stomates on nail polish peels taken from two leaflets of each plant. We ran a regression analysis which revealed a relationship between soil water content and average stomate density per square millimeter. This explained 38% of the variation in stomatal density. We performed a t-test, which showed the relationship to be statistically significant.

SEM IDENTIFICATION OF CHRYSOPHYTA POPULATIONS LINKED TO EUTROPHICATION OF VADNAIS LAKE

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For abstract, see Winchell Papers, page 18.

OSTEONAL AREA DENSITY IN FEMORAL CORTICAL BONE AS AN INDICATOR OF LOCOMOTIVE ACTIVITY IN DINOSAURS

Stan O'Daffer, North Hennepin Community College, 7411 85th Ave. N., Brooklyn Park, MN 55451; University of Minnesota, Ecology Dept., 100 Ecology Bldg., 1987 Upper Buford Circle, St. Paul, MN 55108

For abstract, see Winchell Papers, page 20.

10:30 AN ECOLOGICAL IMPACT STUDY ON *FELIS CATUS* AND *HERPESOTES A. AUROPUNCTATUS* ON THE ISLAND OF ST. JOHN

Erik Swanson and Fred Young, Hamline University, 1536 Hewitt Ave., St. Paul, MN 55104

For abstract, see Winchell Papers, page 19.

MEDICAL SCIENCE

LIMB BUD REGENERATION IN THE FIDDLER CRAB *UCA PUGILATOR*: INFLUENCE OF EXOGENOUS MELATONIN ADMINISTRATION

Anitha Rumalla, Biology Department, Macalester College, 1600 Grand Ave., St. Paul, MN 55105

The vertebrate pineal hormone melatonin is produced in response to environmental darkness, and it is involved in the entrainment of physiological and behavioral processes to the environment. Melatonin has recently been detected at relatively high concentrations in invertebrate nervous tissue, particularly that associated with the visual system. Melatonin in vertebrates often has inhibitory influences; for example in some species it inhibits reproductive behavior and physiology, and it inhibits cell division and tumor growth. In this study, we attempted to determine whether melatonin also has inhibitory influences in invertebrate growth. First, we determined that the fiddler crab *Uca pugilator* produces melatonin in the eyestalks. Then we caused the crabs to autotomize the right third walking leg. We next divided the crabs into four groups: 1) with eyestalks + melatonin, 2) with eyestalks + control solution, 3) without eyestalks + melatonin, and 4) without eyestalks + control solution. Melatonin or control solution was added to the crabs' seawater. We measured the growth of the regenerating limb bud of each crab every two days for 20 days. We found, surprisingly, that melatonin significantly increased the growth rate of limb buds in both groups treated with melatonin.

OXYGEN CONSUMPTION IN AN AQUATIC SALAMANDER,
NECTURUS MACULOSUS

Christopher S. Stromquist, Biology Department, Macalester College, 1600 Grand Ave., St. Paul, NM 55105

Oxygen metabolism in ectotherms varies with water temperature due to changes in partial pressure of gases and changes in metabolic activity. Metabolic rates in ectotherms vary with body temperature, generally increasing two- to three-fold for every ten degree increase in temperature. The mudpuppy *Necturus maculosus*, an ectothermic aquatic salamander, has external gills through which most of its gas exchange occurs. Oxygen consumption in 5 mudpuppies was measured over 50 minutes at 10°C, 24°C, and 30°C with YSI oxygen meters. Oxygen consumption was significantly lower in animals at 10° compared with animals at 24° or 30°; however, there was no significant difference between animals at 24° and 30°. The rate of oxygen consumption decreased over time, with decreasing partial pressure of oxygen, at 24° and 30° but not at 10°. These results indicate that metabolism in mudpuppies is dependent upon both temperature and oxygen availability.

THE INFLUENCE OF MELATONIN ON GROWTH RATE OF THE
GIANT HISSING COCKROACH, *GROMPHADORINA PORTENTOSA*

Maria Cedroni, Biology Department, Macalester College, 1600 Grand Ave., St. Paul, NM 55105

Melatonin is a hormone produced by the vertebrate pineal gland and possibly by photoreceptive structures of invertebrates. Research has demonstrated that melatonin has an influence on circadian and reproductive cycles in vertebrates; however, melatonin function and production has not been extensively studied in invertebrates. Melatonin has been detected in all of the few invertebrates examined, and we detected (with radioimmunoassay) high levels of melatonin in the heads of the cockroach *Gromphadorina portentosa*. To determine whether melatonin affected either the pattern or rate of growth in these cockroaches, we fed animals food containing melatonin (n = 10) or control (n = 10) and weighed them weekly to monitor growth. Results thus far (after 7 months) show a significantly greater growth rate for cockroaches receiving melatonin than for the control group. However, the data indicate that ingested melatonin does not significantly affect the overall pattern of growth in these cockroaches. We plan to further study these cockroaches to determine whether melatonin influences various circadian or circannual processes such as activity patterns and reproductive behavior.

PHOTOTHERAPEUTIC KERATECTOMY: EFFECTIVENESS OF THE 193
NM EXCIMER LASER IN REMOVING CORNEAL OPACITIES IN 138
CASES.

Thomas A. Dudley, Hamline University, P.O. Box 678, 1536 Hewitt Avenue, Saint Paul, MN 55104

Phototherapeutic keratectomy (PTK) was performed on 138 patients using the 193nm excimer laser. The advantage of

using this laser for removal of corneal scars is that there is no secondary scarring do to the photoablation. Phototherapeutic keratectomy was used to treat corneal scars, due to recurrent erosions, granular dystrophy, and band keratopathy dystrophies, and other pathological conditions of the cornea. Data generated from the study of the 138 patients showed visual acuity improvement (shown by a gain of one or more Snellen lines) in more than 83% of the cases. A questionnaire was also mailed to all 138 patients to ask whether or not the PTK procedure met their expectations. 74% of the 64 patients that responded indicated that their goals were at least partially met. 96% of those that responded were satisfied with the outcome of the procedure. The laser is effective in the removal of corneal scars and an excimer laser has been approved by the FDA (3/13/95) for commercial ophthalmic use.

EVIDENCE FOR AN ENDOGENOUS CIRCADIAN RHYTHM OF
TEMPERATURE SET POINT IN GARTER SNAKES.

Thomas D. Moline and Dwight E. Nelson, Department of Biology, University of St. Thomas, St. Paul, MN, 55105.

It is well known that many homeothermic organisms display daily rhythms of body temperature that appear to be controlled by an internal circadian clock. We have used garter snakes to determine whether this ectothermic organism may also display circadian changes in body temperature set points under constant conditions. For these experiments, body temperature of the snakes was monitored using miniature radio transmitters (Model: V, Mini Mitter, Sunriver, OR). The snakes were then allowed to thermoregulate without constraint on a thermal gradient along the bottom of the housing chamber (gradient temperature ranged from 15 to 49°C). The incandescent lighting in the housing chamber was controlled with a timer and regulated to a 24 hour light-dark cycle or constant light (luminance = 250 - 800 lux). Internal body temperatures for the snakes were recorded every 6 min over periods of up to 6 days using a computer-controlled data acquisition package (DataQuest, St. Paul, MN). In a light-dark cycle we observed several patterns of body temperature that may correspond to body temperature cycles documented for garter snakes in light cycles during field studies (Peterson, *Ecology*, 68:160, 1987). In constant light, we observed distinct oscillations in body temperature that may suggest control of behavioral thermoregulation in garter snakes by an internal circadian clock. The body temperature of the snakes in constant light oscillated between approximately 17 and 38°C. The periods of these temperature rhythms in preliminary studies appeared to range from 18 to 24 hours. These experiments indicate that the behavioral thermoregulation in these ectothermic organisms may be controlled by changes in body temperature set points in a manner very similar to that seen in homeotherms.

RESPONSES OF A-DELTA AND C-FIBER PRIMARY AFFERENT NOCICEPTORS IN THE RAT USING NOXIOUS COLD STIMULI

Brian J. Allen, Hamline University 264 W. Curtice St. Paul MN 55107

For abstract, see Winchell Papers, page 25.

MICROBIOLOGY

TEMPERATURE EFFECTS ON GERMINATION RATES OF THE TRUE SLIME MOLD DIDYMIUM NIGRIPES

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For abstract, see Winchell Papers, page 18.

PHYSICS

HOMOGENEOUS LINEWIDTHS OF EUROPIUM IN GLASS

Chris Reyerson, Department of Physics, Astronomy, and Engineering Science, Saint Cloud State University, Saint Cloud, Minnesota, 56301

We used Fluorescence Line Narrowing to measure the homogeneous linewidth of europium in a fluorophosphate glass. Narrowband excitation results in fluorescence of a subset of ions with identical transition energies. This eliminates inhomogeneous broadening due to the random nature of the host. According to the Uncertainty Principle, the shorter the coherence time the broader the homogeneous linewidth. Coherence time is the time the ion spends in the excited state without being disturbed. Coherence time is determined by the number of vibrations present in the host. The number of vibrations present depends on the temperature of the host, thus there is a relationship between the temperature and the linewidth of the transition. This relation typically follows a power law, T^2 for lanthenides in glass. The homogeneous linewidth will give us knowledge of the interaction of the europium ion with the host. We wish to compare our finding with homogeneous linewidths measured for the actinide curium in the same type of glass. The 4f electrons of the lanthanides should interact less with the host than the 5f electrons of the actinides because of the greater spatial extent of the 5f orbitals.

PLANT SCIENCE

A COMPARATIVE SCANNING ELECTRON MICROSCOPE STUDY OF FLORIN RINGS IN SELECTED GYMNOSPERM GENERA

Joshua Rothstein, North Hennepin Community College, 7411 85th Avenue North, Brooklyn Park, Minnesota, 55445

Florin rings of selected species were observed using a scanning electron microscope (SEM). Florin rings are raised

rings produced by subsidiary cells surrounding the stomatal cavity in conifer needles. These rings have been suggested to have a taxonomic importance in conifers. The purpose of this study was to observe the differences in Florin rings in each species. Species observed were *Pinus banksiana*, *P. mugo*, *P. resinosa*, *P. strobus*, *P. sylvestris*; *Picea glauca*, *P. pungens*; *Abies balsamea*; and *Taxus canadensis*. Needles from each species were collected and then submitted to a series of steps including critical point drying in preparation for observation with the SEM. Each species observed had a different Florin ring type and appearance. However, because of the small sample group studied from each genus, it can only be concluded that Florin rings can determine genera and not individual species. A literature search has indicated that Florin ring descriptions of *Pinus mugo*, *Picea glauca*, *Picea pungens*, *Abies balsamea*, and *Taxus canadensis* have not been previously reported. Further study is needed in *Picea*, *Abies* and *Taxus* to establish Florin ring classification due to the few number of species studied here.

SURFACE STRUCTURAL DIFFERENCES BETWEEN *MYRIOPHYLLUM SPICATUM* AND *MYRIOPHYLLUM EXALBESCENS* BY USE OF ELECTRON MICROSCOPY.

Hamenauth C. Mangroo, North Hennepin Community College, 7411 85th Ave N., Brooklyn Park, Minnesota 55445

Electron microscopy was used to observe structural differences between an introduced species, Eurasian watermilfoil (*Myriophyllum spicatum*) and a native species, Northern watermilfoil (*M. exalbescens*). Samples were prepared in a series of steps, including critical point drying, to view under the scanning electron microscope (SEM). Structural surface differences observed between the two species include: 1) varying striated epidermis, 2) presence or absence of secretory trichomes and 3) patterns of debris. Literature review reveals very little information concerning these structural differences between Eurasian watermilfoil and Northern watermilfoil and their function. Further study of the physical characteristics peculiar to Eurasian watermilfoil may enable development of novel methods of controlling the rapid growth.

PSYCHOLOGY

THE INFLUENCE OF NATURAL LIGHT AND DARK ADAPTATION ON COLOR SPECIFIC THRESHOLDS

Marnie Dollinger, Moorhead State University, Moorhead MN, 56560

Many factors influence the detection of colored lights. This experiment investigated two of these factors, dark adaptation and natural light and their effects of the detection thresholds of yellow, red and blue light. All conditions were presented in a randomized double staircase method and a threshold was computed for each staircase and was compiled by color with the thresholds of the other subjects and a mean threshold value was computed for each color in each condition. A significant interaction was found between natural light and dark adaptation and their effect on red and yellow lights. In

Poster Sessions

this interaction yellow was perceived best in dark adaptation followed by red, but in natural light, red was perceived better than yellow; blue was always the hardest to detect. This can be explained by an additive mixture of the yellow wavelength in natural light graying out some yellow wavelengths striking the viewing surface and causing the stimuli to be perceived as less intense.

THE EFFECTS OF CAFFEINE ON BLOOD PRESSURE AND RESPIRATION RATE DURING A STRESS RELATED TASK

Michelle Schrader and Kim Berg, Moorhead State University, Moorhead, MN 56560

Does caffeine produce adverse physiological responses? The present study investigated the effects of caffeine on physiological responses (blood pressure and respiration rate) before, during, and after a stress-related task. Twenty male and female subjects received both conditions of caffeine (200 mg of No-Doz) and no caffeine and were also asked to perform the stress-related task, mental arithmetic. Throughout the experiment both blood pressure, with the use of a Marshall 92 Automatic Oscillometric Electronic Digital Blood Pressure and Pulse Monitor and respiration rate, with the use of a Dual Pneumatic Respiration Transducer which was connected to a Grass Electroencephalograph Model 8-10E, was measured and recorded. A 2 x 3 repeated measure ANOVA was computed for each of the following: systolic blood pressure, diastolic blood pressure, depth of respiration, and respiration rate. Results indicated that blood pressure and respiration rate was higher after caffeine was ingested. When looking at the time the task was presented, it was found that respiration rate and blood pressure was highest during the time the stress-related task was performed.