

**Abstracts of Papers Presented at the
Sixty-eighth Annual Meeting, Virginia Academy of Science
May 23-26, 1990, George Mason University, Fairfax, VA**

Aeronautical and Aerospace Sciences

SUPERSONIC AERODYNAMIC CHARACTERISTICS OF A HIGH-SPEED CIVIL TRANSPORT CONFIGURATION. Jeffrey D. Flamm,* Peter F. Covell,* Gloria Hernandez,* Applied Aerodynamics Division, NASA Langley Research Center, Hampton, VA 23665, and O. J. Rose, Lockheed Corporation, Hampton, VA 23665. Wind-tunnel tests were conducted to determine the supersonic aerodynamic characteristics of a High-Speed Civil Transport (HSCT) configuration in the Langley Unitary Plan Wind Tunnel (UPWT). An attempt was also made to determine the effect which laminar flow would have on the aerodynamics, even though this particular concept is a fully turbulent design. The tests were conducted at Mach numbers from 2.4 to 3.6 and over a Reynolds number range of 0.75 to 5.0×10^6 /ft. Angle of attack varied from -4° to 10° . Preliminary analysis of the test results indicates that the cruise performance is slightly below initial estimates. The pitching-moment characteristics exhibited an unstable trend at low angle of attack which increased at higher angles. The effect of laminar flow was to increase the $(L/D)_{\max}$ by 5.2 percent and to decrease zero lift drag by 6.5 percent.

APPLICATION OF LOW BOOM CONSTRAINTS TO AIRCRAFT DESIGN. Robert J. Mack, NASA Langley Res. Ctr., Hampton, Va. 23665-5225. Aircraft cruising at supersonic speeds produce shock wave filled flow fields around their flight path. On the ground, we experience these distance-attenuated shock waves as a noise called "sonic boom." The annoyance caused by this sonic boom could keep aircraft companies from building airplanes and airlines from offering supersonic air service. This obstacle to the introduction of supersonic cruise aircraft might be overcome if aircraft design procedures would incorporate low sonic boom characteristics along with high aerodynamic, engine cycle, and structural efficiency criteria to permit safe, comfortable, affordable, and profitable operation. Aircraft features which could reduce the sonic boom annoyance on the ground are described in this paper. Their impact on the overall design is illustrated in two 3-view drawings of conceptual "low boom" aircraft which would cruise at Mach 2.0 and at Mach 3.0.

IMPROVING COMPUTER-AIDED CONCEPTUAL DESIGN OF AIRCRAFT - ACSYNT. A. Myklebust* & S. Jayaram*, Mechanical Engineering Dept. Va. Polytechnic Inst. & State Univ., Va. 24061. This presentation describes the enhancement of a well-known aircraft conceptual design code called ACSYNT (AirCRAFT SYNThesis). An interactive, graphical CAD interface for ACSYNT has been created at Virginia Tech in cooperation with NASA-Ames. This interface permits the execution and control of the design process via interactive graphics menus and, by visual inspection of data and aircraft model shaded images, allows rapid evaluation of design configurations. This interactive CAD version of ACSYNT was coded entirely with the international 3-D graphics standard, PHIGS, and is designed to be used on the new generation of high-speed imaging workstations. Current research activities include the improvement of existing geometric modeling techniques to automatically calculate intersections between aircraft components, automatic generation of parametric aircraft models using non-uniform B-Spline surfaces and automatic creation of curvature continuous fillets. This presentation also describes the formation of the "ACSYNT Institute", which is a joint research and development program between Virginia Tech, NASA and other government agencies and the aerospace industry for the development and use of this transportable, computer-aided aircraft conceptual design program.

THE GROWTH OF AVIATION TECHNOLOGY. M. Leroy Spearman, NASA Langley Research Center, Hampton, Virginia 23665-5225. The growth of aviation technology during this century has been somewhat remarkable. The airplane has changed from what was once thought of as a vehicle for sport to a vehicle for many uses that includes sport, transportation, warfare, and exploration. This growth has occurred in many countries and has been fostered by the native talent of individuals as well as the exchange of information between countries and the import and export of hardware. The use of the airplane as an instrument of war has been an important factor in the growth of aviation technology. Periods following wars were also periods of growth as captured equipment, facilities, and scientists were exploited in order to improve airplanes. In addition, as the commercial air transportation market developed, the need for improved air transports also added to the growth of aviation technology. Although the growth in aviation technology has been phenomenal, there is no indication that it has come to an end. The spirit of competition in the commercial market and the quest for military security indicate that the technologies related to aviation will continue to grow.

Agricultural Sciences (*No Abstracts Submitted*)

Astronomy, Mathematics, and Physics

CEBAF HIGH MOMENTUM SPECTROMETER DRIFT CHAMBERS.

O.K. Baker¹, R. Carlini^{2*}, S. Christo^{*}, C. Cuevas^{*}, S. Majewski^{*}, A. McCauley^{1*}, J. Napolitano^{2*}, and R. Raney^{1*}, Continuous Electron Beam Accelerator Facility, 12000 Jefferson Ave, Newport News, VA 23606

¹ And Dept. of Physics, Hampton University, Hampton, VA 23668

² And Dept. of Physics, College of William and Mary, Williamsburg, VA 23185

The Physics Program in Hall C of the Continuous Electron Beam Accelerator Facility (CEBAF) will include an exciting variety of experiments in nuclear and particle physics. A key element of the initial complement of equipment planned for Hall C is the High Momentum Spectrometer (HMS). The HMS will be a moderate resolution spectrometer with large solid angle capable of detecting hadrons with momenta up to 6 GeV/c, and electrons with energies above 4 GeV in a modest π^- background. The detector package planned for the HMS will have standard focal plane instrumentation: Drift chambers (XYUV), scintillation and gas Cerenkov counters, and shower counters. Particular emphasis at the meeting will be placed upon presentation of the prototype drift chamber work going on presently, as well as design calculations and plans for the full array of HMS drift chambers.

THE EFFECTS OF REPEATED LIQUID NITROGEN TO AMBIENT TEMPERATURE CYCLING ON HIGH T_c SUPERCONDUCTORS*. Joseph Beaufait, Randall Caton, and Raouf Selim, Department of Applied Physics and Computer Science, Christopher Newport College, Newport News, VA 23606.

In order to test the suitability of high transition temperature (T_c) superconductors and silver bead contacts for long term applications we developed a computer driven mechanical system that cycles high T_c samples into an LN₂ bath. Data acquisition was automated using an Apple IIe and a multichannel A/D converter with instrumentation amplifiers set at a gain of one thousand to boost the low level signals. Data were taken of overall sample resistance and silver bead contact resistance at LN₂ and ambient temperature. Data were recorded on disk and plotted for a visual check of the experiment's progress. Resistance data were taken using a dc four probe technique. The test current of .03 amps was reversed twenty times at each point and the resultant signals were averaged to eliminate thermal voltages and external noise. The process was repeated thousands of times to simulate years of use in the field. The sample's T_c and critical current were tested before and after the procedure to further evaluate the overall effects of cycling.

* Work supported by NASA grant NAG-1-1042.

OPTIMIZATION OF HARD-CORE FLASHLAMP FOR PUMPING BLUE-GREEN DYE LASER.¹ Jaeho Choi*, In H. Hwang*, Kwang S. Han*, Dept. of Physics, Hampton Univ. Hampton, Va. 23668. A blue-green dye laser output was greatly increased by improving the hard-core flashlamp²(HCF) structure. A short light pulse (~2 μ sec) produced on the alumina insulator surface of the HCF efficiently pumped the laser dye. The maximum output of the HCF pumped LD-490 dye laser was 127 mJ with Ar as the active gas. When the active gas was changed into Xe, the output increased to 160 mJ and the laser efficiency was over 0.1% which is comparable to that of the conventional linear Xe flash lamp. The advantages of the HCF and optimum conditions for LD-490 blue-green dye laser are described.

1. Work is supported by ONR grant No. N00014-89-J-1653
2. K. S. Han, et al., ILS-V conf. Bull. APS. 34 1657 (1989)

ON THE NATURE OF TACHYONS AND TARDYONS IN QUANTUM MECHANICS.

Kenneth C. Jacobs, Dept. of Physics, Box 9661, Hollins Col., Roanoke, Va. 24020. It seems a truism to state that 'mathematics is the language of science'; and it has long been known that there are an infinite number of equivalent mathematical representations of quantum mechanics. Nevertheless, this paper points out that when Special Relativity is taken into account - especially in quantum mechanics - our physical intuition is severely constrained by the types of mathematics which we use. A critical case-in-point is tachyons, particles of imaginary "rest-mass" which supposedly travel faster than the speed of light (c); such particles are believed by many to exist, and they have been sought experimentally. This paper conjectures that tachyons are merely artifacts of the wrong mathematics, and proposes a new mathematical framework for both Special Relativity and quantum mechanics - wherein one has a one-to-one mathematical mapping from tachyons to tardyons (and vice-versa). In essence, the exterior of the light-cone is its interior, the speed of light is a natural upper limit, and space and time are interchangeable and completely equivalent. Some consequences of this new approach are discussed. (Research partially supported by Faculty Awards Grants from Hollins College.)

HORIZONS OF KNOWLEDGE IN COSMOLOGY, Menas Kafatos, Dept. of Physics, George Mason Univ., Fairfax, VA 22030. Unlike the usual situation with theoretical physics which is testable in the laboratory, in cosmological theories of the universe one faces the following problems: the observer is part of the system, the universe, and this system cannot be altered to test physical theory. Even though one can in principle consider any part of the observable universe as separate from the acts of observation, the very hypothesis of big bang implies that in the distant past, space-time regions containing current observers were part of the same system. One, therefore, faces a situation where the observer has to be considered as inherently a part of the entire system. The existence of horizons of knowledge in any cosmological view of the universe is then tantamount to inherent observational limits imposed by acts of observation and theory itself. For example, in the big bang cosmology the universe becomes opaque to radiation early on, and the images of extended distant galaxies merge for redshifts, z , of the order of a few. Moreover, in order to measure the distance of a remote galaxy to test any cosmological theory, one has to disperse its light to form a spectrum which would cause confusion with other background galaxies. Since the early universe would be described in quantum terms, it follows that the same problems regarding quantum reality and the role of the observer apply to the universe as a whole. One of the most fundamental properties of quantum theory, non-locality, may then apply equally well to the universe. Some of the problems facing big bang cosmology, like the horizon and flatness problems, may not then be preconditions on theoretical models but may instead be the manifestations of the quantum nature of the universe.

OPTICAL PROPERTIES OF I-III-VI₂ SEMICONDUCTORS. Yeongkwan Kim and Calvin W. Lowe, Dept. of Physics, Hampton University, Hampton, VA 23668. We have measured the reflectance of LiInSe₂ and NaInSe₂ between 0.689 eV and 3.543 eV. The band gaps of LiInSe₂ and NaInSe₂ are located at approximately 1.65 eV and 1.78 eV, respectively. We observed doublet structure at 0.9 eV associated with stoichiometric deficiencies in the group III and VI elements. We also make the first report of energy levels just below the middle of the bandgap which are associated with the alkali metal in NaInSe₂.

ORBIT-TRACKING USING THE FIRST HERMITE APPROXIMATION POLYNOMIAL Timothy J. McDevitt* and Joseph W. Rudmin, Physics Dept., James Madison Univ., Harrisonburg, VA 22807. During the past year, the use of osculating polynomials to integrate the equations of motion of the solar system has been studied. Results include the discovery of large oscillations in the second osculating polynomial, and of apparent errors which grow exponentially with number of steps in the first polynomial (Hermite approximation polynomial). Such growth would, in some cases, be prohibited by conservation laws which the solar system obeys. The next approach will be to force these laws into the numerical integration algorithm. Results of the past year's work will be presented, and approaches to forcing the conservation laws will be discussed.

IMPROVED SINTERING PROCESS OF SUPERCONDUCTING YBa₂Cu₃O_x. Robert W. McKittrick, Jr.*, Raouf Selim and Randy Caton, Dept. of Applied Physics and Computer Science, Christopher Newport Col., Newport News, Va 23606. YBa₂Cu₃O_x has a superconducting transition temperature, T_c, of 90K. However, practical applications also require high transport critical current density, J_c, at liquid nitrogen temperature (77K). Two computer programs were written to automate the data acquisition necessary to develop a sintering process to improve the critical current in YBa₂Cu₃O_x. The first program measures the transport current density at 77K by incrementing the source current at fixed time intervals and recording the voltage across a section of the sample at each current setting. The second program monitors the resistance of the sample during the sintering process (20-900°C). The program controls the oven temperature, ramp rate and dwell period for several temperature settings. Refinements in the sintering process were then made from analysis of the graphs of resistance vs time, and resistance vs temperature. Utilizing these programs, preliminary results show an increase in the transport current density by tailoring the sintering process. (Supported by NASA grant NAG-1-1042.)

IMAGES OF COSMOLOGY IN MODERN FICTION. Jane C. Webb and Jennifer W. Vincent, Dept. of Phys. & Computer Science, Christopher Newport Col., Newport News, Va. 23606. Major 17th and 18th century writers such as Donne, Pope, and Milton wrestled with the scientific model of the cosmos, where contemporary writers of non-science fiction only infrequently take account of the new cosmology. Even those works purporting to deal with time and space do so on a shallow surface level or use cosmology only as metaphor. Mary Barnard's book of poetry *Time and the White Tigress*, Margaret Atwood's novel *Cat's Eye* and Douglas Adams' *The Hitchhiker's Guide to the Galaxy* support the contention that serious focus on cosmology is unimportant to contemporary authors. Webb and Vincent conclude that while the heliocentric universe mattered greatly to the self-perception of human beings, the new models of space-time developing in modern physics and popularized by physicists such as Sagan and Hawking have no real impact on the image of man in the universe.

IODOPERFLUOROHEXANE AS A SUITABLE LASANT FOR IODINE LASERS. CAPT. CLARENCE L. WELLS, * Dept. of Physics, Hampton Univ., Hampton, Va. 23668. A comparative analysis is made of iodoperfluorohexane, $C_6F_{13}I$ to iodoperfluoropropane, C_3F_7I when used as the gain medium in an iodine laser system. Parameters for this comparison are the absorption cross section in the pumpband 250 to 290 namometers, laser output energy, and the production of I_2 , the major quenching by-product of iodine laser reactions. This study confirms $C_6F_{13}I$ to have an absorption cross section equal to C_3F_7I and laser output energy almost 2 times greater. The amount of I_2 produced is less for $C_6F_{13}I$ due to a recombination process that is yet to be fully understood.

MACINTOSH COMPUTERS IN THE INTRODUCTORY PHYSICS LAB. Donald A. Whitney, Loretta Lamson and Donica Allen, Dept. of Physics, Hampton University, Hampton, VA 23668. The implementation of Macintosh microcomputers in the introductory physics laboratory is described. These were placed into service part way through the spring semester and made an immediate and positive impact upon each student's laboratory experience. Each computer is currently configured with a graphics package, a drawing and paint utility, a word processor, a file server and electronic mail while a mathematics and spread sheet application and SciMaTech interface are to be added soon. Each computer is linked to the others in the departments of chemistry, computer science and physics. The emphasis of the presentation is on student response to this sudden addition to the laboratory and the effect upon the student's laboratory skills. (Supported by the Office of Naval Research, SEMS Program, N-00014-89-J-3238)

Biologv

THE EFFECT OF 6-METHOXYBENZOXAZOLINONE ON REPRODUCTIVE CONDITION IN THE HISPID COTTON RAT, *SIGMODON HISPIDUS*. Vera L. Adams and Robert K. Rose, Dept. Biol. Sci., Old Dominion Univ., Norfolk, VA 23529-0266. A non-estrogenic hormone, 6-methoxybenzoxazolinone (6-MBOA), found in young growing grasses, has been shown to be a reproductive initiator in several herbivorous rodents. However, the mechanism by which 6-MBOA initiates reproduction has not been determined. Many believe that 6-MBOA represents a reliable cue that the vegetative growing season has begun, but it is unknown whether this hormone is a primary cueing mechanism or if it works in conjunction with other environmental factors. Therefore, a controlled laboratory experiment was conducted using *Sigmodon hispidus*, the cotton rat, to determine whether different dosages of 6-MBOA ($4\mu g$, $40\mu g$, and $400\mu g/liter$ of a 4:1 petroleum ether and ethanol solution coated on lab chow) had an effect on the reproductive condition of this species after three weeks. Results showed that there was no significant effect of 6-MBOA on the reproductive condition of either sex, based on testes, seminal vesicle, and uterine weights. Possible effects of 6-MBOA on body growth or rate of food consumption remain to be evaluated.

AN ANALYSIS OF FACTORS AFFECTING REPRODUCTIVE SUCCESS IN A CRAB SPIDER. Michael W. Beck, Dept. of Environmental Sciences, Univ. of Va., Charlottesville, Va. 22903. Fecundity and growth rate of adult female crab spiders, *Misumenoides formosipes*, are examined. Carapace width, a linear size measure of the cephalothorax exoskeleton, is significantly related to both fecundity and growth rate. The size of the carapace changes only during molts, and consequently adult carapace size is a trait derived in earlier life history stages. In *M. formosipes* adult carapace size is influenced primarily by weight gain in the penultimate instar. Foraging decisions during this instar therefore have important consequences on fitness.

It is recognized that earlier life history stages can have important effects upon fitness, but these stages rarely are studied in arthropods. Early instars of arthropods are often difficult subjects to examine because of their size and vagility. Linear size measures of adults provide a means for assessing the effects of previous life history stages upon fecundity.

PATTERNS OF WATER LOSS IN A DORMANT LAND SNAIL. G.F. Birchard, M.C. Barnhart* & J.M. Kidwell.* Dept. of Biol., George Mason Univ., Fairfax, VA. 22030 and Dept. of Bio., San Diego State Univ., San Diego, CA 92110. During periods of reduced food and water availability pulmonate land snails use dormancy as a means of survival. This study examined the patterns of water loss of the snail *Otala lactea* during dormancy. Water loss was measured as mass loss over Drierite on a recording electrobalance in 11 undisturbed snails (mass = 6.07 ± 1.38 g) for periods of 7 or more days. Total water loss was 3.23 ± 1.97 mg·d⁻¹. Water loss showed a discontinuous pattern; periods of high rates of water loss (bursts) alternating with periods of very low rates of water loss (interburst). Burst frequency was $.07 \pm 0.8$ h⁻¹ and interburst duration was 15.00 ± 8.65 h. Interburst water loss rate was $.141 \pm .290$ mg·h⁻¹. The burst water loss rate was variable. The average maximum rate was $1.293 \pm .489$ mg·h⁻¹. The majority of water loss in *Otala* appears to be associated with periodic respiratory activity.

USE OF SPACE AND HABITATS BY INDIVIDUALS AND POPULATIONS. Michael A. Bowers, Dept. of Environmental Sciences & Blandy Experimental Farm, Univ. of Virginia, Charlottesville, Virginia 22903. A spatially explicit model of habitat selection is presented for central place foragers (i.e., where patches differ in accessibility). Computer simulations examined to what extent habitat selection varied within and among individuals according to: i) difference in the intrinsic quality and abundance of two patch types; ii) difference in traveling costs; and iii) increases in the density of foragers. The basic habitat selection model was then incorporated into a modified form of the logistic equation where the per capita reproductive rate varied as a function of the quality of habitat patches selected, and the costs associated with selecting these. Computer simulations showed population growth rates were highest when habitat selection was most pronounced: i.e., when traveling cost and densities were relatively low, and the better quality patch was more abundant.

A SURVEY OF THE FISH FAUNA OF THE UPPER MATTAPONI RIVER BASIN.

Melissa A. Browning and W. Wieland, Dept. of Biological Sciences, Mary Washington College, Fredericksburg, VA 22401. Eleven localities on the Matta, Po, and Ni rivers were sampled using a seine and a backpack electroshocker. Thirty species from ten families and 20 genera were found. *Lampetra appendix* was the only species taken which had not been collected previously in the Mattaponi River basin. The most abundant species were *Notropis procne* and *Etheostoma olmstedi*. The most common species in these streams were *Lepomis auritus*, *L. macrochirus*, *E. olmstedi*, and *Esox niger*. The greatest diversity for a single collection site occurred in the Matta River, however, 23 species were taken from all collection sites in the Po River.

GENETIC COMPOSITION AND SHELL VARIABILITY OF THE CLAM, *DONAX VARIABILIS*, IN THE CAPE HATTERAS AREA. Nancy E. Budd & Laura Adamkewicz, Department of Biology, George Mason University, Fairfax, VA 22030. An investigation of four subpopulations of *Donax variabilis* in the Cape Hatteras area indicates the existence of one homogeneous population. Alloenzyme genotype and allele frequencies do not differ significantly among samples, and only one gene, *LAP*, deviates from Hardy-Weinberg expectations. *LAP* shows the deficiency of heterozygotes typical of bivalves.

The frequencies of certain shell characteristics vary among sites, as does mean shell length. Shell length is associated with the position of the clam on the beach: the further from the water, the smaller the clam. Some shell characteristics are also associated with significant differences in shell length, but no alloenzyme genotype shows this association.

A PRELIMINARY INVESTIGATION OF AMPHIBIAN POPULATION DYNAMICS OF A SHENANDOAH VALLEY SINKHOLE POND COMMUNITY. Kurt A. Buhlmann, ¹VA Dept. of Conserv. & Rec., Div. of Natural Heritage, 203 Governor Street, Suite 402, Richmond, VA 23219, ²J. C. Mitchell, Dept. of Biology, University of Richmond, VA 23173, and ¹C. A. Pague. A community of natural, ephemeral woodland ponds was sampled periodically for amphibians, 1987-90. Ten species (4 salamanders and 6 anurans) utilized these ponds for breeding. The total number of species able to breed at a given pond varies between years and is related to water availability. Dry conditions during winter and early spring 1989 prohibited most breeding of *Ambystoma maculatum*, *A. tigrinum*, and *Rana sylvatica*. The spring larval body size of the fall breeding *A. opacum* was related to fall and winter water levels and determined whether the larvae were predator or prey in their relationship with *A. tigrinum*. Spring breeding amphibians that utilized ponds that dried prior to July 1987 suffered 100% larval mortality. These ponds were unsuitable for 3 summer breeding species of *Rana*. Ponds that retain some water all year establish populations of *Notophthalmus viridescens* which are predators on *Ambystoma* eggs and small larvae. The complexity of the interspecific interactions and variable hydrology suggests that protection of the entire pond community and associated terrestrial habitat is necessary to maintain the amphibian diversity.

PRESENCE OF SIDEROPHORES IN LICHEN MYCOBIONT ISOLATES FROM DIFFERENT SUBSTRATES. Michele R. Carter, Eugene V. Gourley, and Judy H. Niehaus¹, Dept. of Biol., Radford Univ., Radford, VA 24142. Lichens represent a symbiotic relationship between an alga and fungus, in which the phycobiont provides photosynthate to the mycobiont. The contribution of the mycobiont is less clear, but it is widely presumed that it contributes water and dissolved minerals, such as iron. Some fungi, under iron-limiting conditions, produce low-molecular weight compounds called siderophores which solubilize iron and return it to the fungus. We proposed to look for siderophore production by the fungal components of lichens. A total of 90 lichens were collected from three different substrates. Thirteen mycobionts were purified from the Tuscarora Sandstone, 15 from the Rosehill Sandstone, and 18 from concrete. The mycobionts were grown in pure culture and tested for siderophore production in iron limited media. None of the fungi produced siderophores on Grimm-Allen medium, probably because growth was poor. On Hagem's medium supplemented with thiamine, however, one of the Rosehill Sandstone isolates was positive for siderophore production, and a control sample of *Cladonia cristatella* (ATCC #18271) was also positive. Thus, at least some fungal components of lichens produce siderophores. ¹(Supported in part by a grant from the Radford University Foundation to Judy H. Niehaus)

REPEATED SEQUENCES IN CODING AND NON-CODING REGIONS OF MAIZE UBIQUITIN GENE UBI-2. Alan H. Christensen, Dept. of Biol., George Mason University, Fairfax, VA 22030. A genomic clone encoding the highly conserved protein ubiquitin was isolated from a maize genomic library. The UBI-2 gene encodes a transcript of 2.1 kb as determined by Northern blot analysis. A 5.2 kb transcript is also detected by a gene-specific probe in RNA from plants subjected to thermal stress. This transcript represents the 2.1 kb mature transcript plus a 3.1 kb intron which is inefficiently processed following thermal stress. Sequence analysis indicates that the protein coding region consists of seven direct 228 bp repeats encoding the 76 amino acid ubiquitin protein. The nucleotide sequence of coding-region repeats may vary by 17.1%; however, all seven repeats encode the identical protein sequence. The UBI-2 intron also contains a repeated sequence. The sequence is about 136 bp in length and is repeated at least 11 times in tandem, but is present at low copy number in the maize genome.

PARASITISM OF ORANGESTRIPED OAKWORM, ANISOTA SENATORIA (J. E. SMITH) (LEPIDOPTERA: SATURNIIDAE), LIFESTAGES IN THE URBAN LANDSCAPE. M. A. Coffelt and P. B. Schultz, Dept. of Entomology, Va. Polytech. Inst. and State Univ., Hampton Roads Ag. Exp. Stn., Virginia Beach, Va. 23455. Identification and effectiveness of native parasites attacking A. senatoria populations is necessary for developing a biological control program. Egg parasitism by Tetrastichus spp. averaged 0.8% (1988-89), and Trichogramma minutum (Riley) 0.01%. Larval parasitism by Hyposoter fugitivus (Say) averaged 9.8% (1987-89), and a partial second A. senatoria generation in 1989 averaged 15.7% parasitism. Brachymeria ovata (Say) parasitized 1.1% of A. senatoria larvae in 1987-88. Hyperparasitism of H. fugitivus by Ceratosticra meteori (Burks) averaged 20% (1988-89), and 0.65% (1989) by Gelis tenellus (Say). Perilampus hyalinus (Say), a hyperparasite of H. fugitivus, emerged from 0.22% of host pupae (1986-88). Pupal parasitism by the tachinid fly Lespesia anisotae (Webber) averaged 11.7% (1986-89). Collections of Tetrastichus spp., B. ovata, and C. meteori from A. senatoria eggs and larvae represent new host records.

DEMOGRAPHIC PATTERNS OF A FRESHWATER FISH (GAMBUSIA MANNI) IN A VARIETY OF ENVIRONMENTS: PRELIMINARY ANALYSES FROM ANDROS ISLAND, BAHAMAS. Sheilah Dols and Luther Brown, Dept. of Biol., George Mason Univ. Fairfax, VA 22030. Recent studies suggest that male mosquitofish (Gambusia manni) vary their life history patterns in response to the structure of their local population. For example, laboratory analyses indicate that juvenile males are capable of delaying maturity until they are larger than the adult males that they encounter. Females do not show such a pattern. Our studies are designed to examine this effect in wild populations and reveal ecological correlates of the life history patterns of different populations. Andros Island has diverse freshwater bodies that support mosquitofish. These range from large volume, very deep, environmentally stable Blueholes to low volume, very shallow, highly unstable ponds and ditches. We sampled the fish populations in five habitats of each type in January, 1990. Sex ratios were always strongly skewed, with a great excess of females and juvenile fish, but Bluehole populations always had a greater proportion of males than did ponds and ditches. Both sexes were significantly larger in Blueholes than in ponds and ditches. Possible interpretations of these patterns are discussed.

ACUTE HISTOPLASMOSIS IN A VIRGINIA BIOLOGIST FOLLOWING WORK IN A BAT CAVE IN BELIZE. Ralph P. Eckerlin, Natural Sciences Div., Northern Virginia Cmnty. Col. Annandale, Va. 22003. Histoplasmosis is caused by inhalation of spores (conidia) of Histoplasma capsulatum, a fungus which thrives in soils enriched by the feces of birds or bats. One week after returning home from Belize in Central America where he visited caves inhabited by bats, a Virginia biologist began to experience symptoms of lower respiratory disease. Symptoms included cough, chest pain, fever, headache, extreme fatigue and myalgia. When symptoms persisted for a week, a physician was seen. No diagnosis was made initially but a chest x-ray was taken and a course of tetracycline begun. Symptoms persisted. The x-ray showed numerous nodules in the lungs. Physical examination, blood, and urine tests were unremarkable. A presumptive diagnosis of histoplasmosis was made based on the patient's recent history of being in a bat cave and the nodular nature of the pulmonary lesions. Diagnosis was confirmed by a positive immunodiffusion gel test for Histoplasma capsulatum. Follow-up at 3 and 6 months indicated no residual symptoms and a regression, but not disappearance of the lung nodules. Total cost of this episode was \$1371.44.

THE PARASITE CAPILLARIA CONTORTA (NEMATODA: CAPILLARIIDAE) A SOURCE OF WINTER MORTALITY IN BLUE JAY POPULATIONS. Ralph P. Eckerlin, Natural Sciences Div., Northern Virginia Cmnty. Col., Annandale, Va. 22003. During 1967-1969 an epizootic in blue jays, Cyanocitta cristata, occurred in Connecticut associated with infection with the nematode, Capillaria contorta. The birds exhibited gaping, swallowing difficulties, weight loss, weak flight and apathy. Sixty sick, dying and dead birds had a 100% prevalence of infection with C. contorta. The mean intensity of infection was 16 worms per infected bird. Twelve randomly collected blue jays had a prevalence of 93% and a mean intensity of 6 worms. The nematodes were primarily localized in the buccal cavity mucosa or in the buccal and esophagus mucosa. A white, caseous diphtheritic membrane was associated with the presence of the worms. Peak mortality occurred during January, February and March, the colder months of the year. It is believed that the nematode interferes with feeding. When stressed by cold and reduced food supplies in the winter, many blue jays died. Capillaria contorta has now been found in blue jays in Virginia where 5 of 7 birds were infected. Two of the blue jays died of their Capillaria infections.

THE EFFECT OF IMMIGRATION ON ISLAND COLONIZATION AND POPULATION PERSISTENCE OF ORYZOMYS PALUSTRIS ON THE BARRIER ISLANDS OF VIRGINIA. Elizabeth A. Forys & Raymond D. Dueser, Dept. of Environmental Science, The Univ. of VA, Charlottesville, VA 22903. Immigration is hypothesized to be an important mechanism for island colonization and population persistence. Immigration rates were estimated for Oryzomys palustris, the semiaquatic marsh rickerat, on three adjacent islands, in the Virginia Coast Reserve. During a mark-recapture program conducted from May to August, 1989, only 11 of 101 island residents permanently migrated to the other islands. Water provided an important barrier in O. palustris movement patterns. The sex ratio and age structure of emigrants were statistically indistinguishable from the resident population. All immigrations proceeded from an island of high density, to islands of lower density. The population on the high density island exhibited significantly smaller home ranges, male biased sex ratios, and increased habitation of sub-optimal habitat.

CELL MONOLAYER FORMATION IN SHEAR FIELDS. Stephen Gallik, Dept. of Biol. Sci., Mary Washington College, Fredericksburg, VA. 22401. Because shear stress has been shown to affect various biochemical and behavioral parameters of endothelial cells, such as prostacyclin synthesis, cell permeability and cell shape, shear stress is generally regarded as an important feature of the environment in which endothelial cells function *in vivo*. A parallel-plate type of flow channel has been developed to investigate the dynamics of cell monolayer formation in the presence of shear stress *in vitro*. The flow channel is a rectangular glass capillary tube with an aspect ratio of 0.05. Custom-designed manifolds are used to connect the channel to a recirculating perfusion system. Experiments demonstrate that the pressure-flow relationship of the channel is linear through a shear stress of at least 75 dyn/cm², suggesting a laminar flow at these flow rates. Balb/3T3 cell monolayers have been successfully grown under both stagnant and low-flow conditions, demonstrating the suitability of the channel for cell growth.

THE EFFECTS OF GHF ON RAS p21 PROTEIN EXPRESSION IN MORRIS HEPATOMA 7777 CELLS. D. W. Hankley* and R. Barra. Dept. of Biological Sciences, Mary Washington College, Fredricksburg, VA 22401.

Activated ras oncogenes have been detected in Morris hepatoma 7777 cells by the presence of its characteristic 21 kD protein product, p21. The techniques that were used to verify the presence of p21 in cell samples included immunoblot and ELISA. Polyclonal antibodies specific for the p21 were used in conjunction with alkaline phosphatase labeled IgG and the appropriate substrate to give a positive identification of the p21 band. Similarly, the polyclonal antibodies were used in the ELISA assay in conjunction with peroxidase labeled IgG and its appropriate substrate to give a color reaction that could be analyzed spectrophotometrically.

Glycyl-histidyl-lysine (GHL) has been shown to have growth stimulatory effects on a number of different cell types, including hepatocytes and hepatoma cells. In this study, the effect of GHL on p21 was investigated. The results indicate that incubation of Morris hepatoma 7777 cells with 2 ng/ml GHL increased the p21 present in the cells.

SURVIVAL AND GROWTH RATES OF TWO INTERTIDAL SNAILS (Tectarius muricatus and Echininus nodulosus) ON CALABASH BAY, BAHAMAS. Mercedes Huffman and Luther Brown, Dept. Biol., George Mason Univ., Fairfax, VA 22030. The survival and growth of false prickly winkles (E. nodulosus) and knobby periwinkles (T. muricatus) were investigated by capturing, measuring, marking and releasing all snails in a 36m² area of rocky intertidal zone. One year later, the snails were recaptured and measured. Size specific survivorship declined uniformly for all sizes of E. nodulosus. T. muricatus had higher survivorship at smaller sizes, and rapidly decreasing values for larger snails. Mortality rates for both species were minimal for medium sized snails. Individuals of both species varied greatly in their annual growth rates, but the tendency was for intermediate sized E. nodulosus and the smallest T. muricatus to show the greatest annual growth. Estimates based on the maximum and minimum median annual growth give ranges in the age of the largest E. nodulosus of 16-32 years, and the largest T. muricatus of 10-156 years.

EFFECTS OF MATERNAL AGE, MATERNAL PARITY, AND PATERNAL GENOTYPE ON REPRODUCTIVE SUCCESS IN CBA FEMALE MICE. M. J. Jong and A. F. Conway, Dept. of Biol., Randolph-Macon Col., and C. M. Conway, Dept. of Biol., Va. Commonwealth U., Richmond, Va. 23284. Litter size at birth, number of offspring surviving to weaning, and percent of offspring surviving to weaning were measured in female CBA/J mice at ages of 2, 4, or 6 months, during first, second, or third pregnancy, and following mating with CBA/J or DBA/2J males. Litter size and postnatal survival were significantly reduced in females over 4 months of age. Litter size and postnatal survival increased with maternal parity in 6 month old females. Matings with CBA/J or DBA/2J males produced similar litter sizes except during first pregnancies in 6 month old females, in which DBA/2J matings produced significantly smaller litters than CBA/J matings. Offspring of DBA/2J-mated females had significantly higher survival to weaning than offspring of CBA/J-mated females. Offspring of a CBA/J-mated female had significantly higher survival to weaning if the preceding pregnancy in that female had been produced by a DBA/2J mating. In general, maternal age and parity most strongly affected litter size at birth while paternal strain most strongly affected postnatal survival of offspring. (partially supported by a Cheney Research Professorship to A. Conway)

EFFECTS OF PARITY ON THE DISTRIBUTION OF MATERNAL IMMUNOGLOBULIN A IN THE PREGNANT MOUSE UTERUS. Kathleen M. Kennedy, H. Carl Palmer, Jr.*, and Carolyn M. Conway, Dept. of Biol., Va. Commonwealth Univ., Richmond, VA. Immunoperoxidase staining was used to localize immunoglobulins (Igs) G, A, or M in 12.5 day implantation sites of CD-1 mice of equivalent age (8 months) but different parity levels (1st, 2nd, 3rd pregnancy). Staining for all three Igs was observed in both maternal areas (myometrium, decidualized myometrium, decidua basalis, decidua capsularis, uterine epithelium, uterine lumen) and extraembryonic structures (Reichert's membrane, inner and outer yolk sacs, placenta). Significant parity-related increases in IgA+ staining patterns were found in the decidualized myometrium, decidua basalis, decidua capsularis, and inner yolk sac. In addition both the average number of trophoblastic giant cells present at the placenta-decidua basalis junction and the average number of these cells which contained small numbers of IgA+ granules increased significantly with parity. These parity-related increases in IgA+ staining at or near maternal-fetal barriers are correlated with a previously demonstrated parity-related increase in reproductive success in older females. (Supported by the Undergraduate Research Grant Program of VCU)

HABITAT UTILIZATION IN AN INSULAR POPULATION OF DELMARVA FOX SQUIRRELS (*SCIURUS NIGER CINEREUS*). Bonnie J. Larson, Dept. of Envi. Sci., Univ. of Va., Charlottesville, Va. 22903, & R. D. Dueser, Dept. of Envi. Sci., Univ. of Va., Charlottesville, Va. 22903. The relationship between plant (food) resource availability, forest structure and relative abundance of the endangered Delmarva fox squirrel was investigated on Chincoteague National Wildlife Refuge to evaluate the importance of habitat quality on fox squirrel distribution. Fox squirrel abundance was positively correlated with larger overstory trees, higher densities of soft-mast producing hardwoods and higher plant species diversity. Estimated home range areas were small (1.4 - 12.8 ha) compared to reports for other eastern subspecies of fox squirrel (9 - 20 ha), particularly in areas with highest relative abundance. This result may be a consequence of high food resource availability and high squirrel density. These results suggest that the genetic consequences of limited movement may be the most important immediate concern in evaluating the long-term viability of this insular population.

AN ANALYSIS OF EXTERNAL FEATURES AS PREDICTORS OF REPRODUCTIVE STATUS IN SMALL MAMMALS. Kenneth W. McCravy and Robert K. Rose, Dept. Biol. Sci., Old Dominion Univ., Norfolk, VA 23529-0266. Predictions of true reproductive condition of specimens of nine populations of seven species of rodents based on condition of external reproductive features (nipple size, condition of pubic symphysis, vaginal condition, and testis position in males) were compared with the determination of true reproductive condition based on results of necropsy of the same animals. Accuracy of predictions of true reproductive status of females ranged from 58-85% correct, while that of males ranged from 87-94% correct. Overall, nipple size was the best of the three predictors among females. Predictive equations generated with logistic multiple regression analysis, using combinations of external features and body measurements, produced substantial improvement in accuracy of predictions of true reproductive status in females of three species from Manitoba, Canada. Results indicate that external features are more reliable indicators of true reproductive status in males than in females, and that, in females, the inclusion of body weight in a predictive equation may significantly improve predictive usefulness, especially in females of small-bodied, seasonally breeding species.

INTERRELATIONSHIPS OF MAST CROPS, WHITE-TAILED DEER, AND OTHER MAST CONSUMERS. William J. McShea*, Department of Conservation, National Zoological Park, Conservation and Research Center, Front Royal, VA. 22630. Since 1986 we have measured, within a 340 ha study area at the Conservation Center, the production of mast, the movements and behavior of white-tailed deer relative to the mast crop, and the distribution and survival of small mammals within mast-producing areas. The mast crop has been variable, with the largest mast crop in 1989 and the smallest in 1987. With the exception of 1987, the 10-12 white-tailed deer radiotracked each year increased their home ranges during the mast fall. Significantly more deer fecal pellet groups were located within oak stands during the mast fall, and the number of fecal groups seen was positively correlated with the amount of acorns on the ground. Observations of deer show that 50% of the foraging during September and October involved acorns. The average consumption rate during the mast-fall was 0.75 acorns/minute of searching. This resulted in approximately 1 kg acorns/deer/day consumption of the mast crop, and 25-45% of the yearly acorn crop on the ground being consumed by deer. Bumper mast crops did not result in increased mast on the ground in November, only increased foraging on mast by deer during October.

MOVEMENT PATTERNS OF TWO SPECIES OF FRESHWATER TURTLES IN AN URBAN VIRGINIA LAKE.

Joseph C. Mitchell, Dept. of Biology, University of Richmond, Richmond, VA 23173

Sexual differences in seasonal activity and movement were studied in syntopic populations of the painted turtle, Chrysemys picta, and the stinkpot, Sternotherus odoratus 1979-1981 in Laurel Lake, Henrico Co. and Grassy Swamp Lake, Hanover Co., VA. Males of both species were demonstrably more active in spring and fall but females were more active during the nesting season in summer. Distances moved by male painted turtles averaged longer in spring (64.4±12.5 m) but shorter in fall (70.3±18.9 m) than that moved by females (S: 50.8±7.9 m; F: 75.0±18.9 m). The differences were insignificant, however. Male stinkpots moved significantly greater distances in spring (31.3±10.8 m) than females (zero movement). The differences between males (41.2±13.9 m) and females (30.0±8.9 m) in the fall were insignificant. Female painted turtles moved significantly greater distances than males during the nesting season, whereas the reverse was true for stinkpots. These results are applied to the predictions of a model relating movement and activity patterns to life history patterns in freshwater turtles.

(Supported by grants from T. Roosevelt Mem. Fund, Sigma Xi, SSAR, VA Acad. Sci.)

EFFECTS OF BARRIERS TO GENE FLOW ON THE POPULATION GENETICS OF MAMMALS. Nancy D. Moncrief, Virginia Museum of Natural History, 1001 Douglas Avenue, Martinsville, VA 24112. Migration and gene flow are thought to be the processes that prevent genetic divergence among populations. As dispersal among populations increases, variation among populations decreases, and genetic homogeneity increases. Bodies of water, such as major rivers and back-island bays, are thought to serve as barriers to gene flow in some mammals, resulting in greater genetic variation among populations separated by the water barrier. Biochemical techniques were used to assess genetic variability in several rodent species that are predicted to have different abilities to disperse across bodies of water. Empirical results will be reported for 1) populations of tree squirrels that are separated by the Mississippi River and 2) populations of rice rats and white-footed mice that occur on the barrier islands and the adjacent mainland of Virginia's Eastern Shore. In both cases, patterns of genetic variation were found that support predictions about the relative dispersal ability of these species.

DEMOGRAPHIC FEATURES OF SHREWS IN TWO CONTRASTING HABITATS. John F. Pagels & Sandra Y. Erdle, Dept. of Biol., Va. Commonwealth Univ., Richmond, VA 23284, & Joseph C. Mitchell, Dept. of Biol., Univ. of Richmond, Richmond, VA 23173. One hundred and sixty three shrews were captured in oldfield/clearcut (CCH) and forest habitats (FH). Cryptotis parva and Sorex longirostris were captured in greatest numbers in the CCH, 92 percent of 77 captures, and 74 percent of 31 captures, respectively. Captures of Blarina brevicauda, 36, and Sorex hoyi, 19, were approximately the same for each habitat. Numbers of male S. hoyi and S. longirostris were greater than numbers of females captured, but the captures of each sex by habitat were not different from the expected for any of the four species. Age of specimens taken in each habitat did not differ from the expected for any of the species. C. parva, S. longirostris and B. brevicauda were not captured in the FH in coldest winter months. In the mid-Atlantic Piedmont, forest fragmentation and man-made edge and field situations do not negatively impact these species providing that suitable microhabitat is available.

SPECIES COMPOSITION AND SEASONAL SURFACE ACTIVITY OF TERRESTRIAL VERTEBRATES IN FIVE NORTHERN VIRGINIA PIEDMONT NATURAL COMMUNITIES. ¹Christopher A. Pague, ²J. C. Mitchell, ³D. A. Young, and ¹K. A. Buhlmann, ¹Dept. Conserv. & Rec., Div. of Natural Heritage, 203 Governor Street, Suite 402, Richmond, VA 23219, ²Dept. of Biology, University of Richmond, VA 23173, ³POB 1278, Cape Coral, FL 33910. Collections of terrestrial vertebrates for 13 months from five representative plant communities in Prince William Forest Park resulted in 1,109 captures. 81% of the captures were of 15 amphibian species; 5% of the captures were of 7 reptile species; and 14% of the captures were of 8 small mammal species. The seasonal movements of salamander species were spring/fall, spring, or fall. Reptile movements were either late spring/summer or spring/fall. Small mammal movements were generally year round, especially for shrews, with peaks during the spring and fall. We observed species-specific differences in captures among sites with smaller numbers in the more xeric sites, particularly the Virginia pine association. The vertebrate fauna is judged to be depauperate, though possibly recovering, from past human land use patterns.

PROGRESS REPORT ON ESTABLISHMENT OF A BASELINE SIPHONAPTERAN INVENTORY FOR VIRGINIA. Harry F. Painter and Ralph P. Eckerlin, Nat. Sci. Div., Northern Virginia Cmty. Col., Annandale, VA 22003. By 1982, 28 species were known from Virginia. Unpublished records added Corrodopsylla hamiltoni, Euhoplopsyllus glacialis affinis, Peromyscopsylla scotti and Polygenis gwyni. We have previously reported 3, and herein report 7 new state records: Catallagia borealis, Ceratophyllus vison, Megabothris asio asio, M. quirini, Nearctopsylla genalis genalis, Peromyscopsylla catatina and Tamiophila grandis. There are 3 other species that may be in the state, but have not been collected to date. Extirpations and introductions will assuredly occur as habitats change. At least 3 now on the list have not been found for from 20 to 50 years. An introduced flea from the mid-west, E. g. affinis, is included although it might not be established in the state. The baseline inventory for the state of Virginia now includes a total of 42 species. Supported in part by a grant from the Virginia Academy of Science.

IgG CONCENTRATIONS IN MATERNAL SERUM AND AMNIOTIC FLUID FROM CBA FEMALE MICE MATED WITH CBA OR DBA/2 MALES. C. E. Phillips and A. F. Conway, Dept. of Biol., Randolph-Macon Col., Ashland, Va. 23005 and C. M. Conway, Dept. of Biol., Va. Commonwealth U., Richmond, Va. 23284. The relationship between prenatal immunoglobulin transfer from mother to fetus and early postnatal survival of offspring was evaluated using CBA/J female mice mated with either CBA/J or DBA/2J males. Offspring of CBA/J-mated females have significantly lower early postnatal survival than offspring of DBA/2J-mated females. The IgG concentration in maternal serum and amniotic fluid was determined by ELISA. No significant difference in mean serum IgG concentration was found between CBA/J- and DBA/2J-mated females. Mean amniotic fluid IgG concentration in CBA/J-mated females was significantly higher than in DBA/2J-mated females. The amniotic fluid IgG concentrations in CBA/J-mated versus DBA/2J-mated females were the reverse of those predicted by the hypothesis that early postnatal survival in mice depends on IgG transferred from mother to fetus during late gestation. The observed difference in amniotic fluid IgG concentrations may have resulted from removal of some IgG molecules by binding with alloantigens on placental or yolk sac cells during transfer from maternal serum to the fetus in DBA/2J-mated females. (partially supported by a Chenery Research Professorship to A. Conway)

EFFECT OF GASTROPOD SHELL EXCHANGES, EXCHANGE POSITION, AND EXCHANGE CHAIN PARTICIPATION ON GROWTH RATE OF A LAND HERMIT CRAB. Alice Anne Potts and Elsa Q. Falls, Dept. of Biol., Randolph-Macon Col., Ashland, VA 23005. An investigation was conducted with the land hermit crab, Coenobita clypeatus, to determine whether vacancy chain principles could be applied to this species. Eighty specimens were housed in environmental chambers for four months in groups of four and eight and individually, some with extra Cittarium pica shells and some with no extra shells. Crabs in chains of four with larger shells available increased the most in weight and length while crabs without access to larger shells decreased in weight and length, as did individual crabs with extra shells. Changes in length and weight were affected by shell change possibility, chain length, chain position, total body length, and body weight.

MICROTUS PENNSYLVANICUS AND M. PINETORUM DENSITIES AND DIFFERENTIAL RESPONSIVENESS TO A TERRESTRIAL PREDATOR MODEL. Carla Ritzler-Old' and Terry L. Derting, Dept. of Biol., Hollins Col., Roanoke, VA 24020. Distinct differences exist in the multi-year density cycles of M. pinetorum (pine vole) and M. pennsylvanicus (meadow vole). This may be partially due to differential predation pressure and/or predator avoidance abilities of these two species. Wild populations of pine voles have relatively stable densities in comparison to those of meadow voles, suggesting that pine vole populations may be less affected by predators. We examined the behavioral responsiveness of individuals of these species to a terrestrial predator model, hypothesizing that pine voles would be less affected by the model than would be meadow voles. Individuals of both species exhibited freezing behavior in response to movement of the model. However, meadow voles remained immobile for shorter periods of time, and exhibited fewer behavior modifications after exposure to the model, than did pine voles. These results suggest that meadow voles are less responsive to a terrestrial predatory threat than are pine voles. Consequently, meadow voles may be more vulnerable to terrestrial predators and, their population dynamics more affected by predatory influences, than those of pine voles.

THE FATE OF INTACT ABCISCED FRUITS OF THE FLOWERING DOGWOOD, CORNUS FLORIDA. Christopher F. Sacchi, Dept. of Environmental Sciences, Univ. of Va. and Blandy Experimental Farm, Boyce, VA 22620. I experimentally studied the fate of both intact abscised fruits and dispersed seeds without their fruits of the flowering dogwood, Cornus florida. Experiments were designed to test the effects of factors influencing seed predation and the survival of seeds on the forest floor. I examined the response of small mammals including chipmunks or white footed mice to differing densities of fruits, to the presence or absence of the fruit on the seed, and to the presence or absence of leaf litter where seeds rested. Seed predation by small mammals was high from week to week regardless of treatment. The response of seed predators to different seed densities was not strong. Leaf litter on the forest floor played an important role in protecting seeds from predators.

IN VITRO STIMULATION OF VITELLOGENESIS IN THE IXODID TICK, *HYALOMMA DROMEDARII*. Martin E. Schriefer and Daniel E. Sonenshine, Biomedical Sciences, Old Dominion University, Norfolk, Va. 23508. Antibody against egg yolk protein, vitellin (VN) has been utilized in western blot and ELISA systems to quantitatively and qualitatively assess tissue vitellin and vitellogenin (VG). Virgin tissues displayed trace levels of VG or VN. Levels of VG and VN increase in ovary, hemolymph and fat body as a function of mating and preovipositional development in adult females. *In vitro* incorporation of radio-labeled amino acids into immunoprecipitable protein was monitored to assess *de novo* synthesis. Of the above tissues, only fat body displays *in vitro* VG or VN synthesis. Extracts of synganglion from mated females stimulated VG synthesis in cultured virgin fat body 35 fold as compared to control cultures. 20-OH Ecdysone and Juvenile Hormone III did not stimulate *in vitro* VG synthesis by virgin fat body under tested conditions.

SPATIAL PATTERNS IN SNAKES - BEHAVIORALLY DETERMINED OR RESOURCE DRIVEN? Terry D. Schwaner, Virginia Museum of Natural History, Martinsville, Va. 24112. Spatial patterns of individuals were studied in four island populations of tiger snakes (*Notechis ater*: Elapidae) in southern Australia. Within islands snakes were usually aggregated in areas of high densities of prey and/or cover. Differences in the dispersion patterns of snakes between islands were correlated with differences in the spatial distributions of critical resources. When one resource was "saturating" snakes were more highly associated with another that was "limiting." Random dispersion and enhanced displacement was observed on one island where the saturating resource provided both food and shelter and was also randomly distributed. The evidence was consistent with a hypothesis that resource densities were important determinants of dispersion and contributed to evolutionary divergences in these island populations. Interspecific, and inter or intra-sexual social, interactions probably played only a minor role in determining these spatial patterns.

PRODUCTION OF SIDEROPHORES BY MYCORRHIZAL FUNGI. Ann Shoosmith and Judy H. Niehaus, Dept. of Biology, Radford Univ., Radford, VA 24142. In environments where iron is limited or in the oxidized Fe^{+3} form, thus not accessible to organisms, various mycorrhizal fungi obtain iron through low molecular weight, iron solubilizing molecules called siderophores. Forty mycorrhizal fungi were grown in low iron Hagem's and Grimm-Allen media and tested for siderophores with 5mM ferric chloride. When iron binds to siderophores, a red color results. Positive samples were *Ustilago sphaerogena*, *Boletus edulis*, *Cladonia cristatella*, *Cladosporium sp.*, *Rhodotorula sp.*, *Lentinellus omphalodes*, *Suillus variegatus*, *Fusarium oxysporum*, *Aspergillus nidulans*, *A. leporis*, *A. oryzae*, *A. tamarii*, and *A. sojae*. Samples of *Suillus variegatus* (obtained from Kenneth Soderhall, University of Uppsala, Sweden) and *Cladonia cristatella* (ACTT #18271) were further analyzed after filtration and lyophilization. When UV-visible spectrometry was used, *Cladonia cristatella* showed a peak at 430 nm. *Suillus variegatus* showed two peaks at 463 nm and 405 nm. Thin-layer chromatography was used to further analyze the siderophores produced by *Suillus variegatus* by dissolving the siderophores in chloroform and using a buffer of 1-butanol: acetic acid: water (5:1:4). The two R_f values of .267 and .981 obtained may be due to protonated and unprotonated forms of the same siderophore or to two different siderophores. (Supported by a grant from the Radford University Foundation to Judy H. Niehaus.)

EFFECTS OF HANDLING AND PAIR MANAGEMENT ON JAPANESE QUAIL REPRODUCTION. Joseph P. Sullivan, Keith A. Grasman, and Patrick F. Scanlon, Dept. Fish. Wildl. Sci., VPI & SU, Blacksburg, VA 24061. Three experiments studied the effects of handling stress, pair bonding, and frequency of mating on reproduction in Japanese quail (*Coturnix coturnix*) when sexes were caged separately except during 90 min mating periods. In Experiments 1 and 2, 48 females and 48 males were randomized among four treatments: paired continuously (PC); daily with the same male (SP1D); daily with a different male (DP1D); and every third day with the same male (SP3D). In Experiment 3, 44 males and 44 females used in Experiments 1 and 2 were re-randomized among four treatments: PC; SP3D; paired continuously but handled as in SP3D (PCH); and every third day with a different male (DP3D). In Experiments 1 and 3, females were introduced into males' cages. Males were introduced in Experiment 2. In Experiments 1 and 2, the SP1D group laid fewer eggs. The SP1D and SP3D groups had fewer eggs with embryonic development. More eggs hatched from PC females than from other groups in both experiments. In Experiment 2, SP3D eggs had reduced hatchability compared to SP1D and DP1D. In Experiment 3, the SP3D group had fewer eggs laid, developing, or hatching. In conclusion, when sexes need to be housed separately, it is better to introduce females to males' cages on a daily basis and to rotate males among females.

FEMALE INDUCED REPRODUCTIVE INHIBITION OF FEMALE WHITE-FOOTED MICE (*PEROMYSCUS LEUCOPUS NOVEBORACENSIS*): VARIABILITY OF RESPONSE BY VIRGINIA MICE. C. R. Terman, Lab. of End. and Pop. Ecology, Biol. Dept., College of William and Mary, Williamsburg, Virginia 23185. Previous studies have shown that less than 3% of female *P. l. n.* born in a laboratory colony founded by mice trapped near East Lansing, Michigan, give birth by 150 days of age if, in addition to the male, an adult female is present. I examined this phenomenon in three experiments utilizing an outbred laboratory colony founded by adults captured near Williamsburg, Virginia. These experiments demonstrate that: (1) At least 22% of females reared from weaning in the presence of an adult bisexual pair reproduced by 90 days of age; (2) Females housed for 21-90 days of age with their parents or with stranger bisexual pairs and the housed with different bisexual pairs from 90-150 days of age had a significantly ($P < 0.05$) higher parity rate than those housed with the same pairs (parents or not); (3) Rearing young females from 21-90 days of age with individual adult females resulted in a significantly ($P < 0.01$) higher rate of reproduction after pairing with adult males than if reared alone. (Supported by the Thomas F. and Kate Miller Jeffress Memorial Trust.

COMPARISON OF ALCIAN BLUE AND COLLOIDAL IRON STAINING OF GLYCOSAMINOGLYCANS (GAGS) IN CHICK EMBRYO LIMBS. Suzanne R. Thornton¹, Mark Graves², Arthur F. Conway², and Carolyn M. Conway¹, ¹Dept. of Biol., Va. Commonwealth Univ., Richmond, VA, and ²Dept. of Biology, Randolph-Macon Col., Ashland, VA. Eight day old chick embryo hindlimbs were fixed with buffered paraformaldehyde-glutaraldehyde with or without Cetylpyridinium Chloride (CPC), dehydrated in ethanol, and embedded in glycol methacrylate. Sections (2.5 μ) were stained with either Alcian Blue (for 24 hrs) or Colloidal Iron (for 1 hr) at pH 4.0 for detection of GAGs. Some sections were pretreated with 0.1% trypsin prior to staining to determine if protein removal would enhance staining of GAGs. The ectoderm, basement membranes, mesenchyme, and cartilage extracellular matrix (ECM) and lacunae were evaluated for intensity of staining. Darker staining of the cartilage ECM and outer lacunae was obtained with Alcian Blue than with Colloidal Iron for limbs fixed in the presence of CPC. Trypsin pretreatment of sections of CPC-fixed material resulted in decreased staining of cartilage ECM and lacunae while slightly enhancing the staining of the ectoderm, basement membrane, and mesenchyme. Overall, Alcian Blue produced darker staining of the ECM whereas Colloidal Iron produced more distinct staining of cellular structures.

INSULIN HYPOLYCEMIA RAPIDLY INCREASES PHENYL-ETHANOLAMINE-N-METHYL TRANSFERASE (PNMT) IN THE RAT BRAIN. S.A. Wagers, T.D. Gbadebo*, J.K. Stewart*. Dept. of Biology, Virginia Commonwealth Univ., Richmond, Va 23284 Oscillation and immobilization stress, hypertension, and diabetes are associated with increased PNMT activity in the medulla/pons but not in the hypothalamus. In this study, male Sprague Dawley rats were sacrificed 4 hours after a single injection of saline or insulin (10 U/kg body wt., s.c.). Insulin significantly elevated PNMT activity in the medulla/pons and in the hypothalamus.

TISSUE	SALINE	INSULIN	p _≤
Medulla/pons	0.62 ± 0.08(7)	1.11 ± 0.16(7)	0.05
Hypothalamus	4.3 ± 0.41(9)	7.9 ± 0.64(5)	0.001

Values = mean ± S.E.M. pmol/ (60 min x mg protein)

The number of animals is in parentheses.

These findings suggest that insulin hypoglycemia is a potent and rapid stimulator of PNMT activity in the hypothalamus as well as the medulla/pons.

A METHOD FOR MEASURING RELATIVE INTRACELLULAR AND EXTRACELLULAR ORGANO-FLUORINES IN CELL CULTURE BY NMR SPECTROSCOPY. G. Clifford Walton, Anne Lund, and Paul H. Mueller, Depts. of Biology and Chemistry, Hampden-Sydney College, Hampden-Sydney, VA 23943. Nuclear Magnetic Resonance Spectroscopy using ¹⁹F organic compounds has recently been used to determine membrane potentials of human red blood cells. In this work, the organofluorine trifluoroacetamide, was used with yeast cells (*Saccharomyces cerevisiae*) and mammalian L-929 cells in culture. Spectra were taken of medium and trifluoroacetamide alone and of medium, trifluoroacetamide, and cells at various times from time 0 to 40 hours of both cell types. Dual peaks were observed that are attributed to intra and extracellular environments of the ¹⁹F nuclei in both cell systems, with the clearer resolution with the yeast cells. An apparatus was devised for growing the mammalian cells directly in the NMR tube.

PRELIMINARY RESULTS ON THE USE OF THE HORN SHARK AS A TEST ANIMAL IN CHEMICAL CARCINOGENESIS STUDIES. A.G. Wilson*, P.A. Couvillion*, D.C. Abel, and R. Barra. Dept. of Biological Sciences, Mary Washington College, Fredericksburg, VA 22401. Elasmobranch fishes apparently exhibit a very low incidence of neoplasia compared to both bony fishes and other, higher vertebrates. Using the horn shark (*Heterodontus francisci*) maintained in a small recirculating seawater system, we tested the tumor protection hypothesis. We made intraperitoneal injections of either the known hepatocarcinogen methylmethane sulfonate (MMS; 100 mg kg⁻¹ body wt.) or saline (sham) bi-weekly for up to 6 months. Serum gamma glutamyl transferase (GGT) and alkaline phosphatase (AP) levels obtained from monthly samples were not significantly different among the experimental groups and controls. Histological examination of the liver showed uniform parenchymal cells with distinct nuclei and clear cytoplasm containing large amounts of lipid in a control whereas the liver of an MMS-treated animal exhibited areas of apparent degeneration with an infiltration of macrophages and decreased quantities of lipid material. This difference may involve a toxic rather than carcinogenic effect. Although there are no clear indications of a carcinogenic effect after 6 months, the results indicate that longer exposure studies at less toxic levels should be performed. (Supported by the Horsely Cancer Research Fund of the VAS and Mary Washington College student and faculty development grants.)

Botany

HIGH ELEVATION CONIFEROUS FORESTS IN VIRGINIA. H. S. Adams, Arts and Sciences, D. S. Lancaster Cmnty. Col., Clifton Forge, VA 24422, & S. L. Stephenson, Dept. of Biol., Fairmont State Col., Fairmont, WV 26554. Red spruce (*Picea rubens*), the most characteristic species of the subalpine coniferous forests which occupy higher peaks and ridges of the Appalachian system from Maine to Tennessee and North Carolina, has a rather restricted distribution in the mountains of central and southwestern Virginia. The approximate lower limit for red spruce in Virginia is 975 m, although well-developed spruce communities generally do not occur at elevations below 1200 m. Indigenous communities of red spruce exist at no more than about a dozen localities, and at only two of these (Mount Rogers and Whitetop Mountain) is the species relatively abundant. Balsam fir (*Abies balsamea*), commonly present as a codominant species with red spruce in the northern Appalachians, reaches its southernmost limit in the Blue Ridge of northern Virginia, whereas Fraser fir (*A. fraseri*), which has a comparable ecological role in the southern Appalachians, reaches its northernmost limit on Mount Rogers. Values of basal area and density (stems ≥ 10 cm DBH) reported for these communities range from 36 to 56 m²/ha and from 390 to 1320 stems per ha, respectively.

SPATIAL PHYTOPLANKTON RELATIONSHIPS IN THE LOWER JAMES RIVER. Nancy L. Bland and Harold G. Marshall, Dept. of Biological Sci., Old Dominion Univ., Norfolk, Va. 23529-0266. Results of a three year study below the fall line indicated two major regions that were characterized by phytoplankton composition. These were an oligohaline region dominated by fresh water diatoms and chlorophytes and a downstream oligo-mesohaline region dominated by estuarine species. There was a transition downstream of Skeletonema potamos and Cyclotella striata to Skeletonema costatum and Cyclotella caspia as dominant flora. Moving downstream there was a decrease in nutrient levels and phytoplankton abundance, with greatest development of seasonal blooms just below the fall line. The picoplankton, composed of mainly cyanobacteria, also decreased in abundance downstream. (Supported by the Virginia State Water Control Board and EPA.)

AN ANALYSIS OF THE SEEPAGE SWAMP COMMUNITIES AT ELKO, WITH COMMENTS ON SEVERAL RARE PLANTS. Christopher A. Clampitt, Michael L. Lipford, & J. Christopher Ludwig, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA 23219. The Elko area of Eastern Henrico County has been of interest to botanists for decades because of the assemblage of mountain/coastal plain disjuncts that occurs in the seepage swamps. The Commonwealth of Virginia owns 2400 acres in this area, and over the past few years has been developing a Master Plan for the tract. As part of preliminary work, Natural Heritage scientists conducted a study to locate rare species and unique or exemplary natural communities on the Elko tract in 1989. Quantitative data were collected on three of the seepage swamps, with presence data noted for a fourth. Three of the seeps were acidic, while a fourth was circumneutral. Seven species of rare plants were identified during the study, six of which inhabit seepage areas. Of these, three occur within the acidic seepage swamps, but none grow within the circumneutral one.

THE UPLAND PLANT COMMUNITIES OF SEASHORE STATE PARK. Christopher A. Clampitt, Virginia Department of Conservation and Recreation, Division of Natural Heritage, Richmond, VA 23219. Seashore State Park is a 2000-acre island of natural habitat surrounded by the urban portion of Virginia Beach. During 1989, quantitative data were collected on the plant communities of Seashore. Multivariate analysis of these data identified eight upland community types: Foredune (*Ammophila breviligulata* - *Cakile edentula*), Dune Grassland (*Panicum amarulum* - *Iva imbricaria*), Maritime Grassland (*Uniola paniculata* - *Panicum amarulum*), Maritime Forest (*Pinus taeda* / *Quercus virginiana*), Mesic Forest (*Pinus taeda* / *Acer rubrum* / *Persea borbonia*), Dune Forest (*Carya* spp. - *Pinus taeda* / *Symplocos tinctoria*), Dune Woodland (*Pinus taeda* / *Quercus nigra* / *Sassafras albidum*), and Dune (*Hudsonia tomentosa* - *Cyperus grayi*). Several of these community types are rare in the Commonwealth. The structure, composition, environmental setting and interrelationships of these communities will be discussed.

ADDITIONS TO THE FLORA OF THE COLLEGE WOODS, COL. OF WILLIAM AND MARY, JAMES CITY CO., VA. Virginia E. Crouch* & Donna M. E. Ware, Dept. of Biol., Col. of William and Mary, Williamsburg, Va. 23185. A floristic study of the undeveloped properties of the Col. of William and Mary was conducted in 1989 - 90 to supplement a previous floristic study of the College Woods completed in 1969. Approximately 600 species were collected, representing 330 species of which 120 are species newly discovered in the study area. When these are integrated with the existing list, the total number of species known from the undeveloped College properties is 672. Sixteen of the newly discovered species are here first reported for James City Co., and two are new to the Peninsula. Additions to the College Woods flora include *Hexalectris spicata*, a rare orchid; *Panax quinquefolius*, a species listed as threatened in Virginia; and *Isotria medeoloides*, an orchid listed federally and by the State of Virginia as endangered. Vegetation was analyzed for 12 stands representing six general forest types in the study area. Four discrete stands having beech as a major canopy dominant were described, as were representatives of the remaining important types of plant communities on the College properties.

WOOD ANATOMY OF FLUEGGEA SUFFRUTICOSA (EUPHORBIACEAE). Jeffrey Dupree and W. John Hayden, Dept. of Biol., Univ. of Richmond, Richmond, Va. 23173. *Flueggea suffruticosa* is a species of understory shrubs widely distributed in temperate eastern Asia and classified in sect. *Flueggea* subsect. *Geblera*. Wood of *F. suffruticosa* is characterized by: distinct growth rings; pores mostly solitary and circular; moderately short vessel elements with simple perforation plates, moderately inclined end walls, and alternate intervascular pits; fiber dimorphism, including many septate libriform fibers with gelatinous walls and scattered patches of non-septate fiber-tracheids with lignified walls; homocellular square to erect uniseriate rays; heterocellular multiseriate and polymeric rays; and axial parenchyma restricted to a few scanty paratracheal cells. Wood *F. suffruticosa* differs from that of *F. neowawraea* and *F. flexuosa* (both of subsect. *Flueggea*) in having more solitary pores, dimorphic fibers, and strictly circular vessel-ray pits, thus supporting their classification in separate subsections of the genus.

The Current Status of American Chestnut Research. John Rush Elkins, Chemistry Department, Concord College, Athens, WV 24701 and Gary J. Griffin, Department of Plant Pathology, Physiology, and Weed Science, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061.

in its natural setting. The large, surviving trees are probably living because of a low level of blight resistance which allows time for dsRNA-based hypovirulence to debilitate the blight fungus. We are attempting to increase the blight resistance by crossing trees from various locations. We are also pursuing a biochemical screen for resistance based on the utilization of the tannins from American chestnut bark as a nutrient source by the blight fungus.

American chestnuts are generally stable as a shrub in the forest understory but are being lost as they are released in forest clearcuts as a result of high blight incidence, hardwood competition, and intense animal browsing. We are evaluating the hypothesis that managing the clearcuts may lead to an increase in hypovirulence and chestnut survival.

CHANGES IN LAND-USE AND VEGETATION, HAMPDEN-SYDNEY, VIRGINIA. Stanley R. Gemborvs, Dept. of Biol., Hampden-Sydney Col, Hampden-Sydney, VA 23943. The land located where Hampden-Sydney College now stands and the surrounding area has been subject to environmental manipulation since at least before 1776, the founding date of the College. Since then, the human population of the area has expanded dramatically and the uses to which the land has been put have also changed significantly. These changes in population and land-use have led to the development of plant communities that demonstrate a wide variety of successional stages and physiognomy. In order to evaluate the recent changes that have taken place in these plant communities, I used aerial photographs supplied by the Soil Conservation Service of the United States Department of Agriculture. These photos were flown in 1937, 1949, 1972, and 1980. Through the process of photo-interpretation, I transferred plant community information on the photographs to an adaptation of a Prince Edward County Tax Map. Among other findings is that the percentage of open land has decreased from sixty percent to five percent since 1937.

PHYTOPLANKTON COMPOSITION AND SEASONAL GROWTH PATTERNS IN LAKE DRUMMOND, DISMAL SWAMP, VA. Christine Gregory-Phillips and Harold G. Marshall, Dept. of Biological Sci., Old Dominion Univ., Norfolk, Va. 23529-0266. A twelve month study was conducted on the phytoplankton of Lake Drummond with 75 phytoplankton forms identified. Numerous seasonal pulses occurred throughout the year, with highest cell concentrations occurring during the late fall and winter months. The pH ranged during this study between 3.5 and 5.0. The most abundant component was the pico-nanoplankton representing 83% of the total phytoplankton concentrations. This group included primarily cyanobacteria (<3µm) which reached peak development in November. Asterionella formosa was the most abundant diatom accounting for 6% of the total phytoplankton. The Chlorophyceae and Chrysophyceae displayed a bimodal pattern of development, with peaks occurring in the winter and summer months. The Cryptophyceae and cyanobacteria expressed intense late summer, early fall developmental periods.

COMPETITIVE "WEED FUNGI" IN SHIITAKE MUSHROOM PRODUCTION IN VIRGINIA. Gonzalo Guevara and R. Jay Stipes, Dept. Plant Pathol., Physiol. & Weed Sci., Virginia Tech, Blacksburg, VA 24061.

Crop production in VA is in a state of flux, with tobacco production, for example, on a decline in the last decade; therefore, agricultural alternatives are always desired to fill these gaps, and shiitake (Japanese forest) mushroom (*Lentinus edodes*) culture is one of them; mushrooms are grown on artificially inoculated deciduous hardwood (primarily oak) logs from small woodlots. Some growers have encountered seriously diminished fruiting life of their logs, and we are investigating this problem. Our data thus far strongly support our hypothesis that shiitake logs cut from weak, suppressed, understory trees and/or from those on stressful growing sites, or from those growing under droughty conditions, are already or very quickly colonized by Ascomycetous white rotters and have very short fruiting life (1-2 yrs); those cut from healthy, dominant, rapidly growing trees on good sites may produce mushroom crops for many years. *Eutypa spinosa* and *Graphostroma platystoma* have been identified as the most common "weed fungi" on these logs in the VA Highlands. We therefore recommend that shiitake farmers use their best and most vigorous trees in mushroom production. (We thank Drs. Dean Glawe, Lois Tiffany and Jack Rogers for counsel)

RAPID MICROPROPAGATION OF BIRCH- Joressia A. Jamison and Michael H. Renfroe, Department of Biology, James Madison Univ., Harrisonburg, VA 22807.

Birch is an economically important forest tree that is both fast growing and demonstrates a high tolerance to external stresses such as air pollution. There is a need to propagate those trees that grow straight, rapidly, are well-formed, and have superior wood quality for industry. Methods that provide rapid propagation of superior trees are invaluable to the forest industry in tree improvement programs for birch. Micropropagation could permit rapid clonal propagation of trees with desirable traits in a smaller amount of space and time. Nodal explants of European white birch (*Betula pendula* Roth.) were placed on a chemically-defined medium supplemented with μM concentrations of several cytokinins. Bud break occurred after three days of culture and was complete by the eighth day. The cytokinin requirement for optimum bud break was different than the cytokinin requirement for optimum shoot elongation. Any culture that produced callus was discarded. Shoots were excised from the nodes and rooted directly in an artificial soil mix. Up to 100% of the shoots produced by a given treatment could be rooted. No treatment yielded less than 50% rooting. Across all treatments, 92% of the nodal explants produced shoots that were subsequently rooted. Micropropagation using shoot-tip cultures has proved to be an effective way to clonally propagate selected birch trees.

Euthamia and *Solidago*: Goldenrods in Virginia. Miles F. Johnson, Dept. of Biol., Va. Commonwealth Univ., Richmond, VA 23284-2012. There are 2 species and 1 variety of *Euthamia* and 30 species and 17 subspecific entities of *Solidago* making a total of 50 taxa in this treatment of goldenrods in Virginia. Changes in nomenclature reported in the literature and followed in this study involve *E. hirtipes*, *S. elliottii*, *S. canadensis*, *S. curtisii*, *S. boottii*, *S. randii* and *S. erecta*. *Solidago altissimum*, based on the work of Uttal, is recognized as a separate species. New keys to identification and maps of distribution which reflect changes in nomenclature are included in the study. (Supported by the VAS Flora Committee and by the Biology Department, Va. Commonwealth Univ.)

ENVIRONMENTAL THREATS TO THE HEALTH OF MONTANE FORESTS IN NORTHWESTERN VIRGINIA. David M. Lawrence, Graduate Program in Geographic and Cartographic Sciences, George Mason Univ., Fairfax, Va. 22030. Recent studies of forest stressors have raised the question of how environmental stressors interact to affect the health of forest ecosystems. I provide an overview of the major environmental stressors on the health of montane forests in northwestern Virginia, and suggest that additional information on factors affecting forest health would enhance future studies of forest ecology.

THE VEGETATION OF THE GREAT DISMAL SWAMP. Gerald F. Levy, Dept. of Biological Sciences, Old Dominion University, Norfolk, Virginia 23529. The vegetation of the Great Dismal Swamp is recovering from 200 years of anthropogenic disturbance which included numerous fires, repeated logging operations and primarily during this century, the construction of over 100 miles of drainage ditches, many with parallel roads. Most plant communities consist of second- or third-growth forest and dense shrub dominated communities that represent a variety of seral stages. The storied cypress-tupelo gum swamps, are represented by remnants and the extensive Atlantic White Cedar stands have been decimated. The once common "lights" composed of reeds and aquatic grasses, have succeeded to red maple dominated communities. In fact, red maple dominates or is an important component of most community types which can be delimited.

ON THE TRAIL OF FERNALD I. THE SANDHILLS OF THE NOTTOWAY. J. Christopher Ludwig, Department of Conservation and Recreation, Division of Natural Heritage, 203 Governor Street, Suite 402, Richmond, Va. 23219. During the late 1930's and early 1940's, eminent Botanist, Merritt Lyndon Fernald explored the flora of Virginia's southeastern corner, looking for new, unusual, and rare plant species. During these explorations, he described a number of xeric, sandy areas referred to as sandhills. While much attention has been given to those areas along the Blackwater River, little subsequent work had been done along the Nottoway River where three of these areas were described. Results of exploration into the Nottoway sandhills flora is presented emphasizing the occurrence and status of the region's rare plant species.

ANATOMICAL COMPARISON OF WOODY TISSUES OF CHAMAESYCE NUTANS AND C. HYPERICIFOLIA (EUPHORBIACEAE). William McGuire and W. John Hayden, Dept. of Biol., Univ. of Richmond, Richmond, Va. 23173. The temperate Chamaesyce nutans and the closely related tropical C. hypericifolia are herbaceous weeds with C_4 photosynthesis. Woody stem bases of both species reveal: pores in radial alignment; simple perforation plates; fibers with gelatinous walls; homocellular erect uniseriate, multiseriate, and polymeric rays; and the absence of axial parenchyma. The numerous narrow pores of both species suggest a xylem construction capable of withstanding xeric conditions, an observation consistent with their C_4 mode of photosynthesis. Chamaesyce nutans differs from C. hypericifolia in terms of somewhat greater pore density, more variable intervascular pits, shorter vessel elements, simple (as opposed to bordered) pits on fibers, and absence of laticifers in rays. Several wood features suggest pedomorphosis sensu Carlquist, which is consistent with the hypothesized herbaceous phylogeny of the genus.

PHYTOPLANKTON ASSOCIATIONS IN THE PYCNOCLINE LAYER OF THE LOWER CHESAPEAKE BAY. Sean Morrison and Harold G. Marshall, Dept. of Biological Sci., Old Dominion Univ., Norfolk, Va. 23529-0266. During the 1989 summer the phytoplankton composition within the pycnocline layer at two stations in the central region of the Chesapeake Bay was studied. Comparisons were also made to the abundance and composition of phytoplankton assemblages above and below the pycnocline. A distinct pycnocline formed in the lower Chesapeake Bay between April and August. During this period highest concentrations of the total phytoplankton occurred in waters above the pycnocline and within the pycnocline. Diatoms, dinoflagellates, cyanobacteria, chlorophytes, cryptophytes, prasinophytes, euglenophytes, prymesiophytes and the picoplankton tended to be concentrated either at the pycnocline or in the surface waters. Silicoflagellates and chrysophytes had varied vertical seasonal distribution patterns.

PLANT COMMUNITIES OF THE SHENANDOAH NATIONAL PARK. Thomas J. Rawinski, J. Christopher Ludwig, Div. of Natural Heritage, 203 Governor St., Suite 402, Richmond, VA 23219, and Gary P. Fleming 220 Park Ave., Takoma Park, MD 20912. Shenandoah National Park provides abundant opportunities for community study due to diverse vegetation and habitat, and a variety of successional vegetative conditions. An on-going inventory of the Park's natural heritage resources has generated new information on rare species occurrences and plant communities. Plant communities are ideal units of classification, inventory, and management that not only have intrinsic value, but also support species too cryptic or poorly known to be inventoried separately. Thus, community classification and inventory is an effective "coarse filter" approach to biological conservation. Communities within the Park can be classified to a general level using a new hierarchical classification. Seven Ecological Systems, eight Major Vegetation Types, and numerous Classes are identified. Input from the scientific community is sought in refining this classification.

CRYOPRESERVATION OF PINE ZYGOTIC EMBRYOS. Michael H. Renfro, Catherine A. Boyd, Joressia A. Jamison, and D. Kim Kennedy. Dept. of Biology, James Madison Univ., Harrisonburg, VA 22807. Conservation and maintenance of wild-type elite germplasm is an increasingly important issue. Methods need to be found that will preserve selected genotypes for species preservation or use in plant improvement programs based on selective breeding. Cryopreservation is a low-maintenance, relatively-inexpensive technique that holds much promise for germplasm conservation. Zygotic embryos of loblolly pine (Pinus taeda L.) were removed from mature pine seeds and treated with various cryoprotectants alone or in combination. Cryoprotected embryos were then rapidly frozen by immersion in liquid nitrogen or slowly frozen by cooling at a controlled rate to -30 C before being transferred to liquid nitrogen. Frozen embryos were rapidly thawed in a warm water bath and transferred to a sterile culture medium. Growth of these embryos was compared with growth of embryos which had been treated with cryoprotectant but not frozen and also with growth of embryos which had not been frozen or treated with cryoprotectant. Treatment of embryos with cryoprotectant did not adversely affect growth and development of pines. Cryoprotectants allowed embryos to survive freezing to -196 C, although some loss of viability was observed. Additional research on cryoprotectant composition, freezing rates and thawing rates should improve survival of embryos. Cryopreservation appears to provide a promising method for preserving selected pine germplasm. (Supported by a JM University Faculty Assistance Grant and VAS Small Project Research Grant.)

WOOD ANATOMY OF ARGYTHAMNIA BLODGETTII (EUPHORBIACEAE). Trudy Rickman and W. John Hayden, Dept. of Biol., Univ. of Richmond, Richmond, Va., 23173. Secondary xylem is described from woody stem bases of Argythamnia blodgettii, an herbaceous perennial endemic to hammocks and pinelands of tropical Florida. Three specimens collected on Big Pine Key yield the following wood structures: growth rings present; porosity diffuse; pores mostly solitary, circular, and narrow; vessel elements moderately short, with simple perforations, alternate intervacular pits, and moderately inclined end walls; fiber-tracheids non-septate, often with gelatinous walls in latewood; rays homocellular square and erect, uni- or biseriate, and bearing circular alternate pits to vessels; axial parenchyma restricted to a few scanty paratracheal cells. Ecologically, wood of Argythamnia most closely approaches that of desert shrubs, however, its vessel elements are somewhat longer and pore density somewhat less than reported average values for desert shrubs.

Reexamination of the fossil fern Dryopterites. Judith E. Skog, Department of Biology, George Mason University, Fairfax, VA 22030, and Ronald J. Litwin, U.S. Geological Survey, MS 970, Reston, VA 22092. The fossil fern genus Dryopterites was established by Berry in 1911 for ferns that had been described by Fontaine under the genus Aspidium. These fossils are from the Lower Cretaceous Patuxent Formation (Potomac Group) of Virginia. Both Fontaine and Berry indicated that these fossils were related to the fern family Polypodiaceae, on the basis of gross morphological characters. Reexamination of these fossils by epoxy casting and SEM reveals soral, sporangial, and spore characteristics that suggest a systematic position closer to more primitive fern families. Of the six species assigned to Dryopterites by Berry, one (D. dentata) clearly belongs to the Schizaeaceae. The taxonomic assignments of the other five are less certain, but several should be reassigned to the Matoniaceae.

UPLAND OAK FORESTS OF THE RIDGE AND VALLEY PROVINCE IN SOUTHWESTERN VIRGINIA. S. L. Stephenson, Dept. of Biology, Fairmont State Col., Fairmont, WV 26554 and H. S. Adams, D. S. Lancaster Cmnty. Col., Clifton Forge, VA 24422. Upland forest communities of the Ridge and Valley Province in southwestern Virginia are usually dominated by various species of oak, of which chestnut oak (Quercus prinus) and northern red oak (Q. rubra) are the most important. American chestnut (Castanea dentata), formerly a codominant species in the tree stratum of these communities, was almost completely eliminated during the first half of this century by the chestnut blight. Although both chestnut oak and red oak sometimes occur in nearly pure stands, the more common expression is for an admixture of various other species, including red maple (Acer rubrum), hickory (Carya spp.), black oak (Quercus velutina) and white oak (Q. alba), to be represented in the tree stratum. Throughout the region, mixed mesophytic communities occur in sheltered ravines and coves, and red spruce (Picea rubens)-hemlock (Tsuga canadensis) communities occupy a few of the most mesic high-elevation sites.

NEW AND UNREPORTED DISEASES OF Betula uber, ROUND LEAF BIRCH (RLB), IN THE MOUNT ROGERS, VA PROPAGATION PLOTS. R. Jay Stipes, Daniel J. Schweitzer and Marshall W. Trammell, Jr., Dept. Plant Pathol., Physiol. and Weed Sci., Va Tech, and Va. Dept. Agriculture and Consumer Services, Richmond, VA.

Two or perhaps three new diseases have been observed on Betula uber, round leaf birch (RLB) in the Mount Rogers, VA propagation plots. The first is a main leader (crown) dieback observed in concert with Botryosphaeria dothidea cankers; we suspect that cold injury predisposed the tissues to invasion and colonization. This pathogen attacks many woody plants and causes white rot of apple. The second disease is anthracnose that produces tan/brown foliar lesions from which we isolated Glomerella cingulata, the cause of anthracnose of Acer platanoides and bitter rot of apple. The third disease is possibly viral, in which the leaves exhibit a rugose, crinkled appearance; viral inclusions and Koch's postulates remain to be confirmed by clinical examination and experimentation. All plots are being indexed for disease, and correlated if possible with environmental factors. We are also attempting to manage the fungal diseases with fungicides.

THE NEW DOGWOOD ANTHRACNOSE: IS IT ALL THAT BAD? R. Jay Stipes, Dept. Plant Pathol., Physiol. and Weed Sci., Virginia Tech, Blacksburg, VA 24061. Dogwood (*Cornus florida*), as all living organisms, is afflicted with biotic and abiotic stressors; among the former is the common and mildly (?) debilitating "spot anthracnose" (*Elsinoe corni*). "Dogwood anthracnose," ("lower branch dieback") or DA, caused by *Discula* sp., is a lethal and putatively new disease whose origin is unknown. Its "metastasizing" lesions affect bracts, leaves, petioles, twigs, branches and ultimately girdle the trunks (boles), unlike any other known pathogen of dogwood. DA is now known in 19 counties in VA (primarily in the highlands, with one outlier, Westmoreland Co.); and the disease appears to flourish at higher elevations characterized by lower temperatures and higher humidities. Current prognostications are bleak, and DA may well be as bad as most plant pathologists now perceive it to be. Highly effective disease management procedures are now extant, so that individual or small plantings of trees (arboreta, cities, homeowners) can be protected adequately with sanitation and fungicides. We are conducting extensive surveys in VA to determine both the incidence and severity of DA. Various aspects of disease biology and management strategies are also being addressed in our laboratory.

SECONDARY XYLEM OF *EUPHORBIA LEUCONEURA* (EUPHORBIACEAE): WOODY STEM BASES AND THE TRANSITION TO SUCCULENCE Kyriakos Tarasidis and W. John Hayden, Dept. of Biol., Univ. of Richmond, Richmond, Va 23173. *Euphorbia leuconeura*, native to Madagascar, is often cultivated for its striking growth habit; slender seedlings gradually develop a thick 5-sided succulent stem with stipular fringes along the angles and an apical cluster of leaves. Wood structure was studied from the terete hypocotyl and compared with secondary xylem in the transitional and succulent regions. The wood is diffuse porous; perforation plates are simple; intervacular pits are mostly transitional; fibers are non-septate fiber-tracheids; rays include homocellular and heterocellular types; most rays are uniseriate; some multiseriate rays bear laticifers; axial parenchyma is abundant. Transition from the woody stem base to the succulent region shows a progressive increase in pore density, slight increase in pore diameter, and decrease in total xylem area. Despite its succulent stem, wood structure shows characteristics of desert shrubs.

DEMOGRAPHIC STUDIES OF THE SMALL WHORLED POGONIA, *ISOTRIA MEDEOLOIDES*, IN VIRGINIA. Donna M. E. Ware, Dept. of Biol., Col. of William and Mary, Williamsburg, VA 23185. Five colonies of *Isotria medeoloides* have been monitored for four to seven years. Two of these appear to be stable, with the number of newly appearing stems largely offsetting the number of stems failing to reappear and with flowering stems continuing to predominate. Three other colonies have declined radically in numbers, two gradually, and one abruptly. The number of stems failing to reappear in the largest colony has risen gradually from one-third (49) in 1986 to three-fifths (144) in 1989. Vegetative plants have continued to predominate in that colony (six years). A colony with only ten stems in 1986 has dwindled to three stems. The third colony with diminished numbers took an abrupt nosedive in 1989 when only 35.3% (6) of the known stems emerged, in contrast to 87.5% (14) in 1988. Three other subpopulations nearby, which were not closely monitored, also showed similar radical decreases. In all colonies combined, 14 stems have reappeared after one year of dormancy and two after two years.

A COMPARISON BETWEEN PIEDMONT AND COASTAL PLAIN UPLAND HARDWOOD FORESTS IN VIRGINIA. Stewart Ware, Dept. of Biology, Coll. of William and Mary, Williamsburg, VA 23185.

Both the Piedmont and Coastal Plain of Virginia have usually been treated as part of the Oak-(Pine)-Hickory Forest Region. A detrended correspondence analysis ordination was constructed using 51 southern, central, and northern Piedmont and 22 central Coastal Plain upland hardwood forest stands. While white oak Importance Value (I.V) exceeded 10% in 88% of stands in both regions, stands fell into three groups. Coastal Plain stands usually had beech and/or southern red oak I.V.>10%. Most Piedmont stands (non-Triassic substrates) had chestnut oak and/or scarlet oak I.V.>10%, but (northern) Triassic Piedmont sites had hickory I.V.>18% and little chestnut and scarlet oak. Black oak and northern red oak were unimportant outside the Piedmont. Upland Coastal Plain forests have more in common with the Southern Mixed Hardwood Forests of further south than with the Piedmont hardwood forests.

SPATIAL PHYTOPLANKTON RELATIONSHIPS IN THE LOWER CHESAPEAKE BAY. Tracye West and Harold G. Marshall, Dept. of Biological Sci., Old Dominion Univ., Norfolk, Va. 23529-0266. In a four year study, spatial patterns determined by multivariate data analysis characterized the lower Chesapeake Bay on the basis of the phytoplankton composition into three regions: 1. a western region that included river estuarine sites, 2. the Bay entrance and eastern bay region, and 3. the central main stem of the bay. The sub-pycnocline waters contained generally higher and less variable concentrations of cells. There was a decrease in cell abundance and nutrient concentration west to east in the bay, and along its north to south axis. Major periods of development were in fall and late winter to early spring, with the picoplankters, composed mainly of cyanobacteria, having a major unimodal peak in summer. The dominant flora were ubiquitous, with seasonal periods of greater concentrations. (Supported by the Virginia State Water Control Board and EPA.)

RECENT DEVELOPMENTS IN THE PETERS MOUNTAIN MALLOW RECOVERY PROGRAM.

Thomas F. Wieboldt, Dept. of Biology, Va. Polytechnic Inst. & State Univ., Blacksburg, Va. 24061. Peters Mountain Mallow (*Iliamna corei*), a member of the family Malvaceae, was listed as a federal Endangered Species on June 11, 1986. The single known wild population of the species has contained only three plants from 1986 to the present. The population was caged to protect plants from browsing and monitored during 1986 and 1987. In 1987 seeds were retrieved from the leaf litter and used to establish an experimental garden on the university campus. These plants produced an estimated 35,000 seeds in 1988 most of which were used in seed germination experiments. In 1989 the work was further expanded to include seedling survival, resource allocation, and breeding system experiments. These are described and illustrated. The species has been determined to be an obligate outcrosser. Asynchrony of flowering among the few individuals in the Peters Mountain population is believed to be the reason for the lack of seed production. Seed germination requirements (being studied by Baskin and Baskin at Univ. of Kentucky) and seedling survival studies at VPI will help to explain the lack of recruitment to the population and to formulate a longterm management plan for the species.

THE HABITAT AND DISTRIBUTION OF SWEETBAY (Magnolia virginiana L.) IN THE CENTRAL VIRGINIA PIEDMONT. Robert A. S. Wright, Central Va. Biological Research Consortium, 5204 Riverside Drive, Richmond, Va. 23225.

Magnolia springheads are unquestionably the most diverse and interesting wetland plant communities in the relatively barren central piedmont of Virginia. Known piedmont populations of Magnolia virginiana have been located, and their county-by-county distribution have been mapped through herbarium studies and exhaustive field work.

Magnolia virginiana is very localized in central Virginia and populations are confined to wooded, small-tributary headwater seepage swales, sluggish watercourses and swampy banks and wet, poorly-drained Triassic basin sediments. The relationship of localized sweetbay populations in the central piedmont to stream drainage direction may suggest important clues to the ancient plant migration patterns that have fashioned Virginia's current floristic composition.

FLORISTICS AND ASSOCIATED GEOMORPHIC ORIGINS OF A RELICT COASTAL PLAIN SPRINGHEAD AT ROBIOUS, NORTHERN CHESTERFIELD COUNTY, VIRGINIA. Robert A. S. Wright, Central Va. Biological Research Consortium, 5204 Riverside Drive, Richmond, Virginia 23225.

At the drainage head of Spring Creek in northern Chesterfield County near the community of Robious is found a most intriguing cold-water magnolia swamp containing a highly diverse wetland plant association which includes a number of chiefly coastal plain elements. This springhead "bog" is situated on an ancient stream terrace deposit known as the "Bon Air Gravel", and is several miles west of the "Fall Line". With the help of geologist colleagues, an effort to estimate the age of the deposit is made here, and this is correlated to the approximate age of the relict vegetation found at the station. Interesting floristic elements include Dryopteris celsa (historically), Lycopodium lucidulum, Smilax laurifolia, Smilax walteri, Maianthemum canadense, Lilium superbum, Hypericum walteri and a number of other species.

THE HOWERTON BOG, AN EXEMPLARY SPHAGNOUS MAGNOLIA SWAMP COMPLEX IN ESSEX COUNTY, VIRGINIA. Robert A. S. Wright, Central Va. Biological Research Consortium, 5204 Riverside Drive, Richmond, Va. 23225.

At the headwaters of a short, sluggish tributary of Dragon Run near the community of Howertons in Essex County Virginia is an exceptional example of a sphagnum bog community on the coastal plain. A pristine quaking bog and associated magnolia swamp of this quality are exceedingly rare on Virginia's landscape, and an effort to study and inventory its flora have been made. The rare and local flora found thus far include Carex collinsii, Carex leptalea, Eleocharis tortilis, Eriophorum virginicum, Aster novibelgii, Habenaria cristata, Drosera rotundifolia, and Sarracenia purpurea. Conspicuously missing is Smilax laurifolia. Natural Resource Managers are encouraged to explore the acquisition potential of the site, and researchers and educators are encouraged to continue the study of this wonderful sphagnum bog.

Chemistry

METHODS FOR DETERMINING FUEL INSTABILITY. Erna J. Beal* and Dennis R. Hardy*, Code 6181, Navy Technology Center for Safety and Survivability, Naval Research Lab., Washington, D.C. 20375-5000. As available petroleum crudes continue to decrease in quality and the amount of catalytically cracked stock used in middle-distillate fuels increases, fuel instability is becoming a greater problem. Fuel instability is usually defined by the formation of insoluble sediments and gums. Gravimetric stability tests conducted at lower temperatures are generally the best indicators of storage stability of a particular fuel but require storage at 43°C for up to 24 weeks. The widely used higher temperature test, 16 hr. stress at 90°C with oxygen bubbling through the fuel, is not a good predictor of stability of freshly refined fuels. Also the total amount of sediment formed is very low and is hard to quantify. A new method, utilizing an oxygen overpressure of 100 psig for a 16 hr stress period at 90°C, has been developed at the Naval Research Lab. This method is predictive for up to three years of ambient storage, and is rapid and very precise. Results obtained using this new oxygen overpressure method will be presented, along with comparison results from the other standard tests.

HIGH HEATING RATE PYROLYSIS KINETICS OF A CARBON FIBER REINFORCED PHENOLIC RESIN. M. E. Boyle* Chem. Div., Naval Res. Lab., Washington, DC 20375, R. F. Cozzens, Chem. Div., Naval Res. Lab., Washington, DC 20375, and Dept. of Chem., George Mason Univ., Fairfax, VA 22030, & J. A. McPherson*, SFA, Inc., Landover, MD 20785. Recent increases in the use of high performance composite materials under harsh thermal conditions have generated interest in the degradation processes which occur when these materials are heated at high heating rates ($> 10,000$ K/sec). The pyrolysis kinetics of a carbon fiber reinforced phenolic resin composite have been investigated as a function of heating rate (from 0.167 K/sec to 30,000 K/sec). Kinetic modeling parameters derived from these investigations have been used to accurately reconstruct sample thermograms. The unique high heating rate instrument which was constructed for this study will also be described.

"CAP" (GpppN) ANALOGS AS SUBSTRATES OR INHIBITORS FOR (GUANINE-7)-METHYLTRANSFERASE. Mark A. Brundege and Thomas O. Sitz, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061-0308. Most eucaryotic mRNAs must be capped and methylated to function properly in processing and translation. One position that is methylated is at the 7-position on the guanine in the cap structure (7^m GpppN---). When the enzyme that modifies this position, the (guanine-7)-methyltransferase is incubated with various cap analogs, GpppG was found to be a substrate. Another analog, GpppA, was not a substrate but could activate the enzyme when incubated together with GpppG as a substrate. RNA fragments such as oligomers of cytidylic acid were also found to be activators when GpppG was used as a substrate. Fragments of RNA such as CpCpCpCpCp and the cap analog GpppA appear to bind in the RNA domain of the enzyme and allow the enzyme to bind the substrate GpppG with a lower K_m .

THE FLEXIBILITY OF A-DNA. Holly H. Chen*, Dept. of Chem., George Mason Univ., Fairfax, Va. 22030. The flexibility of random sequence A-DNA has been investigated by the technique of transient electric birefringence. Rotational relaxation times which are very sensitive to changes in the end-to-end length of polymers are determined from the field free birefringence decay curves of three defined fragments. They contain 370, 460, and 676 base pairs. The A-DNA conformation was induced in these fragments by 85% trifluoroethanol. Measurements were made at salt conditions, ranging from 0.2 mM Na^+ to 2 mM Na^+ , at 20°C. The relaxation time was found to be independent of the salt concentrations studied. From the birefringence relaxation times of the three fragments of DNA, the persistence length was found to be around 900Å, using the method described by Hagerman and Zimm [Biopolymers 29, 1481-1502 (1982)]. This implies that the A-form of DNA is twice as rigid as the B-form under the same conditions of ionic strength and temperature. A-form DNA, if present during biological functioning, would considerably inhibit bending and therefore provide strange signals for reproductive events.

SOLVENT AND ELECTROLYTE EFFECTS IN ELECTRON TRANSFER REACTIONS OF BIS(PYRIDYL)-DITHIAETHER-COPPER(II) COMPLEXES. Keith M. Davies* and K. H. Whyte*, Dept. of Chemistry, George Mason University, Fairfax, Va., 22030. Electron Transfer reactions of bis(2-pyridyl)-dithiaether copper(II) complexes have been studied in acetonitrile, methanol, acetone, DMSO, and water with ferrocene as reductant. Rate effects are examined in terms of the association of donor solvents with the Cu(II) center. Specific anion rate dependencies observed in acetonitrile with CF_3CO_2^- and BF_4^- as electrolytes are discussed in terms of inner-sphere association and outer-sphere ion-pairing interactions respectively. Equilibrium constants for the redox change have been determined electrochemically in the different solvent and electrolyte media, and Cu(I)-Cu(II) self-exchange electron transfer rate constants have been estimated for the different paths.

MAQUIROSIDES B AND C, CARDENOLIDES FROM *MAQUIRA CALOPHYLLA*. Kenneth E. Davis, Joan M. Rovinski, Gregory L. Tewalt, and Albert T. Sneden, Department of Chemistry, Virginia Commonwealth University, Richmond, VA 23284-2006.

In 1987, the activity-guided fractionation of *Maquira calophylla* (Moraceae), a plant from Peru, led to the isolation and characterization of maquiroside A, a novel cardenolide. The sugar portion of this cardenolide was identified as D-cymarose, an unusual 2,6-dideoxy sugar. The aglycone moiety was identified as cannogenol, a relatively rare aglycone. Two additional cardenolides, maquirosides B and C, have now been isolated from *M. calophylla*. The structures of these cardenolides were elucidated through the use of ^1H and 2-D homonuclear correlation (COSY) NMR spectra. The carbohydrate moiety was again determined to be D-cymarose, but the aglycone of both compounds was found to be cannogenin. The difference between the two compounds is found in the stereochemistry of the anomeric carbon in the carbohydrate moiety. From this data, maquiroside B was determined to be apocannoside, a cardenolide more commonly found in certain plants of the Apocynaceae family. Maquiroside C, however, appears to be a new cardenolide. In addition to these two cardenolides, the aglycone of maquiroside A, cannogenol, was also isolated and shown to be a natural product, not an artifact of the isolation procedure. (Supported by a grant from the Jeffress Trust.)

THE METHANOL-HELIUM INTERMOLECULAR POTENTIAL, Stephen L. Davis* and William R. Entley*, Chemistry Department, George Mason University, Fairfax, Va. 22030. An interaction potential for the methanol-He system was calculated, consisting of an SCF part joined to a long-range dispersion contribution. The SCF part was computed at separations between 4 and 8 bohrs on a grid of 112 or 202 values of the angular coordinates, depending on the methanol conformation. The methanol geometry was taken from Lees and Baker. The basis was a double zeta set augmented with one set of polarization functions on each atom. The superposition error was treated using the ghost orbital method. The conformation dependence was handled using a phase shift approximation which was found to give good agreement with computed SCF interaction energies. For a given R and conformation, the angular dependence was fitted to an expansion in spherical harmonics in which the coefficients are in general complex. Inclusion of all terms through $l=12$ gives an excellent fit, with $m=0$ or 3 terms dominating. The conformation dependence was then fitted to a Fourier series in three-fold multiples of the internal rotation angle. It is found that only the $m=3$ coefficients have appreciable conformation dependence. A comparison with the site-site interaction potential of Billings shows substantial differences in the anisotropy.

NMR STUDIES OF THE INTERACTION OF PARAMAGNETIC LANTHANIDE(III) MACROCYCLES WITH LEWIS BASES. K. K. Fonda and L. M. Vallarino, Department of Chemistry, Virginia Commonwealth University, Richmond, Virginia 23284.

The interaction of uncharged N-donor ligands with macrocyclic complexes of formula $ML(CH_3COO)_2Cl \cdot n(H_2O)$, where M is a lanthanide(III) ion and L is the macrocyclic ligand $C_{22}H_{26}N_6$, has been investigated in solution by nuclear magnetic resonance spectroscopy and luminescence titration studies. Both experiments, conducted in methanol, indicate little or no interaction of the nitrogen ligand with the metal center of the macrocyclic complex. Attempts to isolate a 1,10-phenanthroline complex of the Eu-macrocyclic produced instead the carbonato-bridged species $([(CH_3COO)EuL_2(\mu-CO_3)]^2)$, which incorporated atmospheric carbon dioxide. The crystal structure of this species showed a bis-chelating carbonato group linking the two Eu macrocycles, which were folded in a butterfly configuration toward the external bidentate chelating acetates. Ionic hydroxides and clathrated water completed the structure.

ENHANCED PRECONCENTRATION TECHNIQUES USED TO STUDY THE GEOCHEMICAL FATE OF PESTICIDES IN SURFACE WATERS. Gregory D. Foster, Dept. of Chem., George Mason Univ., Fairfax, VA 22030, & Paul M. Gates, U.S. Geological Survey, Arvada, CO 80002. Information on water quality and the environmental fate pathways of pesticides in riverine systems is often based on the results of GC/MS analysis. Because detection limits are not low enough in the most routine analytical methods, enhanced preconcentration techniques such as continuous-flow liquid-liquid extraction (CFLLE) and high capacity solid-phase extraction (HCSPE) were developed for the purpose of measuring pesticides in stream waters. Recoveries of 37 pesticides were compared by using both CFLLE and HCSPE upon fortification of 10-L stream water samples with 10 ng/L of each pesticide. Mean recoveries using CFLLE were 85% for the organochlorines, 101% for the organophosphates, and 87% for the triazines; corresponding recoveries using HCSPE were 88%, 89%, and 83%, respectively. Precision in recovery results could be related to preconcentration technique and matrix-related effects.

MODIFICATIONS OF POLYHYDROXY POLYMERS FOR DRUG DELIVERY, L. Mark Hodges, Raphael M. Ottenbrite, Dept. of Chem., Va. Commonwealth Univ., Richmond, Va. 23284. Present topical applications of drugs to the eye are unsatisfactory for of ophthalmic therapy. Eye drops and ointment administrations are rapidly diluted and removed from the absorption surface by reflex blinking, tearing, and tear-turnover. Consequently, pharmaceutical laboratories are currently looking at modified polymers for use in drug controlled release studies. The objective of this study is to modify polymers such as hydroxyethyl cellulose and polyvinyl alcohol with hydrocarbon chains of various lengths by means of ester linkages. Acetate, hexanoate, and stearate ester groups were attached to both polymer systems by reacting the respective acid chlorides with the polymer. The polymers were purified by repeated precipitations from $CHCl_3$ with divinyl ether. The degree of loading of these ester groups, which ranged from 1-30%, was determined with a 300 MHz 1H NMR spectrometer.

VAPOR / LIQUID EQUILIBRIA OF MICROEMULSIONS. Abul Hussain* and Mark Hixon*, Dept. of Chemistry, George Mason Univ., Fairfax, VA 22030.

A computer controlled headspace gas chromatograph (HSGC) was developed to study the thermodynamics of microemulsion formation. The sampling precision of the HSGC was found to be <0.5% relative standard deviation for a solute concentration of >20 μ mole fraction in most solvents and microemulsions. Activity, Henry's constant (K), and activity coefficient (γ) of octane, decane, and toluene were measured in microemulsions containing either CTAB or C₁₈DMB as the surfactant, n-butanol as the cosurfactant, and NaBr as the electrolyte. The activity data were used to define the critical microemulsion concentration. The activity of decane in C₁₈DMB microemulsions as a function of volume fraction of decane showed two phase transition points. The nonlinearity of K values as a function of volume fraction of toluene in CTAB microemulsions was explained in terms of oil partitioning in bulk water, the interface, and the droplet core. A relatively high γ values (>10) of octane suggests that the droplet core is somewhat polar. The size of the droplets in C₁₈DMB microemulsions was found to be a linear function of the activity of decane over a limited decane volume fraction. (Supported by a ACS-PRF grant from the American Chemical Society).

PREPARATION AND EVALUATION OF PRODRUGS. Kiyoshi Iwamoto, Raphael M. Ottenbrite, Bart vant Riet, Stanley R. Webb, Dept. of Chem., Va. Commonwealth Univ., Richmond, Va. 23284. Didox(3,4-dihydroxy-benzohydroxamic acid), a new anticancer drug, recently entered human clinical trials. The data from phase I study indicated that the half-life of the drug in serum was less than 20 minutes. The goal of this project is to enhance the therapeutic efficacy by preparing pro-drugs of didox which would generate didox *in vitro* in a sustained mode by bio-transformation within the body. In this study, we have prepared several precursor compounds of didox with low molecular weight groups attached (acetyl, isobutyl, and pivaloyl groups) and a didox-polymer conjugate (a polymeric prodrug). The biological assays using mice with the L1210 leukemia indicated that the precursor compounds as well as the polymeric prodrug provided significant antitumor activity.

FORMATION OF SULFIDIC LAYERS ON COPPER SURFACES WHEN EXPOSED TO HYDROCARBONS CONTAINING ELEMENTAL SULFUR. Eerik Maandi* and John Schreifels*, George Mason University, Fairfax, VA 22030 and Jerry Weers*, Petrolite Co., 369 Marshall Ave., St. Louis, MO 63119. The general mechanism of corrosion and growth of films on copper surfaces, when exposed to hydrocarbon fuels containing elemental sulfur, was studied in terms of composition, thickness and rate of growth. The time dependent growth of these films was studied using Auger electron spectroscopy along with standard ion sputtering techniques. It was found that the thickness of the films increased rapidly with increasing exposure to the corrosive fuel for short exposures, while for long exposures the thickness increased slowly. This behavior was shown to obey the parabolic law that is used to describe oxide film growth in air. The relative amount of sulfur in a layer directly beneath a thin hydrocarbon overlayer was found to increase with time.

ALUMINOSILICATE STABILITIES UNDER BLOOD PLASMA CONDITIONS. R. Bruce Martin, Chemistry Dept., Univ. of Virginia, Charlottesville, VA 22903. Up to 20% each of aluminum and silicon co-reside as aluminosilicates in the cores of senile plaques found extracellularly in the victims of Alzheimer's disease. This paper shows that under conditions prevailing in the blood plasma, the free Al³⁺ concentrations permitted by six aluminosilicates (6-100x10⁻¹⁴M) are competitive with those from citrate and transferrin at 10 μ M or greater total aluminium concentrations. With equilibria in a competitive range, kinetic effects play a significant role. Aluminosilicates probably form at bound Al³⁺ sites bathed in a silicic acid-containing fluid.

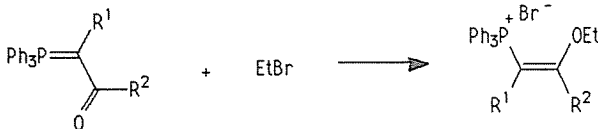
A METHOXY SUBSTITUTED LADDER POLYMER AND ITS PRECURSOR. J.S. Mee & Robert V. Honeychuck, Dept. of Chem., George Mason Univ., Fairfax, VA 22030. Two new polymeric materials have been synthesized via the condensation of 2,5-dichloro-3,6-dimethoxybenzoquinone and 1,2,4,5-tetraaminobenzene. The first is a soluble polymer which is thought to be linear in nature. The second is an insoluble material which may have a ladder structure. The infrared and nuclear magnetic resonance spectra of these materials will be discussed, as will their use in degenerate four wave mixing. Fabrication of these substances into forms amenable to the third order nonlinear optical measurements will be presented. [Research supported by the ONT/DEW Hardened Materials Block Program at Naval Research Laboratory, Washington, D.C.]

SYNTHESIS OF THE N-GLUCURONIDE CONJUGATES OF BARBITAL AND PHENOBARBITAL. S. E. Mongrain* and W. H. Soine, Dept. of Med. Chem., Va. Commonwealth Univ., Richmond, Va. 23298. In man, N-glucose conjugation has been proven to be a significant pathway for the metabolism of barbiturates following oral administration. To determine if N-glucuronide conjugation is also a metabolic pathway for barbiturates, it was desirable to have synthetic conjugates for use in metabolite identification and as analytical standards. Two approaches to the synthesis of the barbiturate- β -D-glucuronides were evaluated: oxidation of the barbiturate glucoside to the glucuronide, and direct conjugation of the barbiturate to glucuronic acid. The selective protection and deprotection of the glycoside necessary for oxidation to the glucuronide were unsuccessful. Direct condensation of the persilylated barbiturate with methyl-1,2,3,4-tetra-O-acetyl- β -D-glucuronate using trimethylsilyl triflate gave the protected barbiturate N-glucuronide in excellent yield. The conjugates were subjected to alkaline hydrolysis with sodium methoxide in methanol to give the barbiturate- β -D-methyl glucuronates. (Supported by NIH grant GM 34507.)

THE CHEMISTRY OF SHALE DERIVED FUELS. George W. Mushrush and Gregory D. Lacy, Department of Chemistry, George Mason University, Fairfax, VA. 22030. There are many obstacles to the use of middle distillate fuels derived from western oil shale crudes. One of the significant and undesirable changes noted in shale-derived middle distillate fuels is the formation of solids with increasing time in storage. Deposit formation in fuels is triggered by autoxidation reactions and can be related to the concentration of active oxygen species i.e., hydroperoxides. Chemical characterization of these deposits indicated that they are not simple polymers, but are formed by interactive reactions involving many of the trace heteroatom components present in these unstable fuels. This paper will examine the interactive effects of various polar nitrogen heterocycles with hydroperoxides.

SYNTHESIS OF β -ALKOXY VINYLPHOSPHONIUM SALTS; A STUDY OF THEIR REACTIVITY IN MICHAEL-TYPE REACTIONS. Bradley K. Norwood and Suzanne M. Ruder, Department of Chemistry, Virginia Commonwealth University, Box 2006, Richmond, Virginia, 23284.

As part of a study directed towards construction of cyclopropyl triphenylphosphonium salts, compounds of the general structure **1** have been synthesized. We have explored the use of these β -alkoxy vinylphosphonium salts as potential Michael acceptors under a variety of conditions.



METHYLATION INHIBITORS: IMPACT ON "CAP" METHYLATION AND TUMOR CELL GROWTH. Keith A. Oxenrider and Thomas O. Sitz, Dept. of Biochemistry, Virginia Tech, Blacksburg, VA 24061-0308. Most eucaryotic mRNAs must be modified prior to processing and translation. One of these modifications is the addition of a 5'-cap structure (GpppN---). This cap structure is further modified by methylation of the guanine, producing 7^mGpppN---. Most of the mRNA isolated from normal rat kidney (NRK) cells grown in culture contains this modified structure. RNA isolated from the post-polysomal supernate of NRK cells treated with the adenosine analog neplanocin A (a possible antitumor agent) was found to be a substrate for the (guanine-7-)-methyltransferase. The RNA from treated cultures had three times the methyl-accepting capacity of RNA isolated from control cultures. Another analog, 3-deazaneplanocin A showed identical results. The (guanine-7-)-methyltransferase has a low K_i value for the product, S-adenosylhomocysteine (SAH). These adenosine analogs inhibit the SAH-hydrolase enzyme and cause SAH to be elevated in the treated cells. Therefore, contrary to other reports, neplanocin A does inhibit cap methylation in tissue culture cells.

SYNTHESIS AND PYROLYSIS OF ALKYLPIRIDINES DERIVED FROM FOSSIL FUEL SOURCES. Wayne M. Stalick, Shadan Shirkhodai and Farahnaz Malek-Gilani, Department of Chemistry, George Mason University, Fairfax, VA 22030. An important current goal in chemistry is to develop a better understanding of the decomposition pathways of alternate fuel sources such as oil shale and coal. Recently a number of studies have been made demonstrating that studies of model compounds can give good extrapolations to the natural product. Alkylpyridines have been identified as major constituents of oil shale and lower rank bituminous and lignite coals, however, no comprehensive study of the thermal properties of these compounds has been made. The project goal is to determine the breakdown parameters of these models and to elucidate the mechanism of free radical cleavage under typical pyrolytic conditions, thus establishing correlations to the liquefaction of certain coals and oil shale. The current study reports on the progress of the synthesis of model alkylheteroaromatic compounds and the initial pyrolysis results of the pure compounds under delayed coking conditions. The synthesis of a number of alkylpyridines has been achieved using a modified Brown and Murphey synthesis and characterization accomplished by ir, nmr, and GC/MS.

ADHESION - RELATED SURFACE CHEMISTRY FEATURES OF SOLID SUBSTRATES. Laura Sporakowski & J. P. Wightman, Dept. of Chem., Va. Polytechnic Inst. & State Univ., Blacksburg, VA 24061. Adhesion is an interdisciplinary phenomenon which includes synthetic polymer chemistry, polymer characterization and surface or interfacial chemistry. Adhesive bonding is being increasingly used in a number of industries including the construction of aircraft and buildings. The objective of the present work was to characterize the surfaces of several materials having application in adhesive bonding. Samples of marble, polyester, carbon fiber/polymer matrix composite and Ferrottype plates were used as substrates. The sample surfaces were pretreated in several different ways and analyzed by contact angle and x-ray photoelectron spectroscopy (XPS). The wettability of composite, polyester, and Ferrottype plate, as determined from contact angle measurements, significantly increased after a 1 minute exposure to an oxygen plasma. Plasma treatment of marble removes a hydrocarbon-like contamination layer resulting in a shift in the C 1s XPS photopeaks and a reduction in the carbon content of the marble surface. [Research supported by the Adhesive and Sealant Council and the NSF S&T Center]

NEW BISMALLEIMIDES FOR THERMALLY-STABLE POLYIMIDES, Fang Sun, Joseph Smith, Jr., Raphael Ottenbrite, Dept. of Chem., Va. Commonwealth Univ., Richmond, Va. 23284. Polyimides are one of the most important engineering materials available and are referred to as "high-performance materials" because of their excellent stability in high temperature-related applications. Synthetically, there are several routes to prepare these polymers. In our laboratory, we have been developing polyimides, via Diels Alder type condensation polymerization, with the combined advantages of high thermostability and facile melt-processibility without elution of volatile by-products. We have designed and prepared a series of different bisdienes, as well as prepared polymers with commercially available bismalleimides. We have also successfully synthesized several new kinds of bismalleimides with good mechanical properties which are being evaluated.

THE PREPARATION OF POTENTIAL POLYMERIC DRUG CARRIERS. Stephen C. Thompson, Raphael M. Ottenbrite, Dept. of Chem., Va. Commonwealth Univ., Richmond, Va. 23284. Over the past twenty years there has been a great deal of research devoted towards the development of polymeric drug carriers. In this work, copolymers of maleic anhydride and activated esters of acrylic acid derivatives were synthesized to be evaluated as potential drug carriers. The maleic anhydride monomer functionalizes the polymer backbone so as to give control over the solubility. The activated ester groups serve as a site for the attachment of compounds pendant to the polymer chain such as drugs, targeting groups and labeling moieties. The N-hydroxysuccinimide ester of N-acryloyl-4-aminobutyric acid provided a 1:1 copolymer with maleic anhydride. The molecular weight was controlled by changing the initiator and monomer concentrations. A molecular weight series ranging from 9,000-40,000 was developed. Fluorescein amine was used as a fluorescent tag and attached to the polymer chain at the succinimide ester site. A pentapeptide was attached to the polymer and is being evaluated as a potential cell binding moiety.

Education

LANGUAGE-ORIENTED LEARNING CYCLE: A FRAMEWORK FOR SCIENCE LEARNING. George E. Glasson & Rosary V. Lalik*, Va. Polytechnic Inst. & State Univ., Blacksburg, Va. 24061-0313. The language-oriented learning cycle is an instructional model that involves students in constructing science knowledge through concept exploration, clarification and elaboration activities. This model was developed as part of the Reading to Learn in Science Education (RTL/SE) Project funded by the Virginia Department of Education. During the past two years, we worked with six teacher associates and two teacher journalists as they reflected on their instructional beliefs and analyzed their teaching while working to apply this hands-on approach to science teaching. Data from teacher and student responses were collected throughout the duration of the project and analyzed to understand conceptual development. During the spring of 1990, four of the teacher associates conducted workshops using the language-oriented learning cycle as a framework for science teaching with 13 new teacher participants. During June of 1990, the project staff will host a RTL/SE Leadership Conference for teachers from school divisions in southwest Virginia. Conference participants will attend presentations, workshops and discussions about this method of teaching.

FACTORS AFFECTING THE ALTERNATIVE SCIENCE CONCEPTS OF SECONDARY STUDENTS. Edgar D. Morris*, Thomas G. Teates, & George E. Glasson, Va. Polytechnic Inst. & State Univ., Blacksburg, Va. 24061—0313.

The purposes of this study were to characterize the physical science conceptions held by students in two kinds of school populations and to determine what variables might predict these students' knowledge of physical science concepts. The predictor variables assessed included formal reasoning ability, prior knowledge of science, grade level, experience in science courses and gender. The results of the study revealed noted differences between sample means of the two populations. A regression analysis of each sample population indicated those independent variables that made significant contributions to predicting these students' knowledge of physical science concepts. In the rural sample, science achievement, gender and formal reasoning ability were the statistically significant independent variables. In the governor school sample, formal reasoning ability and grade were the statistically significant independent variables.

TEACHING AND LEARNING THROUGH BAHAMIAN FIELD EXPERIENCES. Verma H. Rivers, Dept. of Biol., Lynchburg College, Lynchburg, Va. 24501. Field experiences are claimed to be one of the better means of learning for students. Students were taught Coral Reef biology in the Bahamas. They spent from 8:30 A.M. till 4:30 P.M. in the water observing the life of the reefs. Students could snorkle or scuba dive. They studied the ecology of the reef, plants, geology of the Island, and the caves on the Island. In the evenings from 7:00 P.M. till 10:00P.M., they wrote their journals, keyed out the organisms into genus and species, and attended lectures in the field station lab. The finality of the course on the island after 10 days was a lab practical. The students return to campus on mainland and are given time to write their journals, which are turned in within two weeks. From this intensive, concentrated study of coral reef environments students learned 95% of the material covered. The culmination of the course is a Bahamian party at the Professors home to share slides, pictures, and relive the stay in San Salvador.

CONSTRUCTIVISM AND THE CLASSROOM - WHAT IS THE COST OF EMPOWERMENT?

THOMAS G. TEATES, Div. of Curriculum and Instruction, Va. Polytechnic Institute and State Univ., Blacksburg, VA 24061. With increasing frequency the empowerment of teachers is being reported in the literature as a desirable outcome best approached through a shift from a positivist epistemology to one characterized as radical constructivist. Work reported by theorists and researchers such as von Glasersfeld, Tobin and Wheatley suggests that this shift in the basic framework from which teachers view their professional responsibilities and structure their curriculum and instructional activities will require serious, honest, and thorough rethinking of their roles.

A PROTOTYPE COMPUTER NETWORK FOR USE WITH LARGE CLASSES.

Frederick Hartline & George R. Webb, Dept. of Physics and Computer Science, Christopher Newport College, Newport News, VA 23606. A prototype asymmetric computer network for use in large classes has been developed and tested in a joint effort by COMTEK and Christopher Newport College. This network and its attendant software, together called CLASSTALK, have had a profound effect, changing the usually passive atmosphere in large classes to one in which participation and active learning are predominant. Studies conducted over a three-semester period in an introductory physics course show that to 80% of the students the use of CLASSTALK increased their understanding of the subject.

MICROCOMPUTER-BASED DIAGNOSIS AND REMEDIATION OF SIMPLE ARISTOTELIAN ALTERNATIVE CONCEPTIONS OF FORCE AND MOTION. Herman G. Weller*, Div. of Curriculum and Instruction, Col. of Education, Virginia Tech., Blacksburg, Va. 24061. Science students often bring naive models of the natural world to the classroom which can be resistant to traditional methods of teaching. If both the teacher and the student are unable to detect and change these conceptions, the ability of the student to learn may be seriously impeded. A solution to this instructional dilemma would be to devise a method which a teacher could use to determine whether such naive models, or *alternative conceptions*, are held by a student and, if so, help the student to develop a plausible conception more in line with the scientific viewpoint to replace each alternative conception. The author is investigating such a method: A microcomputer-based system for the diagnosis and remediation of Aristotelian alternative conceptions held by 8th-grade physical science students. First, three conceptions have been chosen which follow directly from Aristotle's *Physica*. Second, structured interviews, similar to R. J. Osborne's "Interviews about Instances", have been conducted with a small sample of students. The interview data indicated that 8th-grade science students, weak as well as strong learners, are likely to possess one or more of these conceptions. Third, several weeks after they had covered force and motion in their science class, over 85% of the 8th-grade students tested at a suburban middle school were diagnosed by the microcomputer program as possessing one or more alternative conceptions. Of the students with the alternative conceptions, the ones who worked through the two microcomputer simulations were found afterward to have a significantly lower number of the alternative conceptions than the students who did not.

Engineering

NON-LINEAR ANALYSIS OF THE INTERACTION OF A BUNCHED ELECTRON BEAM AND THE FIELDS OF A REENRANT CAVITY IN A HIGH POWER MICROWAVE AMPLIFIER. Raef Alkhayat*, ECE Dept., George Mason University, Fairfax, Va. 22030. An experiment is being carried out at GMU to study a new concept of microwave generation that uses transverse modulation instead of the conventional longitudinal modulation. This paper involves a non-linear analysis of the interaction of a bunched beam and the fields of a reentrant cavity. Starting with Maxwell's Equations, an expression for the wave equation in the cavity is obtained. The electric field in the cavity is chosen to be time, radial and axial position dependent. The orthogonality properties of the field are used to develop the expressions describing the nonlinear evolution of the field's amplitude and frequency as a function of time. The expressions involve a source function related to the nature of the beam. The expression for the source is being developed in order to provide a mean for predicting the rf output in terms of the beam parameters. (In collaboration with FM Technologies. Supported by C.I.T and D.O.E)

INTEGRATED INTELLIGENT SYSTEMS FOR CONTROL DESIGN. Guy O.Beale *, and Francisco J.Arteaga *, Dept. of Electrical and Computer Engineering, George Mason Univ., Fairfax, Va.

The objective of this research is to develop the capability of designing control systems for complex processes where the rigorous techniques of modern control and estimation theory are coupled with the experience and skills of practicing control engineers to produce a "superior" control scheme. This capability will be implemented through a set of intelligent computer systems which will integrate the analytic and heuristic knowledge needed to design a control system for a complex process such that user-specified performance requirements are satisfied. The ability to translate performance specifications stated in the language used by the applications engineer into parameters required by the design algorithms and to determine which design algorithm is most suitable for the application will characterize the intelligent systems. The ability to evaluate a particular design relative to the performance objectives and modify that design if necessary will also be a capability of the intelligent systems.

INVESTIGATION OF DEEP LEVELS IN GaAs:Si AND SI GaAs BY DLTS AND PICTS METHODS. Gordhan R. Barevadia, Vishnu K. Lakdawala, and Karl H. Schoenbach, Dept. of Elect. and Comp. Eng., Old Dominion Univ., Norfolk, Va. 23529. The study of deep levels in semiconductor has gained increased interest because of their role in the performance of semiconductor devices. Basic information about deep level parameters such as activation energy, concentration, and capture cross section for electrons/holes of the traps is necessary to predict the device behavior. We have used Deep level Transient Spectroscopy (DLTS) technique to characterize LEC grown Si doped n-type GaAs ($\rho \approx 0.055 \Omega \cdot \text{cm}$). Two impurity levels of activation energy 0.83 eV (EL2) and 0.41 eV (EL5) have been identified. This method requires a well behaved Schottky or pn junction which is difficult to achieve for very high resistivity material such as SI GaAs. Therefore, we have developed a Photo-Induced Current Transient Spectroscopy (PICTS) set up for characterization of the high resistivity material. By employing rate window method on the current transient, we have investigated three deep levels with activation energies of 0.38 eV, 0.67 eV and 0.78 eV in semiinsulating gallium arsenide ($\rho \approx 10^8 \Omega \cdot \text{cm}$). (This work is supported by the SDIO/IST and managed by ONR)

CASCADE, A DYNAMIC VISUAL ENVIRONMENT FOR THE DESIGN OF COMPUTERS. David E. Britton*, Dept. of Electronic and Computer Engineering, George Mason Univ., Fairfax, Va. 22030. A dynamic environment for the description, simulation, and analysis of digital computer systems and system components has been developed by the author. This environment is called CASCADE, a Computer Aided System and Component Architecture Design Environment. CASCADE is built upon the Schemata Method which includes the specification of operation precedence, the control structure, and the data path. The critical components of CASCADE have been prototyped to verify its correctness, and to show that it is a practical method for the design of hardware systems. Simulation is based on an underlying Petri Net simulator (for control flow), a small generic set of control modules, and operator constructs. CASCADE can be integrated with existing design environments that use Hardware Definition Languages and Architecture Languages.

THE DESIGN OF A CUSTOM MICROELECTRONICS CHIP FOR USE IN PYRAMID STRUCTURES. Vichai Chanthashivaku*, Dept. of Electrical and Computer Engineering, George Mason Univ., Fairfax, Va. 22030. Pyramid structured computers have proven to be very efficient in image processing. The GAM2 pyramid at George Mason Univ. has also been used for image processing, and for digital simulation utilizing numerical integration. All of the existing processing elements were designed for image processing with simple ALU. A new processing element is designed primarily for matrix manipulation. In this PE, the ALU is capable of adding at one time four 1-bit inputs from children on the lower level, or from the four nearest neighbors. Each PE has its own memory, and there is local addressing allowing different PE's to access different memory locations at the same time. This provides for denormalization of the children PE's in parallel, and that improves the floating-point addition of the operands in children PE's memories by a factor of more than three. Adding of all PE's on the bottom level requires only n-1 adding times, where n is the number of levels in the pyramid.

STUDY OF CATHODOLUMINESCENCE FROM AN ELECTRON-BEAM CONTROLLED GaAs SWITCH. Mandakini Kale, V.K. Lakdawala, K.H. Schoenbach, Dept. of electrical and computer engineering, Old Dominion University Norfolk, VA 23508. Theoretical and experimental studies of cathodoluminescence on electron beam controlled gallium arsenide is under progress. The experimental setup to measure spatially resolved cathodoluminescence in zinc doped region in bulk semiinsulating material and the penetration depth of light in bulk semiconductor is discussed. It is seen from previous work that zinc doped cathodoluminescent layer in semiinsulating gallium arsenide decreases the switch resistance by more than four orders of magnitude. (Sponsored by ARO and AFOSR.)

A GAS HYDRATE THERMAL ENERGY STORAGE SYSTEM.

Professor Lembit U. Lilleleht, Ph. D. and Steven Charles Hunt, M. S., Department of Chemical Engineering, University of Virginia, Charlottesville, VA 22903.

A Gas Hydrate Thermal Energy Storage System was developed from an existing 8100 BTU air conditioning unit. A three-component mixture of Refrigerant 142b, water and a heat transfer oil were emulsified and cooled within a sealed shell-and-tube heat exchanger. A data acquisition system was used to measure and record the temperatures and pressure within the system, and to control a series of pumps, compressor and blowers. The gas hydrate formed from the emulsion is a medium which may be used within a phase change material (PCM) latent heat cool storage system. The system examined offers economic and environmental advantages over its conventional counterparts.

PERFORMANCE EVALUATION AND ARCHITECTURAL ALTERNATIVES FOR SIGNALING SYSTEM NO.

7. Lynn M. Patterson* and Dr. B. Jabbari*, Dept. of Electrical and Computer Engineering, Fairfax, Va. 22030. Signaling System No. 7 (SS7) is a relatively new out-of-band signaling protocol. It is currently being implemented by many telecommunication companies to provide basic call signaling. This research proposes that the SS7 protocol be used to transport the other areas of telecommunication traffic, such as intelligent network services, billing and network management. The architectural issues and the key performance measures associated with using the SS7 network and protocol for these other areas of traffic are examined. The SS7 protocol is robust enough to handle these other areas of traffic. Also, an integrated SS7 network would be more reliable and more cost effective than traditional methods of transporting this traffic. Lastly, the call setup time for intelligent network calls can be reduced by using the SS7 protocol. Therefore, based on these reasons, the recommendation of this research effort is that the SS7 protocol and network be used to carry all types of telecommunication traffic. (Support received in part from MCI Corporation).

STUDY OF LOCK-ON EFFECT IN A LASER CONTROLLED GaAs:Si:Cu SWITCH. Randy Roush, K.H. Schoenbach, and V.K. Lakdawala, Electrical and Computer Eng., Old Dominion Univ., Norfolk, Va. 23529. Silicon doped, copper compensated, gallium arsenide has been used as an optically controlled switch at low electric fields. Photoionization of electrons from deep copper centers into the conduction band provides the photocarriers which are able to drift under the influence of an electric field. The lifetime of the photocurrent is generally on the order of microseconds. At high electric fields, the lifetime of the photocurrent persists for extremely long times compared to the low field decay times. This is known as the lock-on effect. Current-voltage characteristics display an Ohmic region at low fields and a rapid increase in current at higher fields. This effect may be attributed to double injection at the contacts. Double injection, in conjunction with the characteristics of the deep levels in the bandgap, may lead to a theoretical description of the lock-on effect in gallium arsenide. (This work is supported by the SDIO/IST and managed by ONR).

A NOVEL HEARING AID DEVICE, BASED ON SACCCULAR DECODING OF SUPER-SONIC BONE CONDUCTION STIMULI. Ruth A. Skellett & A. M. Clarke, Ph.D., Div. of Biomedical Engineering; M. L. Lenhardt, Ph.D., Dept. of Otolaryngology, Va. Commonwealth Univ., Richmond, Va. 23298. Humans can hear frequencies above 20 kHz, but only by bone conduction, that form of hearing which results from direct vibratory stimulation of the skull and ear. This form of "super-sonic" hearing can be exploited in terms of a novel form of hearing aid. Speech frequencies are amplitude modulated using a 40 kHz carrier and demodulated by the inner ear such that the resulting stimulation is perceived as speech. Preliminary discrimination scores were found to be 85% correct. A double sideband circuit (suppressed carrier) has been developed that will also support speech perception. Two deaf subjects have been tested and both can hear tones in the supersonic range and can detect the presence of speech. Since these individuals have little measurable high frequency hearing, we postulate it is the acceleration detectors in the saccule that are responding to the bone conduction signals.

ANALYSIS OF SYSTEMS USED FOR DATA ACQUISITION AND MANAGEMENT DURING CPR IN THE EMERGENCY DEPT., THE POTENTIAL FOR THE ADDITION OF AN ARTIFICIAL INTELLIGENCE SHELL. P.L. Thery, N. Patel, A.M.L. Conner, J.P. Ornato, A.M. Clarke, Div. of Biomedical Engineering and Dept. of Medicine, MCV-VCU, Richmond, VA. 23298. Two data acquisition and management systems have been developed to improve the documentation system existing in the cardiac emergency care units. Both systems allow simple and rapid menu-driven entry of important events occurring during a cardiac emergency. Included in the documentation are drug administrations, heart rhythm observations, vital signs, and numerous other procedures commonly taking place during cardiac trauma. The systems include real-time signal displays of several analog electrocardiogram channels, serial data acquisition and upon request, storage of up to 6 seconds of data. After completion of the emergency, a standardized report sheet is printed and a display of the recorded data is available. Both systems were written to comply with the American Heart Association recommendations. A C language version has been written for maximum portability between systems while a Prolog version has been written as a potential shell for an Artificial Intelligence system.

MID AND LOW LEVEL VISION TASKS FOR THE HERMES STRUCTURE. HALEH VAFAlE*, Dept. of Electrical and Computer Engineering, George Mason University, Fairfax, Va. 22030 Computer vision is an active research field with open problems in areas related to machine learning and knowledge representation. This research proposes the combined use of the HERMES structure and machine learning techniques in order to perform simple through more complex object recognition, i.e. low to mid level vision tasks, in a given image. There are two major paradigms in machine learning: symbolic and non-symbolic. Upon observing both paradigms it is apparent that development of a multi-strategic system could overcome some of the existing weaknesses and bottlenecks, as well as taking advantage of their strong points. A visual language which combines vision processing tasks in a multi-strategic manner is proposed as the means to accomplish our goal.

THE DESIGN OF A DEFLECTION AND OUTPUT CAVITIES FOR A HIGH POWER MICROWAVE AMPLIFIER. Jose E. Velazco, ECE Dept. George Mason Univ., Fairfax, Va. 22030. Analysis and design parameters of deflection and output cavities for a novel concept of microwave generation that uses transverse modulation instead of conventional longitudinal modulation is presented. The design considerations of a rectangular resonator to generate the transverse modulation of an electron beam is included. A cylindrical resonator in the TM_{016} mode is designed to convert the energy of a bunched beam into RF power. Conversion of transverse deflection energy into longitudinal bunching is obtained in a small bending magnet by means of the path length difference. The solution of the wave equations for the fields inside of the deflection cavity is derived, including field perturbations. Study of the interaction between an electron beam and electromagnetic fields in the TM_{019} mode that will generate deflection is presented. Analysis of the loop-coupled cavity is conducted, including the input impedance of the cavity, the coupling factor and the matching considerations. (In collaboration with FM Tech., supported by C.I.T., D.O.E.)

Environmental Science

EARLY DEVELOPMENT OF A CONSTRUCTED FRESHWATER TIDAL MARSH ADJACENT TO THE CHESAPEAKE BAY. Candy C. Bartoldus* & Francis D. Heliotis*, Dept. of Biol., George Mason Univ., Fairfax, Va. 22030. Eight productivity methods were used to estimate the accumulation of aboveground biomass by planted species Scirpus pungens and Peltandra virginica and 2 dominant invading species Typha angustifolia and T. latifolia. The aboveground estimates for S. pungens, ranging from a low of 348 g/m²/yr (Peak Live) to a high of 1404 g/m²/yr (Hopkinson et al. method) demonstrate the extreme results from different computational methods. By incorporating measurements of shoot height, mass, growth, mortality, and density to calculate NAPP, phenometric methods (Williams-Murdoch, Hopkinson et al., Whigham et al., Sum-Density, & Sum-Interval) provided the most accurate estimates. For all species, phenometric NAPP estimates ranged 1.4-4.0 time higher than annual production estimates from harvest methods (Peak Live, Peak Total, & Smalley). Total production of the constructed marsh was determined by taking the most accurate estimate for each species and adjusting for measures of density and coverage.

REPRODUCTION OF ANADROMOUS STRIPED BASS IN TIDAL FRESHWATERS OF NORTH AMERICA. James H. Cowan, Jr., Edward D. Houde* and Edward Rutherford*, Univ. of MD System, Chesapeake Biological Lab., Solomons, MD 20688. The effects of river discharge on recruitment variability in striped bass populations in the Potomac River, MD and in the Sacramento-San Joaquin River system, CA were compared. Results from published studies, particularly those that contained regression models of recruitment on environmental variables, consistently suggested a positive relationship between river flow and strong year classes in both populations. However, striped bass populations in both areas have declined since the 1970's and the predictive capabilities of the regression models eroded in post-decline years. Furthermore, recent studies in the Potomac River indicate that episodic high mortalities of striped bass eggs and larvae are sometimes associated with high river discharge events. In contrast, in the highly water-managed Sacramento-San Joaquin system, strong year classes are still associated with high flow years but regression relationships developed there predict recruitments much higher than those actually observed in the years since the population decline. Although it is likely that fresh water discharge and associated environmental variables still interact to modify year class strength in both populations, low and exploited adult populations and their consequent low reproductive output probably amplifies the potential for natural or man-induced changes in the spawning environment to result in year class failure.

PHYSIOLOGICAL ECOLOGY OF BLUE CRABS IN TIDAL FRESH WATER. Peter L. deFur, Environmental Defense Fund, 1108 E. Main St., Richmond, VA 23219. Blue crabs, Callinectes sapidus release their eggs in the ocean and larvae settle out of the plankton in mesohaline areas (ca. 15-20 ppt). Thus, crabs in freshwater habitats have migrated through temperature, salinity and probably oxygen gradients. Crabs acclimated to fresh water in the lab, or collected from freshwater have a higher blood pH and maintain a blood to water ionic gradient of about 650 mOsm. The respiratory pigment, hemocyanin, has a different subunit composition and greater oxygen affinity in crabs acclimated to low salinity or low oxygen, indicating that complex metabolic adjustments are associated with the migration. Crabs in fresh water or low salinity areas prefer shallow water and smaller creeks over larger water bodies, one explanation being the need for a suitable molting site. Blue crabs molting in freshwater gain two additional benefits. First, the weight gain at the molt is greater, perhaps by 100%, resulting in fewer molts needed to achieve a given size. Second, the changes in blood chemistry are lesser than in crabs molting in high salinity. Blue crabs inhabiting freshwater expend considerable muscular and metabolic energy to gain the advantage.

EUTROPHICATION OF TIDAL FRESHWATER ECOSYSTEMS: MITIGATION BY BENTHOS AND HYDRODYNAMICS? Jeroen Gerritsen, Anna T. Shaughnessy, J. Ananda Ranasinghe, & A. Fred Holland, Versar, Inc. 9200 Rumsey Rd., Columbia, MD 21045. The physical characteristics of tidal freshwater ecosystems allow for the dominance of suspension feeding bivalves in the trophic dynamics of these systems. Tidal freshwater systems are shallow, well-mixed, and do not typically stratify as do many deeper estuaries and lakes. This allows the continual circulation of phytoplankton through the water column and enhances capture of phytoplankton by suspension feeding benthos. Shallow, well-mixed estuarine regions are known to develop large populations of suspension feeding bivalves, which can control phytoplankton to a degree not possible in deeper regions. We demonstrate this with a model of benthic suspension feeding applied to several regions of Chesapeake Bay. A majority of primary production is consumed by suspension feeders in shallow, well-mixed zones where large populations of bivalves have developed, but in deep regions or in shallow regions without sizable populations of benthic suspension feeders, large fractions of primary production are not consumed.

EFFECTS OF SUMMER STORMS ON THE PHYTOPLANKTON OF A TIDAL POTOMAC RIVER EMBAYMENT. Jackson D. Harper, Dept. of Biol., George Mason Univ., Fairfax, VA. 22030. The role of hydrometeorological factors in controlling phytoplankton in a freshwater tidal ecosystem was investigated and digitally simulated. The study site was Gunston Cove, an embayment of the Potomac River near Washington, D.C., which was subject to urban runoff and nutrient loading from a sewage treatment plant. Measurements were taken daily for 108 days during the summer of 1986. Cold fronts which occurred on average every 4.7 days were associated with 10 storm flows which brought silt loads with adsorbed phosphorus to the cove and caused phytoplankton flushing. The Gunston Cove Ecosystem Model (GEM) was written in Turbo Pascal for microcomputers. Algal growth was found to be sensitive to light, water temperature, phosphorus, algal growth rate, respiration, and algal sink rate. It was less sensitive to zooplankton grazing, mean tide, and floating-leaved vegetation. Simulation exercises suggested a positive feedback relationship between algal growth and sedimentary phosphorus release.

SPATIAL, SEASONAL, AND INTERANNUAL VARIATIONS IN THE PHYTOPLANKTON OF A TIDAL FRESHWATER EMBAYMENT. R. Christian Jones and Claire Buchanan, George Mason Univ., Fairfax, VA 22030. Phytoplankton populations have been monitored on a biweekly to monthly basis at 12 stations in the tidal freshwater Potomac River since 1984. Stations were located in two shallow embayments (Gunston Cove and Dogue Creek) and in the mainstem channel area. Summer chlorophyll levels were consistently greater in Gunston Cove than in the mainstem areas. Cell density generally reflected chlorophyll dynamics. Blue-greens dominated phytoplankton assemblages at all sites particularly in summer. Microcystis aeruginosa was important in the late summer phytoplankton in the cove in most years, while it was found in large numbers in the river only in 1985. Microcystis dominance was related pH values high enough to enhance sediment phosphorus release. Years with lower phytoplankton densities were characterized by multiple frontal passages during the summer and lack of long sustained hot, dry periods.

SEASONAL AND INTERANNUAL PATTERNS OF FISH POPULATIONS IN A PORTION OF THE TIDAL FRESHWATER POTOMAC RIVER. Donald P. Kelso and Sue Touart, Dept. of Biol., George Mason Univ., Fairfax, Va. 22030. From 1984 through 1989 fish collections with a 15 ft. otter trawl have been made at one station in the Potomac River, one station in Dogue Creek embayment, and three stations in Gunston Cove embayment. The 371 trawls were made monthly or more frequently from Mar. to Dec. and caught 34,386 fishes in 34 species. Five species accounted for 87 to 94% of each year's total: 1. white perch 2. bay anchovy 3. brown bullhead 4. gizzard shad 5. blueback herring. Mean catch per trawl was 129.4 in 1984, 73.5 in 1985, 84.2 in 1986, 113.6 in 1987, 67.7 in 1988, and 63.5 in 1989. Declines in white perch catch in 1988 and 1989 parallel increases in blueback herring in 1987, 1988, and 1989 and gizzard shad in 1989. The seasonal abundance of the total catch is bell shaped, with low numbers in the early spring and late fall and peak numbers in the summer, due to newly metamorphosed juveniles. White perch increase in June, followed by gizzard shad and blueback herring in July and bay anchovy in August. Brown bullhead numbers fluctuate less from month to month. Year classes are evident each year in white perch and blueback herring and in most years in brown bullhead and gizzard shad. Bay anchovy year classes are less obvious, perhaps due to extended spawning periods or immigration of different cohorts.

SEASONAL PHYTOPLANKTON DYNAMICS WITHIN TIDAL FRESHWATER RIVER SYSTEMS OF THE LOWER CHESAPEAKE BAY. Harold G. Marshall and Lewis Affronti. Dept. of Biological Sciences, Old Dominion University, Norfolk, Va. 23529-0266. Results of a four year monitoring study of phytoplankton in the lower James, York and Rappahannock Rivers indicated distinct assemblages in the oligohaline and mesohaline regions, with a transitional oligo-mesohaline region that will vary seasonally and annually in its extent. Five to six seasonal assemblages formed a seasonal successional pattern where the timing and duration of the spring bloom was influenced by the seasonal rains. Cell concentrations generally increased into the mesohaline sections, then decreased downstream into the Chesapeake Bay. The greatest abundance of cells was in the James River which also contained the highest concentrations of nutrients. In each river the nutrient levels decreased downstream. The diatoms had spring and late summer - early fall growth peaks, with dinoflagellates most abundant in late winter and summer. Cryptomonads, chlorophytes, euglenoids and cyanobacteria were common, with the picoplankton most abundant during summer. Sub-pycnocline waters moving upstream provided a conduit for estuarine and mesohaline species to enter the river systems. Supported by the Virginia State Water Control Board.

BENTHIC-TIDAL FRESHWATER ECOSYSTEM INTERACTION: THE WASHINGTON EXPERIENCE
Harriette L. Phelps Dept. of Biol., Univ. of the District of Columbia, Washington, D.C. 20008. The exotic clam, *Corbicula fluminea*, is estimated to have been introduced in the freshwater tidal Potomac river estuary near Washington, D.C. in 1976. The population increased rapidly and in 1981 a tripling of water clarity was reported in the region of the clam beds. In 1983 there was a sudden reappearance of submerged aquatic vegetation in the same portion of the estuary, growing to 50% of the river by 1986 with dramatic increases in fish and wildfowl. In September 1986 an extensive clam population survey at 102 sites on five transects found significant populations in all areas except the dredged channel. Calculations estimated the July 1986 population could have filtered 33% to 100% of the water in a 5-km region. The action of clam filtration and increased vegetation on sediment and nutrient precipitation may have been responsible for the restoration of the Potomac to the conditions of 50 years ago in only 5 years. The Potomac may be a tidal freshwater ecosystem having two metastable states governed by water clarity, with transition facilitated by the establishment of large populations of an exotic filter-feeding bivalve. It is considered an outstanding ecological success in the Chesapeake Bay region. Funded by D.C Environmental Services.

CLIMATE, WATER CLARITY AND SUBMERSED MACROPHYTE POPULATION DYNAMICS IN THE TIDAL POTOMAC RIVER. N.B. Rybicki and V.P. Carter, USGS, Reston, VA 22092. The role of climatic variation in the population dynamics of submersed aquatic macrophytes may be as important as that of anthropogenic affects. Following a resurgence of submersed macrophytes in the upper tidal Potomac River in 1983, population density increased steadily and plants spread down river into the lower tidal river. However, in 1989, there was a 60 percent decrease in macrophyte area in the upper tidal river, mostly as a result of loss of the dominant species, *Hydrilla verticillata*, whereas the plant population in the lower tidal river continued to increase. We attribute the decrease in plants to a cold, wet and cloudy growing season. Low spring water temperatures caused delayed sprouting and stunted growth of *Hydrilla*. There was a reversal in water clarity between the upper and lower tidal rivers, largely as a result of higher than normal discharge which remained high through August. Summer Secchi depths at Piscataway Creek (upper tidal river) averaged 0.4 m whereas summer Secchi depths at Quantico (lower tidal river) averaged 1.0 m. In addition, available sunshine was 15-20 percent below average during June-September. These factors had a severe effect on the *Hydrilla*, a tropical exotic, but did not have any apparent effect on the other dominant species.

SPAWNING AND YOUNG-OF-THE-YEAR RECRUITMENT OF STRIPED BASS, MORONE SAXATILIS IN THE POTOMAC RIVER: THE ROLE OF NUMBERS VS. THE ENVIRONMENT.

Eileen M. Setzler-Hamilton*, Chesapeake Biol. Lab., Univ. MD System, CEES, Solomons, MD 20688.

We assessed stocks of larval striped bass in the Potomac Estuary during the years 1974-1977, 1980-1982, and 1986-1987. Abundances of striped bass eggs and early larval stages are not correlated to subsequent recruitment as measured by the Maryland Juvenile Seining Index. The best correlation of mean density of larvae from Maryland Point to Sheridan Point, river km 102-158, occurs during the second week of May; $Juv. Ind = 2.6582 + 0.0036 \bar{x} \text{ density}, r^2 = .61$. However large sample variability results in little confidence in the predictive ability of the equation. Environmental variables, particularly water temperature and river flow, with its subsequent influence on both distribution and abundance of zooplankton prey populations, and on distribution of larvae, are the major factors controlling yearclass success.

ANNUAL VARIATIONS IN BIOMASS PRODUCTION: A COMPARISON OF TIDAL FRESHWATER AND TIDAL BRACKISH WETLANDS. Dennis Whigham, Smithsonian Environmental Research Center, Edgewater, MD 21037 and Robert L. Simpson, William Paterson College, Wayne, NJ 07470.

Previous comparisons between tidal freshwater and other types of wetlands have not given consideration to potentially important annual differences in biomass production. Using the few longer-term data sets that are available, we will test the hypothesis that annual variations in biomass production are minimal in tidal freshwater wetlands due to the lack of moisture and salt stress. Annual variation in biomass production should be greatest in tidal wetlands that experience differences in growing season salinity and in non-tidal freshwater wetlands that experience annual differences in moisture availability. Variations in biomass production should be low in salt marsh habitats which are regularly flooded.

FISH PREDATION ON LITTORAL MICROCRUSTACEA ASSOCIATED WITH WATER CHESTNUT (*Trapa natans*) IN TIVOLI SOUTH BAY, A HUDSON RIVER TIDAL FRESHWATER WETLAND. David J. Yozzo and William E. Odum, Dept. of Env. Sci., Univ. of Va., Charlottesville, Va. 22903. The littoral microcrustacean fauna of Tivoli South Bay was studied from June to September, 1989, with emphasis on the Ostracoda. The effects of fish predation on microcrustacean densities were tested by means of a short term predator exclusion experiment. Fish were excluded from *Trapa natans* plots in four screened exclosures. An equal number of open cages allowed foraging. Fish predation did not have a significant effect on densities of ostracods or other microcrustaceans. Ostracod densities increased throughout the experimental period, whereas cladoceran and copepod densities decreased in both treatments. Analysis of fish stomach contents revealed that ostracods were frequently selected for as a dominant food item by fish utilizing *T. natans* as a feeding area and refuge. These results suggest that the productivity of ostracods in aquatic systems may have been previously underestimated. The value of *T. natans* as habitat for forage fish is significant, and may serve to enhance total fish production in the Hudson River Estuary.

Geology

IDENTIFICATION OF HIGH RADON ROCK UNITS IN NORTHERN VIRGINIA. Charles E. Chrosniak, Douglas G. Mose and George W. Mushrush, Center of Basic and Applied Science, George Mason University, Fairfax, Va. 22030. Rock units in northern Virginia comprise 3 physiographic provinces, within which radon represents very different levels of environmental hazard. Rock units in the Coastal Plain province exhibit generally low soil radon and indoor radon, and less than 20% of the homes exceed the U.S. EPA's "Action Level" of 4 pCi/l (level above which home repairs should be considered to lower indoor radon). Rock units in the Culpeper Basin show greater variation, but most have a low percentage of homes above 4 pCi/l. The greatest hazard is within the Piedmont province, where some rock units have an average soil radon and average well water radon above 3000 pCi/l, and an annual indoor radon level in excess of 4 pCi/l (approximately 50% of the homes above 4 pCi/l). Studies indicate that total gamma aeroradioactivity can predict which rock units constitute the greatest radon hazard.

A STUDY OF POINT BAR DEPOSITION WITH REGARD TO FINING-UPWARD SEQUENCE AT PEMBROKE, VIRGINIA. Warren T. Dean* & Kimbell L. Knight*, Dept. of Geol., Radford Univ., Radford, Va. 24142. A study of point bar deposition on the New River near Pembroke in western Va. showed a deviation from the normal fluvial point bar fining-upward sequence, suggesting an aeolian influence. A perpendicular transect of the point bar was made with one surface and one subsurface sample collected from each of 11 stations. Using traditional methods of sieving and analysis, mean grain size, median grain size, and sorting were determined for each sample. Plots of median grain size vs. station number showed the normal fining-upward sequence for stations 1-5 but showed an abnormal coarsening-upward sequence for stations 6-11. Three lines of evidence suggest that aeolian influence modified normal fluvial processes affecting the surface samples: 1) Topography suggests that wind is funneled over the point bar and vegetation traps the wind-blown sediments, 2) Median grain size plotted against station number shows the surface samples to have a very uniform size away from the river which is consistent with aeolian transport and inconsistent with normal fluvial deposition, and 3) Sorting of the surface samples was much greater than was sorting for the subsurface samples, which is also more consistent with aeolian transport.

GEOVIDEOS FOR TEACHER TRAINING AND FIELD TRIP PLANNING. Ruth G. Deike*, US Geological Survey, Reston, VA 22092. A video record of any geological field trip can be made easily and with relatively inexpensive equipment. The video can be designed for a wide variety of uses, for example, teaching (both teachers and students); to prepare students for taking the field trip; to refresh leaders before another trip; and, continued study of the field trip site. Raw footage of the trip is obtained with a good camcorder (videocamera/VCR, \$1500). Footage should reflect the intended use of the video, i.e. the photographer identifies with the intended audience. Be generous with close-ups, and on-site explanations from the trip leader. Appropriate maps and illustrations are taped, then the footage is catalogued, and the final master tape is edited using a second VCR with audio-dub capability (\$1000). The master version is constructed from beginning to end using report-writing principles: Determine the intended audience; What action do you want audience to take; Keep points simple and made quickly; Use a clever beginning and ending. Narration and/or music is added last to pull the story together.

EFFECT OF SUB SLAB VENTILATION ON THE REDUCTION OF INDOOR RADON. Paul DiBenedetto, Douglas Mose and George Mushrush, Center of Basic and Applied Science, George Mason University, Fairfax, Va. 22030. Indoor radon levels above 4 pCi/l are estimated by the U.S. EPA to constitute an unreasonable risk that can be reduced by a reasonable expenditure. Several methods can be used to reduce the inward movement of soil-derived radon through soil-facing floors and walls. The most common remedial method is the installation of a vacuum system, which pulls soil air from below the home. To determine if this method works for an extended period of time (1 year) after installation, and to determine the relationship between pre-remediation indoor radon and the willingness of the homeowner to expend @ \$1000 for the system installation, a population of @ 1500 homeowners with indoor radon were offered the system. Approximately 10% of this group requested sub-slab ventilation, but the request group had an average indoor radon that was only slightly higher than the indoor radon of the entire group. The implication is that some people with essentially no risk from indoor radon install remediation systems, and some people with an obvious need elect to not install a remediation system.

IMPLICATIONS OF SEGMENTED ALLUVIAL FANS, STUARTS DRAFT, VIRGINIA. Debra F. Duffy and G. Richard Whittecar, Department of Geological Sciences, Old Dominion University, Norfolk, VA 23529

Alluvial fan complexes along the western flank of the Blue Ridge mountains in Augusta County, Virginia consist of very coarse quartzite gravels deposited during at least three different periods. Each alluvial unit is topographically distinct and displays different degrees of clast weathering and soil development. The oldest units are characterized by totally incompetent ghosts of quartzite clasts and reddish (2.5YR) argillic soils more than 2 m thick. Old remnant surfaces cluster along the toe of the fan complex; the youngest lie close to the fan apexes. In tectonically active areas this map pattern often indicates relatively rapid uplift of the source area. Although uplift can not be dismissed, two other factors may have influenced the distribution of fan surfaces in the study area. 1) Solutional lowering of remnant surfaces overlying the Shady Dolomite probably destroyed many relatively old features close to the mountain front. 2) Pleistocene climate changes may have controlled the timing of both the production of talus by periglacial frost shattering and the delivery of sediment to the youngest fans by massive rainfall events.

RADON IN THE SEDIMENTS OF THE CENTRAL VIRGINIA COASTAL PLAIN. Bruce K. Goodwin, C.R. Berquist, Jr., Tracey E. Whitesell, Col. of William and Mary, Williamsburg, Va. 23185, & Jennifer M. Cooper, Dept. of Geology, James Madison Univ., Harrisonburg, Va. 22807. Radon 222 concentrations were measured in interstitial gas from unconsolidated sediments of five coastal plain formations (the Eastover, Yorktown, Bacons Castle, Windsor and Shirley formations) at three study areas: York River State Park, The College of William and Mary Woods, and Chippokes State Park. The Yorktown was sampled at all three study areas, the Eastover and Bacons Castle were each sampled at two study areas, and the Windsor and Shirley were sampled at only one study area. Sampling was done by suspending charcoal canisters in auger holes. At the York River State Park canisters were in place from July 3-10, 1989; at the other sites they were in place from January 11-18, 1990. Of thirty six holes tested, eighteen in the Yorktown Formation had an average radon concentration of 1050 pCi/l, and eighteen in the other units had an average radon concentration of 200 pCi/l. The results suggest that over a distance of 20 miles much higher radon values are found in the Yorktown Formation than in the other units. The gamma ray scintillometer shows highest radioactivity to be around fossilized whale bones in the Yorktown Formation, although this may not be the only source of radon.

INTERNAL STRUCTURE OF THE COAL BEARING PORTION OF THE CUMBERLAND OVERTHRUST BLOCK: W. S. Henika Va. Div. of Mineral Resources, Blacksburg, VA 24061-0411. Most of Southwest Virginia's remaining coal resources occur within the Cumberland block (Wentworth, 1921) which is now recognized to extend southwestwards from the Canebrake fault in Tazewell Co., Va. for almost 250 km. to the Jacksboro fault in Campbell Co., Tn. The southwest end of the block was moved at least 21 km. to the northwest along the Pine Mtn. thrust by a clockwise rotation about a pivot in northeast Buchanan Co. Va. during the Alleghanian orogeny. This mass movement involved uplift and rotation of the block across a series of intersecting tectonic ramps producing opposing uplifts at the southwest and the northeast ends. At least 6 major transverse faults developed across the block during rotation. Subthrust duplication and uplift in the Powell Valley area and imbrication along the southeast block boundary faults may have reactivated the crossfaults producing local inversion and apparent lateral displacements. Copyright 1990, Commonwealth of Virginia.

A GUIDE TO THE ENGINEERING AND GEOLOGIC CHARACTERISTICS OF THE MAPPED ROCK UNITS OF VIRGINIA. David A. Hubbard, Jr.*, Virginia Div. of Mineral Resources, P.O. Box 3667, Charlottesville, VA 22903. Specialization within the disciplines of architecture, civil engineering, and geology has increased the technical terminology and jargon used within each discipline. The terminology and jargon of one discipline may be an obstacle to a practitioner of another discipline who seeks data or the interpretations of professionals working in the other discipline. Data and interpretations presented on geologic maps may not be readily understood by the architect or civil engineer involved in the design of landscape modifications or structures. Detailed physical site evaluations can and do miss important geologic information. A guide, in which rock characteristics and test data are compiled for each mapped rock unit, is under development at the Virginia Division of Mineral Resources. Parameters discussed include: Lithologic Description; Bedding; Fracturing and Cleavage; Topographic Expression; Weathering -Karstification; Soil Development -Shrink-Swell Potential, -USDA Soil Survey Percolation Limitations; Drainage; Porosity and Permeability; Groundwater; Rock Failure Mechanisms; Mineral Resources; Construction Materials; Rock Test Data. Copyright 1990, Commonwealth of Virginia

QUARTZ CHARACTERISTICS AND PROVENANCE OF LOWER PALEOZOIC ARENITES OF NORTHERN VIRGINIA. Elizabeth Larsen* and Richard J. Diecchio, Dept. of Geology, George Mason Univ., Fairfax, VA 22030. The petrologic characteristics of quartz grains in Lower Paleozoic arenites were investigated to determine possible provenance of successive sandstone units. Quartz grains in the Eocambrian Swift Run Formation have similar characteristics (crystallinity, extinction, and rutile inclusions) to those in the underlying Precambrian Pedlar Formation. The craton-derived Chilhowee Group (Eocambrian (?) to Cambrian) differs from the Swift Run and Pedlar in that there is an absence of grains with straight extinction, a presence of polycrystalline grains, and abundant grains with rutile inclusions. Unlike the lower arenites, the Silurian Massanutten Sandstone has abundant polycrystalline and straight extinction quartz grains, very few undulose grains, and very few rutile inclusions. It is possible that the Massanutten could have been partially derived from the Lower Paleozoic rocks, but there is evidence of some other source.

TIDE SPRING VIRGINIA--A LOOK AT THE UNDERGROUND. James D. Lehman, Dept. of Physics, James Madison Univ., Harrisonburg, Va. 22807. The overall ebb and flow performance of Tide Spring was documented during the 1982-87 survey. The underground spring body was noted to be quite extensive, and the drawdown at flow's end is considered to be the action of a hydraulic jump. A serious attempt was made to locate the reservoir using audio techniques during normal cycling. A noise pocket was discovered 55 meters south of the spring opening. A buried microphone at two meters monitored this action. Efforts to correlate this bubbly noise to a breaking siphon is complicated by the time of occurrence. Current work continues in an attempt to verify the nature of this pocket as well as to refine the location of the holding reservoir.

WORKING WITH TEACHERS TO ENHANCE INTEREST AND PUBLIC EDUCATION IN THE GEOSCIENCES. Stephen W. Lenhart & Chester F. Watts, Dept. of Geol., Radford Univ., Radford, Va., 24142; and Karen Fisher, Pulaski Co. H. S., Dublin, Va., 24084. Teachers Researching Interesting Places for Science (T.R.I.P.S.) is a newly created organization administered by, and for, public school Earth Science teachers of southwestern Virginia to enhance their learning experience, and subsequently their teaching effectiveness, through educational and enjoyable field-oriented activities. T.R.I.P.S. was formed by the Radford University Department of Geology by (1) distributing an interest survey to public school Earth Science teachers, (2) convening an organizational meeting for those teachers indicating an interest in such an organization, and (3) offering continued support by suggesting ideas for field trips and by providing, when asked, field trip leaders. T.R.I.P.S. has been a successful attempt to contribute to public awareness and education pertaining to geology and the environment, and the extension of this organization into other locales for the benefit of other public school Earth Science teachers is encouraged.

FAUNAL ASSOCIATIONS IN LATE ORDOVICIAN-AGE CENTRAL APPALACHIAN FAUNAS. Jack E. Nolde, Virginia Division Mineral Resources, Box 3667, Charlottesville, Va 22903.

A census of 36 faunal species in 75 samples from the Late Ordovician-age Reedsville Formation collected from Pennsylvania to Tennessee have been re-examined using R-mode cluster analysis and polar ordination. R-mode cluster analysis grouped the 36 species into four faunal associations: 1) Ambonychia praecursa-Modiolopsis modiolaris, 2) Ambonychia cultrata-Pterinea demissa, 3) Lyrodesma poststriatum-Praenucula levata, and 4) Loxoplocus abbreviata-Loxoplocus ventricosta. Polar ordination illustrated the interrelationships among the clusters and the gradational nature of the faunas, this led to an interpretation of two faunal gradients: 1) a transition from dominance of infaunal, bivalves to dominance of epifaunal brachiopods and gastropods, and 2) a low-diversity community, primarily of r-strategists, which characterized the unstable intertidal zone, while a more stable subtidal zone supported moderately diverse communities with both r- and K-strategists.
Copyright 1990, Commonwealth of Virginia.

BIOFACIES ANALYSIS OF LATE ORDOVICIAN-AGE CENTRAL APPALACHIAN FAUNAS. Jack E. Nolde, Virginia Division Mineral Resources, Box 3667, Charlottesville, Va 22903.

Seventy-five samples containing 36 faunal species from the Late Ordovician-age Reedsville Formation collected from Pennsylvania to Tennessee have been re-examined using Q-mode cluster analysis and polar ordination. Q-mode cluster analysis grouped the samples into six biofacies that are reflected across the area by the temporal and geographic development of four recognizable environments: 1) Lingula-Tancrediopsis-Plectonotus, 2) Lingula-Ambonychia-Plectonotus, and 3) Plectonotus, intertidal; 4) Orthorhynchula-Rafinesquina-crinoid, upper subtidal; 5) Hebertella-Zygospira, upper to lower subtidal; and 6) Dalmanella-Sowerbyella, lower subtidal. Polar ordination illustrated the gradational nature of the samples that led to interpretation of two environmental gradients: 1) fossil diversity was highest in the intertidal zone and decreased into the upper subtidal zone, and 2) hydrodynamic energy was low in the intertidal and lower subtidal zones and increased from both directions toward the upper subtidal zone.
Copyright 1990, Commonwealth of Virginia.

BUILDING STONES FROM NORTHERN VIRGINIA. James V. O'Connor, Dept. of Env. Sci., Univ. of DC, 4200 Conn. Ave. NW, Washington, DC 20008. Building stones are special urban landscapes. Local stones reflect regional mining districts in nearby geomorphic sub-provinces. Investigations on classifying rock types and their internal features also lead to an examination of weathering and artistic processes. Trade names may be different from the geologic formation names. Among the common native stones from Northern Virginia are Alexandria bricks, Potomac cobblestones, Virginia Freestone, Seneca Red or brownstone, Potomac Marble, Potomac Bluestone, Occoquan granite, Trap (diabase), Weverton quartzite, and Catoctin greenstone. Buildings constructed from each regional stone provide a ready-made field trip for tracking both examples of stone use and quarry source for each dimension stone.

SCENIC LANDFORMS OF NORTHERN VIRGINIA. James V. O'Connor, Dept. of Env. Sci., Univ. of DC, Washington, DC 20008 & Ruth Deike, MS-432, USGS, National Center, Reston, Va. 22092. VIRGINIA MINERALS, (v.34 #3, Aug. 1988) highlighted scenic landforms of Virginia using topographic maps. Our investigation of local topographic maps indicated much more scenery than the two scenic landforms listed for Northern Virginia. Our select sites occur on USGS topographic maps; high-light different scenic geomorphic vocabulary; and are on accessible public property. Among the landforms chosen are: runs, falls, neck, point, marsh, terraces and scarps, spring, meadow, mouth/delta, and drainage divide. Map documentation and field trip potential for eleven scenic sites developed into a short preview video. The select scenic landforms on the video are a simple model for a variety of geoeeducational opportunities associated with using the natural resources in your backyard. Local scenic landforms stimulate an inquiry into the dynamics of earth cycles and evolutionary processes. The rare occurrence of natural landforms in the urban environment must be used to foster enjoyment and investigation of the world around us.

NITROGEN IN GROUNDWATER OF THE NORTH RIVER BASIN. Natalie Prince* & W. C. Sherwood, Dept. of Geol. and Geog., James Madison Univ., Harrisonburg, Va. 22807. Nitrogen concentrations from dissolved nitrates in groundwater were investigated in the North River Basin in Rockingham and Augusta Counties, Va. A total of 147 well water samples were collected at the intersections of a one mile grid superimposed over a map of the basin. Nitrate analysis was carried out using ion chromatography. Concentrations ranged from 0 to 28 mg/L of nitrate nitrogen with a mean value of 5.7 mg/L. The present limit for safe drinking water in Virginia is 10 mg/L. While the average concentration of 5.7 mg/L is significantly below the safe 10 mg/L limit, approximately 18% of the samples exceeded 10 mg/L of nitrogen. Two areas in the basin contained the highest nitrogen concentrations: 1) the Dayton - Dale Enterprise area in Rockingham County, and 2) the Mount Solon area of Augusta County. Attempts were made to correlate nitrate concentrations with bedrock and soil types. Neither were successful. Two anthropogenic sources were also examined; effluent from septic systems and nitrates from agriculture. The correlation between nitrate in groundwater and the intensity of agricultural operations appears to be significant. More work is needed to determine specific nitrate sources, nitrate movements in groundwater, and seasonal variations in nitrogen concentrations.

ANALYSIS OF A SIGNIFICANT GAS-BEARING STRUCTURE IN THE MID-ATLANTIC OUTER CONTINENTAL SHELF. Grant A. Richardson, Bionetics Corp., Vint Hill Farms Station, Warrenton, VA 22186, & Fredrick Keer, Minerals Management Service, 381 Elden St., Herndon, VA 22070. The deepest horizon of the most significant hydrocarbon discovery (gas and minor oil) lying 80 miles east of the New Jersey coastline was analyzed to predict the location of a high geopressured gas zone within Jurassic age strata. The discovery, ranging from 12,000 to 18,000 feet below the seafloor, lies within a high-angle growth fault-bounded anticline possibly resulting from movements of a deeply buried crustal block. Interpretations were derived from ten seismic lines and well drilling data collected by private exploration conducted during the early 1980's. Fault-plane analyses were used to assemble computer-generated structure-contour maps of the Bathonian horizon (middle Jurassic) from the seismic lines. The position of the high geopressured gas zone, predicted by the computer structure modeling, coincides with the drilling depth at which the zone was encountered.

SOIL RADON, SOIL PERMEABILITY AND THE PREDICTABILITY OF INDOOR RADON. Mohamed Santur, Douglas G. Mose and George W. Mushrush, Center of Basic and Applied Science, George Mason University, Fairfax, Va. 22030. Several studies have shown that indoor radon can be directly related to soil parameters, such as soil uranium, soil permeability and/or porosity, soil thickness, depth to water table, inclination of surface, and other factors. To determine if indoor radon could be predicted by easily measured criteria that are understandable to a typical homeowner, a comparison was made between indoor radon, soil radon concentration, and soil permeability. The study showed that although soil radon alone or soil permeability alone could not predict indoor radon, a reasonably high percentage of homes have an indoor radon level which can be predicted if soil radon and soil permeability are both measured. This predictive method is important in an area where new homes are to be constructed, in cases where a home currently has an indoor radon problem, or in cases where the homeowner wants to anticipate potential problems which could arise as the basement walls and floor develop post-construction cracks.

AVAILABLE COAL RESOURCES OF WISE 7.5-MINUTE QUADRANGLE, SOUTHWEST VIRGINIA. Roy S. Sites*, Va. Div. of Mineral Resources, Charlottesville, VA 22903. Evaluation of 18 Pennsylvanian age coalbeds, for a more realistic determination of coal available for mining, involved examining the impact of various land-use and technologic restrictions applied to remaining coal resources. From coalbed outcrops, mined areas, coal thicknesses, and defined restrictions to mining, original, remaining, and available coal resources for each coalbed were calculated using U.S.G.S. computer-based geostatistical programs. Results show only 4 percent of the coal has been mined leaving 771-million short tons (mst) of remaining coal resources. Specific restrictions applied affected 33 percent of the remaining coal resources, thereby showing 67 percent, or 520 mst, of the remaining coal resources to be available for mining. Nearly 90 percent of the affect of total restrictions applied were technologic. This study reveals current remaining coal resources for this one quadrangle to be nearly half the amount as previously presented for the entire county. Applied restrictions to mining can significantly affect the remaining coal resources and provide a more realistic available coal resource estimate.

THE RADFORD UNIVERSITY SUMMER GEOLOGY FIELD SCHOOL FOR TEACHERS. Jonathan L. Tso and Chester F. Watts, Dept. of Geology, Radford Univ., Radford, Va. 24142. The Summer Field School for Teachers is a 6-credit course designed for middle school physical science and secondary school earth science teachers from Virginia. The course provides teachers with basic first-hand experience in geologic mapping, data collection and the geology of Virginia. The course is divided into two parts: a correspondence course beginning in late spring, and an intensive on-campus 3 week class that begins in mid-summer. A basic review of rocks and minerals, historical geology, stratigraphy, and the geology of Virginia is accomplished through classroom instruction. Numerous one-day trips in the Valley and Ridge and Blue Ridge of southwest Virginia provide experience in field identification and description of specimens, observation and measurement of geologic structures, and exposure to nearly the entire Precambrian to Paleozoic stratigraphic section in the region. During a three-day field mapping project in the local Radford area, the teachers are responsible for identifying formations, mapping contacts on a topographic base map, measuring orientations, drawing a geologic map, and providing a complete lithologic write-up and geologic history. A 4-day field trip takes the class around the state from Radford to Virginia Beach to Northern Virginia back to Radford. During the course, the teachers visit all the geologic provinces of Virginia and have numerous opportunities to collect samples, take photographs, and create teaching materials for use in their own classroom teaching.

LOCATING A GROUNDWATER SUPPLY IN COLLUVIAL DEPOSITS FOR INGRAM VILLAGE, GILES COUNTY, VIRGINIA. Chester F. Watts and Ernst H. Kastning, Institute for Engineering Geosciences, Dept. of Geology, Radford University, Radford, Va. 24142. Located in the Valley and Ridge Province of Virginia, much of Giles County is underlain by limestone of Middle Ordovician age containing a well-developed karst landscape. Mountain ridges of the county, such as Pearis Mountain, consist of resistant sandstones of Silurian and Ordovician age. Illegal sinkhole dumping has resulted in groundwater pollution in some of the karst areas. When the community of Ingram Village experienced contamination of its spring water and occasional cessation of water flow, the immediate concern for engineers was whether or not identifying the recharge area would be difficult owing to the complex nature of water movement in karst. However, the geologic map of Giles County, published in 1986, led the authors to believe that the springs were fed by a clean, perched water table in a valley underlain by low permeability sedimentary rocks and filled with colluvium from the Ordovician and Silurian sandstone formations from the ridge above the community. Field investigation confirmed this hypothesis and made identification of the recharge area straightforward. Also, alluvial fans filling two adjacent valleys were identified as large perched water table aquifers with water volumes more than adequate for the needs of the Ingram Village community. Indeed, it would appear that many such clean, perched aquifers exist in the county and that they may well be the answer to some of the water supply problems of the small communities. The study also clearly illustrates the value of published geologic maps to municipalities and land use planners.

EVIDENCE FOR THE JAMES RIVER HEADWATERS LYING WEST OF THE BLUE RIDGE BY LATE MIOCENE TIME. Robert E. Weems, MS 928, U.S. Geological Survey, Reston, VA 22092

Well rounded, green-stained granite and quartzite cobbles occur occasionally at about 85 feet elevation just north of 18th and Coalter streets in Shockoe Valley, Richmond, Virginia, along the contact between the middle Miocene Choptank Formation and upper Miocene Eastover Formation (Claremont Manor Member). One 14-cm-long quartzite cobble (USNM 449125) with abundant straight, parallel tubes of Skolithos, probably came from the Lower Cambrian Erwin Quartzite. The Silurian Keefer and Tuscarora quartzites are less likely source lithologies that also contain Skolithos. All of these units only occur west of the Blue Ridge in central Virginia, so the presence of this large cobble in Richmond suggests that the ancestral James River had established essentially its present course across the Piedmont by 10 million years ago (late Miocene time) and was draining areas west of the present Blue Ridge much earlier than previously known.

GEOSCIENCES EDUCATION: CHALLENGES AND OPPORTUNITIES IN THE 90'S. Robert C. Whisonant, Dept. of Geol., Radford University, Radford VA 24142. A great paradox presently confronts geoscience educators. Even as alarmingly low numbers of students continue to choose geology as a major field of study, public and student awareness of environmental problems (toward the mitigation of which geology makes significant contributions) has perhaps never been higher. The Geology Department at Radford University has modified the undergraduate curriculum and intensified efforts toward public education to meet the challenges and opportunities of the 90's presented by this paradox. Among the changes in the geology curriculum are addition of a Specialty in Engineering Geosciences, a new second semester introductory Environmental Geology course, an interdisciplinary "Professional Development in the Sciences" course, and an innovative Summer Field School designed for secondary science teachers. Strategies to affect more directly public education include (1) teaching of Continuing Education courses; (2) cooperation with science museums to teach courses and develop exhibits and educational materials; and (3) strong involvement with secondary school personnel concerning projects such as a special field trip organization for science teachers. These efforts have a double "pay off" in that not only is geoscience education advanced but also the Geology Department enjoys an activist image that enhances recruiting and the competition for University resources.

GEOMORPHOLOGY AND LATE QUATERNARY HISTORY OF A BLUE RIDGE HILLSLOPE, SHERANDO, VIRGINIA, G. Richard Whittecar and Derek W. Ryter*, Department of Geological Sciences, Old Dominion University, Norfolk, VA 23529

Hillslopes underlain by Catoctin metabasalts consist of bedrock cliffs, talus slopes, boulder streams, colluvial slopes, residual knobs, and debris fans. Soils on upper fans are relatively red (2.5YR) with high iron and clay contents, and contain clasts with relatively thick weathering rinds. Lower fan soils are more brown (7.5YR to 5YR) with significantly less iron and clay in the subsoil and thinner weathering rinds. Boulder streams extend downhill from talus slopes and choke drainages immediately uphill of the upper debris fans. Geomorphic relationships suggest that these boulder streams moved by solifluction and associated creep and probably grew during the Pleistocene under episodic periglacial climates. Debris fans result from catastrophic rainfall events that probably occur most often during interglacial periods. Upper debris fans ceased to accrete either when boulder streams halted the delivery of fine grained sediments by blocking drainages or when marginal streams pirated debris flows. Surfaces of upper fans may be Sangamonian age or older. Lower fans formed when Back Creek increased slopes of its tributaries by widening its valley; these fan surfaces may still be accreting.

Materials Science

Stress-Corrosion Cracking Study in Natural Seawater, R. A. Bayles and P. F. Slebodnick, Code 6327 and E. Dail Thomas, Code 6370.1, Naval Research Laboratory, Washington DC 20375-5000. Stress-corrosion cracking (SCC) is a phenomenon in which a susceptible material exposed to the conjoint action of stress and a specific environment experiences catastrophic failure following an incubation period and subcritical crack growth. Such cracks are often undetected until they reach a depth at which the geometry is such that fast, overload fracture occurs causing failure of a component. Cathodic polarization of steel suppresses general anodic corrosion of the surface by transferring the site of the corrosion reaction to another material. Deep within the crack, however, the corrosion reaction may not be completely suppressed and, additionally, hydrogen which is produced by the cathodic polarization at cathodic sites in the neighborhood of the crack may be absorbed at the crack tip and accelerate the cracking process. To determine what level of electrochemical polarization for cathodic protection is safe over the long term, experiments are underway at the Marine Corrosion Facility of the Naval Research Laboratory in Key West, Florida. Testing of fracture mechanics specimens of a 5% Ni steel exposed to flowing natural seawater and cathodic polarization provides a quantitative measure of susceptibility to SCC.

MODELING OF GaAs MOCVD IN A HORIZONTAL REACTOR WITH COMPARISON TO GROWTH EXPERIMENTS L.R. Black¹ and I.O. Clark, NASA Langley Research Center, Hampton, VA 23665-5225, B.A. Fox and W.A. Jesser, Department of Materials Science, University of Virginia, Charlottesville, VA 22903-2442. Metalorganic chemical vapor deposition (MOCVD) of GaAs in a horizontal reactor was performed and the process mathematically modeled in order to test the ability of the model to accurately predict the effects of the various deposition parameters on the growth rate. A reactor with a rectangular cross-section and a tilted susceptor was used in this study. The mass flow rates of the reactants, trimethylgallium (TMG) and arsine, were held constant in all runs. Growth experiments were performed at both one atmosphere and 0.1 atmosphere using hydrogen as the carrier gas. The deposition process conditions were modeled with an advanced computational fluid dynamics code enhanced for flows with complex multiphase chemical reactions. Densities were calculated from the ideal gas law, and heats of reaction were obtained from the enthalpies of formations of the individual species. The influence of a single surface reaction $\text{Ga}(\text{CH}_3)_3 + \text{AsH}_3 \rightarrow \text{GaAs}(s) + 3\text{CH}_4$ was also tested in the model. Film thickness profiles were predicted by the model for comparison with those of the experimentally produced GaAs thin films. The model and data are in good agreement for low pressure growth runs and for the leading edges of the atmospheric pressure runs. Work is in progress to refine the model in order to improve agreement at the trailing edges of the GaAs thin films grown at atmospheric pressure.

¹ University of Virginia Graduate Student

CORROSION BEHAVIOR OF AN AL-FE-GD METALLIC GLASS IN AQUEOUS ENVIRONMENTS R.G. Buchheit, G.E. Stoner and G.J. Shiflet, Department of Materials Science, Thornton Hall, University of Virginia, Charlottesville, Virginia 22903. Anodic polarization in aqueous $\text{ClO}_4^-/\text{Cl}^-$ environments of various pH were used to assess the baseline corrosion behavior of an $\text{Al}_{90}\text{Fe}_5\text{Gd}_5$ metallic glass. Compared to the crystalline version of the same alloy, the glass exhibited a higher breakaway potential due to lack of microstructural heterogeneity but an increased dissolution rate in the passive region due to lattice disorder. The corrosion rate of the glass is lower than expected in alkaline solutions due to the enrichment of oxidized iron in the surface film. In neutral solutions, degradation in corrosion resistance is mitigated by the formation of an iron enriched film in pits associated with second phase particles.

Fractography of Graphite Reinforced Epoxy Composites, K.W. Campbell, Geo-Centers, Inc., Ft. Washington, MD 20744, D.A. Meyn* and C. D. Beachem*, Materials Science and Technology Division, Naval Research Laboratory, Washington, DC 20375-5000. As the amount of composite materials in use grows, the need for a thorough understanding of the mechanisms involved in their failure becomes increasingly important. In this work the failure of graphite reinforced epoxy composites is investigated fractographically under conditions of both static and dynamic loading. Fracture surfaces of failed specimens are studied over a range of magnifications using a field emission scanning electron microscope. Microstructural features such as hackles, scallops and river marks are identified and their relation to the failure mode and loading conditions is discussed. The benefit of viewing stereographic pairs of micrographs and precision matching of areas from both fracture surfaces using stereofractography is described and demonstrated.

CONCRETE BRIDGE PROTECTION AND REHABILITATION: EVALUATION OF CHEMICAL TECHNIQUES TO INHIBIT THE CORROSION OF REINFORCING STEEL IN CONCRETE. William D. Collins and Robert E. Swanson, Dept. of Materials Engr., Va. Polytechnic Inst. and State Univ., Blacksburg, Va. 24061. Reinforced concrete is one of the most widely used and accepted materials of construction. However, the rapidly growing use of de-icing salts on roadways has contributed to the severe deterioration of reinforced concrete bridge decks and other structures. Several chemical approaches were pursued and are being considered in an attempt to retard the chloride-induced corrosion of reinforcing steel, including inhibitors, a scavenger, and polymer coatings. The corrosion behavior of embedded reinforcing bars was evaluated before and after chemical treatment using corrosion potential measurements and electrochemical impedance spectroscopy. In addition, a novel means of protection through the removal of chloride contaminated concrete was formulated for future evaluation.

SEMICONDUCTOR MATERIALS' RESEARCH FOR INFRARED DETECTOR APPLICATIONS. J. H. DINAN,* US Army CECOM Center for Night Vision & Electro-Optics, Fort Belvoir, VA 22060.

Imaging radiation sensors are required for a variety of military and commercial applications. Thermal imagers sensitive to radiation in the 3-5 and 8-12 micron atmospheric windows are especially suited for strategic and tactical military systems. For the past decade, the DOD has sponsored an intensive research program aimed at identifying and developing semiconductor materials, device structures, and processing techniques which result in efficient detection and imaging in these spectral regions. Mercury cadmium telluride, a semiconductor alloy whose bandgap can be adjusted by adjusting the alloy composition, has emerged as the material of choice. Liquid phase epitaxy and several forms of vapor phase epitaxy are being developed to provide a reliable material deposition technique. Conventional wet-chemical processing techniques are used to form the two-dimensional arrays which make up the detector portion of an infrared focal plane. A brief review is given of the DOD involvement in this technology. The state of the art in materials' growth and processing is presented. Barrier problems and proposed solutions involving either alternate semiconductor materials or non-conventional growth and processing techniques are discussed.

DIAMOND GROWTH BY MODIFIED HOT FILAMENT-ASSISTED CHEMICAL VAPOR DEPOSITION F. P. Doty and W. A. Jesser, Dept. of Materials Science, Univ. of Va, Charlottesville, VA. 22901. The low pressure growth of diamond thin films is well known, and has been accomplished by activating hydrocarbon/hydrogen mixtures near a heated substrate by means of a hot filament, DC glow discharge, etc. Many researchers have reported that externally applied voltages strongly affect the chemical vapor deposition (CVD) process, and this has been attributed to electron bombardment effects. For this work, a filament-assisted CVD reactor was modified by placing a charged aperture between the filament and the substrate, enabling independent control of the substrate voltage and the filament to substrate current. Growth experiments under various conditions indicate that negatively charged species participate in the growth mechanism, and that the reaction rate depends on the substrate potential. The growth rate becomes negligible when the substrate is held at negative potential, even in the presence of a large current, which calls into question the electron bombardment explanation of growth rate dependence on electrical bias. These results suggest that diamond may form at low pressure by an electrochemical reaction. The results also suggest that patterning of the deposited film may be accomplished by using electrostatic fields.

{110} GROWTH TWINS IN TiAl: C. R. Feng*, D. J. Michel* and C. R. Crowe*, Materials Science and Technology Division, Naval Research Laboratory, Washington, D.C. 20375-5000. The microstructure of a XDTM processed and cast Ti-45Al/TiB₂ composite was investigated by TEM Methods. The microstructure was found to exhibit a TiAl/Ti₃Al two-phase lamellar structure. The orientation relationships between TiAl and Ti₃Al were $\{111\}_{\text{TiAl}} // (0001)_{\text{Ti}_3\text{Al}}$ and $\langle 110 \rangle_{\text{TiAl}} // \langle 1120 \rangle_{\text{Ti}_3\text{Al}}$. Differently oriented TiAl areas were observed to coexist within the same TiAl lamella. The atomic arrangements corresponding to the the orientations of these areas before and after a sixty(60) degree tilt suggested that these areas were {110} twins. Since all $\{111\}\langle 110 \rangle_{\text{TiAl}}$ orientations parallel to the $(0001)\langle 1120 \rangle_{\text{Ti}_3\text{Al}}$ orientations were equivalent with respect to the Ti₃Al, differently oriented $\{111\}_{\text{TiAl}}$ could nucleate at the same $(0001)_{\text{Ti}_3\text{Al}}$ and grow in different $\langle 110 \rangle_{\text{TiAl}}$ at the same time. From these suggestions, the results have indicated that these {110} twins were growth twins.

THE STRUCTURE OF THE CELLULAR GROWTH FRONT IN Cu-3%Ti. Richard W. Fonda* and Gary J. Shiflet*, Dept. of Materials Science, Univ. of Va., Charlottesville, Va. 22903. The cellular (or discontinuous) precipitation reaction has long been considered to proceed by the advancement of a disordered, incoherent growth front. However, transmission electron microscopy studies of this reaction in Cu-3wt%Ti have revealed structures at the growth front that do not conform to this conception. At low undercoolings the growth interface between the lamellar Cu₄Ti precipitate phase and the supersaturated matrix is highly structured and maintains a particular facet direction along the growth front, indicating the presence of a crystallographic habit plane between the two phases. This habit plane is maintained through small deviations in growth front direction away from the orientation of the habit plane. If the precipitate growth interface is a very low energy habit plane then the facet direction may be maintained even with large deviations between the habit plane and the local grain boundary orientation. However, larger deviations are usually associated with the adoption of a different habit plane that is better aligned with the local grain boundary direction. This behavior indicates a significant influence of crystallography on cellular precipitation in this alloy. With larger undercoolings the influence of the increased driving force due to a more negative Gibbs free energy gradually overwhelms the predominance of crystallography, leading to a roughening of the growth front that conforms more closely to the classical morphology.

THE EFFECT OF ION NITRIDING ON THE ABRASION RESISTANCE OF WEAR RESISTANT MATERIALS. William G. Halley, Robert E. Swanson, and Norman S. Eiss, Virginia Polytechnic Institute and State University, Blacksburg, VA. 24061

Ion nitriding has been evaluated as a means of improving the abrasive wear resistance, measured by dry sand rubber wheel abrasion tests, of several materials. Samples of a medium carbon low alloy steel, a chromium ferritic stainless steel, and a chrome-vanadium powder metallurgy tool steel were tested. All samples received the same nitriding treatment. The effect on wear resistance varied from a 45% decrease in wear volume loss to a 44.1% increase in volume loss. Tests run for shorter intervals showed that once the nitrided layer was broached, the wear rate increased with the exposed substrate area, finally approaching the untreated wear rate.

Results are presented in the form of volume loss, SEM micrographs of the wear tracks, optical photomicrographs of microstructures, and microhardness depth profiles.

THE APPLICATION OF TRANSMISSION ELECTRON MICROSCOPY AS A TOOL TO INVESTIGATE THE LOCALIZED CORROSION PROCESSES IN AN ALUMINUM-LITHIUM ALLOY. Raymond J. Kilmer and Glenn E. Stoner, Dept. of Materials Science, University of Virginia, 22901. Transmission Electron Microscopy (TEM) was employed to investigate the localized corrosion processes in alloy 2090, an Al-Li-Cu alloy. It was demonstrated through correlation of Scanning Electron Microscopy (SEM) and TEM of foils that were freely corroded in 3.5 w/o NaCl that the electrochemical properties of the foil mirrored that of the bulk alloy. This technique hence allowed for examination of the corrosion event at a point relatively close to initiation and more easily allowed for the correlation of the role microstructure in the corrosion event. The localized corrosion phenomena examined included constituent particle pitting, preferential subgranular boundary attack and the formation of an unusual passive film.

EFFECT OF MICROSTRUCTURE, YIELD STRENGTH AND FREQUENCY ON HYDROGEN ENHANCED FATIGUE OF STEELS, R. Krishnamurthy and R.P. Gangloff, Department of Materials Science, University of Virginia, Charlottesville, VA 22903. Constant stress intensity experiments were conducted with C-Mn A537 under cathodic polarization in 3.5% NaCl. The steel microstructure and yield strength (400 to 1000 MPa) were varied by changing the tempering levels, and da/dN increased as the tempering temperature was decreased. Either yield strength or microstructure, or both these could be causes for the differences in corrosion fatigue crack growth rate. At a constant ΔK of 23 MPa/m, the plot of da/dN vs. frequency exhibits three regimes: high frequencies ($f > 1$ Hz) da/dN is independent of frequency, intermediate frequencies (f between 0.1 and 1 Hz) da/dN increases with frequency and finally da/dN is independent of frequency at saturation frequencies ($f < 0.1$ Hz). The diffusion based corrosion fatigue model predicts a square root relationship between da/dN and frequency. This relationship is exhibited by the various microstructures of A537 in the intermediate frequency range. The model also predicts that da/dN is inversely proportional to yield strength in the saturation frequency regime, and directly proportional to yield strength in the intermediate frequency regime. The martensitic and pearlitic A537 conform with the model prediction, whereas spheroidized A537 and the Cu precipitation hardened A710 steel have rates which are not consistent with model prediction. This inconsistency suggests a strong microstructural effect on hydrogen fatigue which should be factored into the model. These results provide a glimpse of the complicated relationship between frequency, yield strength and microstructure.

MICROSTRUCTURAL PROPERTIES AND ELECTROCATALYTIC BEHAVIOR OF PLATINUM AND PLATINUM-CHROMIUM DISPERSED CATALYSTS. Charles F. Kroen and Glenn E. Stoner, Center for Electrochemical Sciences and Engineering, Department of Materials Science, Univ. of VA, Charlottesville, VA 22903. The current output at constant applied potential and the catalyst size, structure, and composition of platinum and platinum-chromium alloy dispersed catalyst electrodes were examined. Comparisons of the microstructures of the "as-received" electrodes and those after operation revealed a significant increase in the average catalyst diameter for both the platinum and platinum-chromium electrodes. The measured platinum catalyst size increase, which is approximately linear with time, is not consistent with the relationship predicted by classical (LSW) coarsening models or by the nucleation inhibited mechanisms previously found operating on platinum particles on alumina substrates at elevated temperature. Energy dispersive spectroscopy revealed that a nearly complete loss of chromium occurred in the platinum-chromium alloy catalyst as a result of electrode operation and the inclusion of phosphorus in the catalyst particles for both the platinum and platinum-chromium electrodes. These factors suggest that a dissolution-deposition mechanism may be responsible for the catalyst coarsening observed as a result of electrode operation.

OBSERVATIONS AND ELECTROCHEMISTRY OF THE FIBER/EPOXY INTERFACE OF CARBON FIBER REINFORCED PLASTICS (CFRP). T. Mangiacapre, Dept. of Materials Science, Univ. of Va., Charlottesville, Va. 22903. The purpose of this research was to determine if moisture ingress down the fiber/epoxy interface of a CFRP could be detected as an increase in the double layer capacitance C_{dl} . To do this, the specific double layer capacitance C_{sp} was determined for individual pitch fibers having an average diameter of $10\mu m$ and was found to have an average value of $82.7 \pm 9.4 \mu F/cm^2$. Individual fibers were then electrically connected to a wire and set vertically in Epon 828 epoxy to form a modeled composite. These samples were then cured and polished to $1\mu m$ alumina to expose the cross section of the fiber flush with the surface of the epoxy. Samples were then placed in an oven at $90^\circ C$ for 10 minutes (causing the interface to debond) and immediately placed in solution for C_{dl} measurements using an Electrochemical Impedance Spectroscopy (EIS) technique. Upon cooling in solution, air within the interface contracts and draws solution down into the interface. An increase in the C_{dl} was measured over a period of one hour for three samples. By dividing the values of the C_{dl} by the C_{sp} , an increase in exposed area, and therefore penetration distance, could be determined. A final penetration distance of approximately $20\mu m$ was found for the three samples.

THERMAL PROFILES IN VERTICAL BRIDGMAN FURNACES. W. Rosch, W. Jessor, D. Knuteson, Materials Science Department, University of Virginia, Charlottesville, Va 22903, and A. Fripp, W. Debnam, NASA Langley Research Center, Hampton, Va 23665. Comparison of experiments conducted with two vertical Bridgman furnaces configured to have isothermal hot and cold zones showed unexpected differences. With the furnace set to the same control temperatures, identical instrumented fused silica samples were inserted in order to determine temperature profiles. It was found that one furnace gave thermal profiles that were extremely sensitive to the sample position, while the other furnace did not. Research done to date indicates that a difference in furnace emissivity is at least partially responsible for this discrepancy.

THE NON-DESTRUCTIVE EVALUATION OF ALUMINUM-POLYMER LAMINATES USING ELECTROCHEMICAL IMPEDANCE SPECTROSCOPY. Gayle R. T. Schueller and S. Ray Taylor, Materials Science Department, The University of Virginia, Charlottesville, VA 22903. Aluminum-polymer laminates have a wide variety of structural applications. Catastrophic failure in these materials occurs either cohesively, within the polymer, or adhesively, by interfacial disbonding at the metal/polymer interface. Since cohesive failure is relatively well understood, non-destructive detection of adhesive failure is essential to the evaluation of laminate strength. Electrochemical impedance spectroscopy (EIS) is proposed as a possible new technique for non-destructively evaluating metal/polymer disbonding. Natural oxides of aluminum in borate buffer were analyzed by electrochemical impedance spectroscopy. Flat samples were used to characterize the general capacitance-time behavior and general electrochemical impedance response. Crevice geometries were then considered, resulting in an increase in distributed element effect and an increase in stabilized capacitance with increasing crevice area. These results show the sensitivity of EIS to the size and shape of defects in pseudo-laminates and offer encouragement for the application of EIS as a non-destructive test for delamination in aluminum-polymer laminates.

ELECTROCHEMICAL MEASUREMENTS FOR THE DETERMINATION OF DYNAMIC STATES IN THE BRIDGMAN CRYSTAL GROWTH CONFIGURATION. Brian R. Sears, T.J. Anderson, R. Narayanan, Dept. of Chemical Engineering, Univ. of Florida, Gainesville, Fl. 32611, and A.L. Fripp, G. Woodell, W.J. Debnam, NASA Langley Research Center, Hampton, Va. 23665. A solid-state electrochemical technique is used to measure the binary diffusion coefficient of dilute oxygen in liquid tin. The diffusion coefficient is presented as a function of reciprocal temperature. The experimental design is considered to be superior to previous designs used for oxygen diffusion measurements in liquid metals due to improved isothermal character of the melt. Electrochemical cell designs to simulate vertical Bridgman crystal growth are also presented and are used for measurement of effective diffusivities of oxygen across thermally unstable tin melts. A dynamic transition from a stagnant melt to steady flow is evidenced in the plot of effective diffusivity versus thermal Rayleigh number for an aspect ratio (H/R) of 1. Likewise, a dynamic transition from steady flow to oscillatory flow is evidenced as a discontinuity in the plot of effective diffusivity versus thermal Rayleigh number for aspect ratio 5. A final electrochemical cell design is proposed for determination of flow orientations, e.g. roll cell structure and flow direction, as well as for characterization of oscillatory flow patterns in Bridgman crystal growth simulations.

SOME SCALING STUDIES ON COMPOSITE MATERIAL SYSTEMS. Kuen Tat Teh*, & John Morton, National Science Foundation Science and Technology Center for High Performance Polymeric Adhesives and Composites, Engineering Science & Mechanics Dept., Va. Polytechnic Inst. & State Univ., Blacksburg, Va. 24061. General aspects of scaling of composite materials are outlined. An approach based on similarity is presented in order to highlight sources of scaling effects. Experimental results from ply-level scaling studies on graphite-epoxy composites show that the uniaxial tensile strength decreases by scaling up the laminate. The problems associated with ply-level scaling are discussed. Future studies on simply supported sublaminate-level scaling composites subjected to transverse normal impact are outlined. The preliminary studies on quasi-static three point bend test are presented. The results are used as the basis for selecting the correct parameters to scale the impact input energy and for comparing the impact test results in the future. (Supported by the National Science Foundation Science and Technology Center at Va. Polytechnic Inst. & State Univ.)

PERFORMANCE OF METAL OXIDE COATINGS FOR TITANIUM ALLOYS IN HOT CORROSION ENVIRONMENTS Patrick J. Taylor, Karl E. Wiedemann, Analytical Services and Materials Inc., 107 Research Drive, Hampton, Va. 23666. Titanium alloys and specifically titanium aluminides are attractive materials for aerospace applications because of their high-temperature specific strength. A great concern, however, is the embrittlement from high-temperature hot corrosion of these materials. Several oxide systems were investigated as potential hot corrosion resistant coating materials for these titanium alloys. Relative performance of the oxide systems was determined from normalized weight gain data taken at 982 C (1800 F.) Results are presented from the systematic investigation of these oxide systems. Regions of optimal performance were discovered via a mathematical response surface analysis of the empirical data.

FACTORS AFFECTING THE DURABILITY OF Ti-6Al-4V/EPOXY BONDS. Jennifer A. Filbey, Hoechst-Celanese, Charlotte, NC 28232 & J. P. Wightman, Dept. of Chem., Va. Polytechnic Inst. & State Univ., Blacksburg, VA 24061. The use of adhesives for structural applications provides uniform stress distribution throughout the bond line, weight savings and corrosion resistance. It is therefore desirable to make not only strong but durable adhesive bonds. The chemical pretreatment given to Ti-6-4 surfaces can greatly affect the durability of the adhesive bonds. The Ti-6-4 surfaces were chemically or electrochemically pretreated by chromic acid anodization (CAA) or by a phosphate fluoride (P/F) acidic etch. The pretreated surfaces were characterized by chemical composition and topography. The pretreated surfaces were adhesively bonded with FM-300 in two configurations - the lap shear and the wedge. Strength to break measurements with the lap shear bonds indicate there is no dependence of the surface pretreatment on initial lap shear strength. The wedge test however shows a marked dependence on the surface pretreatment used. In addition to the surface pretreatment, aluminum alkoxide coatings enhanced the durability of P/F treated surfaces. [Research supported by Office of Naval Research].

Medical Sciences

SYNTHESIS AND TESTING OF POTENTIAL INHIBITORS OF ARACHIDONIC ACID 5-LIPOXYGENASE IN A MOUSE MODEL. S. T. Allen, L. T. Alty, M. C. Sackett, D. A. Brown, C. D. Eckman, R. A. Sances, W. E. Allen, S. T. Bienert, G. K. Duwel, E. F. Mutz, Department of Chemistry, Washington & Lee University, Lexington, VA 24450; J. F. Stubbins, Department of Medicinal Chemistry, Va. Commonwealth Univ., Richmond, VA 23298. Structural analogs of N,N-diethyl-4-methyl-1-piperazinecarboxamide (diethylcarbamazine, DEC) a known inhibitor of arachidonic acid 5-lipoxygenase (5-LO), were synthesized to determine the structural components necessary for biological activity. A good inhibitor of this enzyme would have potential uses in treating asthma, rheumatoid arthritis, and inflammatory bowel disease. Current agents used in treating these diseases all have undesirable side effects which could be eliminated by using a more specific agent, such as a 5-LO inhibitor. The arachidonic acid-induced inflammation of the mouse ear is being used to test the anti-inflammatory potency of these compounds. Testing for five analogs and DEC is complete. Three of the analogs are less potent than DEC ($IC_{50} = 0.25$ mg/ear, maximum inhibition of swelling = 40%). A fourth analog is at least tenfold more potent with a slightly higher level of inhibition while the fifth analog is as potent as DEC and it inhibits swelling 100%.

NOVEL 1-SPIROPIPERIDINE-1,2,3,4-TETRAHYDRO-BETA-CARBOLINES OF POTENTIAL BIOLOGICAL INTEREST. P. Bartyzel^{*}, Dept. of Medicinal Chemistry MCV/VCU, Richmond, VA 23298 and S. Misztal^{*}, E. Tatarczynska^{*}, E. Chojnacka-Wojcik^{*}, Institute of Pharmacology Polish Academy of Sciences, Krakow, Poland. A series of novel N-aminoalkyl derivatives of 1-spiro-(N-benzylpiperidine)-1,2,3,4-tetrahydro-beta-carbolines were synthesized and examined in preliminary pharmacological screening in comparison to diazepam and buspirone. 2-[2-(1-Phenyl-4-piperazinyl)-ethyl]-1,2,3,4-tetrahydro-beta-carboline-1-spiro-4'-N'-benzylpiperidine, administered intraperitoneally but not intragastrically showed anxiolytic properties in the four-plate test in mice and in the conflict test in rats. The anxiolytic effect appears at doses 100 times lower than the dose disturbing locomotor coordination, and ca. 200 times lower than the toxic dose. This compound is devoid of anticonvulsant properties in the pentylenetetrazole convulsions test and therefore it distinctly differs from diazepam in its profile of action which, apart from the anxiolytic effect, shows anticonvulsant and neurotoxic properties. Its activity resembles that of buspirone, but in contrast to buspirone it is active in the four-plate test.

B LYMPHOCYTE DIFFERENTIATION, A PROBABLE SITE OF ACTION FOR ANTI-AIDS DRUG, DIDEOXYADENOSINE. W. Cao^{*}, M. L. Stern^{*} and A. E. Munson. Dept of Pharmacol. and Toxicol., MCV/VCU, Richmond, VA 23298. Previous studies showed that the B cell is targeted by 2',3'-dideoxyadenosine (ddA), an anti AIDS drug. The purpose of this study was to determine the sensitive stage(s) in antibody forming cell (AFC) production affected by ddA. Spleen cells from B6C3F1 female mice treated as with up to 350 mg/kg ddA for 30 days showed no difference in percentage or in absolute numbers of B cell (surface IgM positive), T cell (Thy1.2 positive), T helper cell precursor (L3T4 positive) or precursor of T suppressor cell and cytotoxicity T cell (Lyt-2 positive) as compared to vehicle-treated mice. Proliferative ability of splenic B cell driven by B cell mitogen, Lipopolysaccharide (LPS) or F(ab')₂ fragment of anti-mIgM plus IL-4 were unchanged in ddA-treated mice. However, the IgM AFC responses to sheep erythrocytes (SRBC), LPS and DNP-Ficoll were inhibited in ddA-treated mice. Since the percentage and absolute number and the proliferative ability of B cell are not affected by ddA and antigen processing capability of adherent cells is intact along with intact T accessory cell function, the reduction of IgM AFC response may be caused by a selective action on B cell differentiation. (Supported by NIHES 55094 and training grant NIHES 07087.)

SALMONELLA CONTAMINATION DETECTION IN FOOD PRODUCTS. Germille Colmano, Dept. Biomed. Sci.s, VMRCVM, VPI & SU, Blacksburg, VA 24061. **First experiment:** gave evident separation of filtrates and controls at 24 hrs incubation, comparing 50 cells/ml of Salmonella typhimurium, S. arizona, Escherichia coli, or a combination of them, inoculated into Lactose Broth (LB) or Lactose Broth with chicken. **Second experiment** (repeated detection at time zero): in inoculated, immediately filtered samples, the growth medium use by bacteria was detectable at time zero. **Third experiment** (field sampling duplication): separated distilled water washes from 6 whole raw chickens, compared with a water wash spiked with bacteria and read against sterile distilled water. **Fourth experiment** (above water washes cultured in broth and read against broth, at time 0, 4, 8, and 24 hours): noticeable large differences, not only in the 24 hr cultures, but also on the zero time cultures. **Conclusion:** S. typhimurium differentiation from S. arizona, E. coli and a combination of all three, with detection in samples immediately after collection time, offers a novel, rapid and simple way to test for differentiation of pathogenic bacteria in food products.

STRUCTURE-ACTIVITY STUDIES ON SOME NOVEL 5-HT₃ LIGANDS.

A. Damodaran*, R.A. Glennon*, Dept. of Medicinal Chemistry, MCV/VCU, Richmond, Va 23298. Quipazine is a non-selective serotonin (5-HT) ligand that binds with high affinity ($K_i = 1.5$ nM) at 5-HT₃ receptors. Because little is known regarding the binding of structurally-related arylpiperazines at 5-HT₃ receptors, and in order to develop a more selective ligand, we undertook a structure-affinity relationship (SAFIR) study of quipazine analogs. Taking advantage of some of our early findings (i.e., that tertiary amines bind at these sites, and that the entire quinoline nucleus of quipazine is unnecessary for binding), we prepared and evaluated a small series of mono- and bi-cyclic aryl piperazine derivatives. Several of these compounds (e.g. NMQ) bind at 5-HT₃ receptors with a greater selectivity than quipazine. (Supported in part by PHS Grant NS 23523).

BEHAVIORAL RELATIONSHIPS BETWEEN 5-HT_{1A} AND 5-HT₂ RECEPTORS. N.A. DARMANI*, B.R. MARTIN, U. PANDEY* AND R.A. GLENNON*. DEPTS OF PHARMACOL/TOXICOL. AND MED. CHEM., MCV-VCU, RICHMOND, VA 23298.

Radioligand binding studies have identified several types of central 5-HT binding sites (5-HT₁, 5-HT₂, 5-HT₃ & 5-HT₄). The 5-HT₁ site appears to consist of several subtypes of which the 5-HT_{1A} sites are best studied. Recent literature indicate that there may be functional interactions among 5-HT receptors. One of the most often used models of 5-HT₂ receptor function is the head-twitch response (HTR) in rodents. In the present study the selective 5-HT₂ receptor agonist DOI was used to induce HTR in mice. The hallucinogen, DOI (0.06-5.0 mg/kg, i.p.), induced HTR in a dose-dependent manner. For drug interaction studies a dose of 2.5 mg/kg DOI was used to induce HTR and the induced behavior was observed for 30 minutes post-injection. Pretreatment with a nonselective 5-HT agonist (5-MeO DMT, 2-8 mg/kg, i.p.), a selective 5-HT_{1A} agonist (8-OH DPAT, 0.5-2.5 mg/kg, i.p.) and the 5-HT₂ selective antagonists (ketanserin, 0.063-1.0 mg/kg, i.p., and spiperone 0.03-0.5 mg/kg, s.c.) dose dependently reduced the DOI-induced HTR. Pretreatment with the 5-HT_{1B/5-HT_{1C}} agonist TFMP (0.3-1.25 mg/kg, i.p.) or the 5-HT_{1B} agonist RU 24969 (1.25 mg/kg, i.p.) did not affect the DOI-induced HTR. These results suggest that simultaneous co-stimulation of 5-HT_{1A} receptors modulate the 5-HT₂ receptor-induced HTR. Supported by NIDA grants DA-05274 and DA-01642.

SIMULTANEOUS HPLC DETERMINATION OF CAROTENOIDS AND RETINOIDS. B. P. Dezzutti, P. Carcaise-Edinboro and R.B. Brandt. Dept. of Biochem. & Dept. of Oral Path., Med. Col. of Va., Va. Commonwealth Univ., Richmond, Va. 23298. Previous studies by others have suggested that vitamin A (retinol) or retinoids such as retinyl esters have a role in the prevention of carcinogenesis. Recently β -carotene, the plant precursor of the retinol has been implicated in lowering the risk of some types of cancer. In this report a method is described for the simultaneous determination of carotenoids and retinoids in serum using high performance liquid chromatography (HPLC). Human serum (250 μ l) that had been protected from direct light was added to 750 μ l of 1% sodium ascorbate (w/v) and to 2.0 ml of absolute ethanol and extracted with 5.0 ml of N-hexane. After centrifugation a 4.0 ml of aliquot was evaporated using a nitrogen stream. The residue was dissolved in 1.0 ml of 80:20 methanol:toluene (mobile phase) and 200 μ l was injected for HPLC using a Supelcosil LC-18 25 cm column. A flow rate of 1.5 ml/min with a Waters 490 programmable detector at 325 nm for the retinoids and 454 nm for the carotenoids. Standards of retinol, retinyl esters and β -carotene were analyzed spectrophotometrically. Retention time (sec) for retinol (145), retinyl palmitate (537) and β -carotene (519). Values for a normal human population are included. Supported by the Smokeless Tobacco Research Council.

EVALUATION OF HALOGEN-CONTAINING Δ^8 -THC ANALOGS. F.L. Friend, D.R. Compton, and B.R. Martin, Dept. Pharm. & Tox., MCV-VCU, Richmond, Va. 23298. A limited number of cannabinoid analogs exist which contain a halogen (fluoro- or chloro-) substituent. Few of these analogs have been reported active and only one (Abbott 41988) has been evaluated in humans. Previously, we reported that both 5'-bromo- Δ^8 -THC and - Δ^9 -THC were potent and efficacious in mouse tests. Therefore, halogenated analogs of Δ^8 -THC were synthesized and evaluated in male ICR mice for effects on locomotion, temperature, tail-flick latency and ring-immobility following an intravenous injection. The analogs evaluated were 2-iodo-, 5'-bromo-, 5'-iodo-, 5'-trifluoro-, 11-fluoro- Δ^8 -THC. Average ED₅₀ values (mg/kg) over all four test of the multiple evaluation procedure for the 2-iodo-, 5'-bromo-, 5'-iodo-, 5'-trifluoro- and 11-fluoro- analogs were 3.6, 0.3, 0.5, 1.0 and 6.3, respectively. The 2-iodo analog produced the greatest separation of effects. It was 12 and 29 times more effective in producing antinociception than depressing locomotor activity or temperature, respectively. Halogenated substitutions at the 5' side chain (bromo, iodo, trifluoro) produced analogs potent in all measures, however, the 11-fluoro analog failed to suppress locomotor activity and was weakly active in the other measures. (Supported by NIDA grant DA-03672, and the Commonwealth of Virginia Center on Drug Abuse).

EFFECTS OF PHARMACOLOGICAL DOSES OF ESTROGEN ON SOLUBLE PROTEINS OF THE MOUSE ANTERIOR PROSTATE. Andrew D. Grove and Roman J. Miller, Dept. of Biology, Eastern Mennonite Col., Harrisonburg, VA 22801. Swiss Webster mice were injected with estrogen to determine its effect on soluble proteins of the anterior prostate. Five treatment groups received three injections per week for a four week period: OIL (peanut oil 100 ul/injection, control); EA (0.01 mg beta-estradiol/kg body weight); EB (0.1 mg/kg); EC (1.0 mg/kg); ED (10.0 mg/kg). After treatment, anterior prostates were removed, pooled by group and homogenized. Protein aliquots from the groups were separated by polyacrylamide gel electrophoresis and quantified by densitometry. Based on their responses to exogenous estrogen, five protein classes were found. Protein type A was present in all treatment groups but showed a linear reduction with increasing estrogen doses. Protein type B was found only in EC and ED, but not in OIL. Protein type C was present in all groups and showed little response to exogenous estrogen. Protein type D was evident only in EB, EC, and ED. Protein type E was present in all groups but was reduced with low doses of estrogen and showed increased amounts with high doses. Increasing estrogen doses profoundly affected protein quantities ranging from ten-fold increases to nine-fold decreases from control levels.

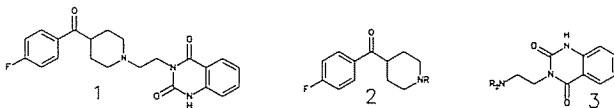
VASCULAR ACTIONS OF REACTIVE OXYGEN INTERMEDIATES IN PREGNANT AND NONPREGNANT RATS. Jayne Hart and William Freas. Biol. Dept. George Mason Univ., Fairfax, VA and Uniformed Services Univ. of the Health Sciences, Bethesda, MD.

Hematoporphyrin (HPD)-treated blood vessels that are exposed to laser light (photodynamic therapy) develop long-lasting contractions that appear to be initiated by reactive oxygen intermediates (ROIs). In order to determine if there are pregnancy-induced changes in these vascular responses, vessels (aorta, mesenteric, carotid and caudal arteries) from nonpregnant (NPG) and 21 day pregnant (PG) rats were suspended between platinum electrodes in 37°C, Krebs-filled oxygenated tissue baths and isometric tension recorded. Responses of the NPG and PG vessels to norepinephrine, activation of sympathetic nerves by transmural stimulation and laser light (633 nm) after HPD (3 ug/ml) were compared. All vessels studied responded with sustained contractions to a 20 min laser exposure after HPD treatment. The magnitudes and durations of these contractions were similar in NPG and PG vessels, as were responses to NE and electrical stimulation before and after laser treatment. Thus, pregnancy does not modify the vascular responses to photodynamic generation of ROIs in isolated blood vessels. (Supported by USUHS Grants R08006 and GM8027.)

BIODISPOSITION OF ^3H -SOMAN IN GUINEA PIGS AFTER INHALATION EXPOSURE AND INTRAVENOUS ADMINISTRATION. W.T. Hawkins and B. R. Martin. Dept. of Pharm/Tox. MCV-VCU. Richmond, Va. 23298.

The biological fate of soman has not been previously investigated in guinea pigs despite their extreme sensitivity to organophosphates. Male guinea pigs (6/group) were exposed to the volatilization of 238 μg of ^3H -soman (4.65 $\mu\text{g}/\mu\text{Ci}$) at 65 $^{\circ}\text{C}$ for 10 min. for the inhalation route and 15 $\mu\text{g}/\text{kg}$ (4.65 $\mu\text{Ci}/\text{kg}$) for the intravenous route of administration. The exposed animals were decapitated at each time point, dissected, and total radioactivity was measured in tissue homogenates of blood, brain, heart, lung, liver, diaphragm, kidney, trachea, testicular fat and carcass, with urine and feces assayed at the 4, 8 and 24 hr time points. Tissue homogenates were subjected to an extraction scheme for the quantitation of free soman, the inactive hydrolysis product (PMPA), phosphorylated tissue (bound PMPA), and residual metabolite (MPA). ^3H -Soman penetrated all tissues rapidly with maximum concentrations of soman and metabolites found within 5 min. The following rank order of tissue concentrations of soman and metabolites were: lung > trachea > kidney for the inhalation route and blood > kidney > lung for the intravenous administration route. The highest concentrations of free soman were found between the 5 and 15 min. time points. Bound PMPA tissue concentrations were highest at the 5 and 15 min. time points except for the kidney, liver, and blood which were highest at 15 and 30 min. time points. (Supported by USAMRDC, Contract #DAMD 17-88-C-8075).

INVESTIGATIONS INTO THE MODE OF BINDING OF KETANSERIN AT 5-HT₂ RECEPTORS. J. L. Herndon* and R. A. Glennon*, Dept. of Medicinal Chemistry, MCV/VCU, Richmond, VA 23298-0581. Ketanserin (**1**) is a potent and "selective" 5-HT₂ antagonist. Comparison of its molecular structure with that of structurally rigid lysergic acid diethylamide (LSD), another potent 5-HT₂ ligand, suggests several possible modes of binding for ketanserin at this common binding site. Molecular modeling (distance geometry and systematic conformational searches) confirm that several overlaps between LSD and ketanserin are energetically favorable. Based on these possibilities, a series of compounds (**2** and **3**) incorporating the different potential pharmacophoric groups were designed, synthesized and evaluated to deduce the mode of binding of ketanserin at 5-HT₂ receptors. (Supported in part by PHS Grant NS 23523).



AN ASSESSMENT OF POTENTIAL CONTAMINATION AND EXPOSURE DURING LARGE SCALE PRODUCTION AND PURIFICATION OF HIV-1. Jolanda N. Janczewski, K. K. Oates, George Mason Univ., Fairfax, VA 22030, & E. B. Sansone, NCI-FCRF, Frederick, MD, 21701. The epidemic of the Acquired Immunodeficiency Syndrome has led to intense concern among health care workers about the risks they may face in the work environment. A subpopulation of health care workers, laboratory personnel (specifically those involved in large scale production and purification of HIV-1) was the focus of this project. The objective of this study was to evaluate the potential for environmental contamination and worker exposure to HIV-1 during the production and purification process. Specifically, a chemical tracer was substituted for the virus, in order to identify and quantitate the potential environmental contamination and/or worker exposure resulting from any errors in design, engineering controls, or work practices during large scale production runs. (Research supported in part by the National Cancer Institute, under Contract No. N01-CO-74102, with Program Resources, Inc.)

ORIGIN OF FOLLICULAR DENDRITIC CELL (FDC) IN CB17 MICE WITH SEVERE COMBINED IMMUNODEFICIENCY (SCID). Zoher F. Kapasi*, L.D. Shultz*, G.F. Burton*, M.H. Kosco*, J.G. Tew & A.K. Szakal*. Depts. of Anatomy/Microbiology, MCV/VCU, Richmond, VA 23298, Jackson Lab., Ma., Basel Inst. for Immunol., Sw. FDCs appear to play an important role in the regulation and maintenance of secondary antibody response. Antigen is trapped and retained by FDCs which form a three dimensional network in lymphoid follicles, the FDC-reticulum. CB17 SCID mice lacking functional B and T cells, unlike athymic nudes, lacked functional FDCs. To reconstitute the SCID mouse FDC-reticulum, 10^7 Lewis rat or CB17 bone marrow or nude splenic B cells and/or CB17 T cells were injected i.v. Using the histochemically detectable antigen horseradish peroxidase, passively immunized reconstituted CB17 SCID mice were examined for FDC-reticulum development 24 hrs after footpad challenge. Although B cells induced cortical development in draining lymph nodes, FDC-reticulum development occurred only in SCIDs receiving Lewis rat or CB17 bone marrow or B plus T cells. One FDC-reticulum site in a SCID mouse reconstituted with Lewis rat bone marrow was positive for KiM4R, a rat FDC specific monoclonal antibody; however, this observation is insufficient to conclude a bone marrow derivation of FDCs. The demonstrated B and T cell requirement for development of functional FDCs suggests a need for T and/or B cell lymphokine production. Support: AI 17142-07 & CA 20408.

INTRATHECAL ADMINISTRATION OF CANNABIOIDS PRODUCES ANTINOCICEPTION IN RATS.

A.H. Lichtman & B.R. Martin, Department of Pharmacology and Toxicology, Virginia Commonwealth University, Richmond, VA 23298

The antinociceptive effect of intrathecally (i.t.) administered levonantradol (40 μ g), CP 55,940 (10, 30, 60, or 100 μ g), Δ^9 -THC (100, 300, or 1,000 μ g), and the DMSO vehicle was investigated. Antinociception was assessed in the tail-flick test at various time points after drug or vehicle administration. All 3 cannabinoids produced significant antinociception compared to the vehicle-treated controls which did not differ from baseline. At 30 min, the percent maximum effect (MPE) for the levonantradol-treated animals was 74 ± 12 and for each respective Δ^9 -THC-treated group the MPEs were 33 ± 14 , 58 ± 15 , and 43 ± 20 . The CP-55,940-treated animals exhibited peak antinociception at 60 min. At this time the MPE produced by each respective drug dose was 0 ± 4 , 35 ± 12 , 39 ± 12 , and 56 ± 14 . Finally, the antinociceptive effect of i.t. levonantradol (40 μ g), CP-55,940 (30 or 100 μ g), and the DMSO vehicle was investigated in spinally transected rats. Each drug significantly elevated tail-flick latencies compared to the vehicle control animals. At 30 min, the MPE produced by levonantradol was 78 ± 16 . The MPE produced by each respective dose of CP-55,940 was 18 ± 2 and 36 ± 11 . These results indicate that cannabinoids can produce antinociception through a direct spinal mechanism, although they do not preclude the possibility of supraspinal contribution. This work is supported by NIDA grant DA 03672 and the Commonwealth of Virginia Center on Drug Abuse Research.

EFFECT OF CD4 AND CD8 POSITIVE T LYMPHOCYTE DEPLETION ON GERMINAL CENTER DEVELOPMENT.

Andrea M. Lister*, J.G. Tew & A.K. Szakal*. Depts. of Anatomy/Microbiology, MCV/VCU, Richmond, VA 23298. Antigen that is transported to lymph node follicles is processed and presented by follicular B cells to T cells. Although T cells are present in follicles, their role in the germinal center response is not clear. B cell presentation of the antigen to T cells in vitro results in the release of T cell lymphokines believed to be needed for germinal center development. After administration of an anti-CD4 / anti-CD8 cocktail to deplete mouse T cells, the spleen and lymph nodes were excised seven days after footpad challenge and examined for the development of germinal centers. Significant suppression in germinal center numbers and germinal center compartment size suggested that in the absence of alpha/beta T cells, gamma/delta T cells are not adequate to provide the T cell help. Support: AI 17142-07.

THE STIMULUS PROPERTIES OF MELANOTROPIN RELEASE-INHIBITING FACTOR (MIF) AND THEIR ASSOCIATION WITH MORPHINE. Colleen R. McLaughlin, Aron H. Lichtman, Dept. of Pharm/Tox., VA Commonwealth Univ., Richmond, VA 23298, Dept. of Psychol., Dartmouth Col., Hanover, NH 03755, and Michael S. Fanselow, Dept. of Psychol., UCLA, Los Angeles, CA 90024. Reports in the literature indicate that MIF may interfere with the formation of tolerance to morphine. Therefore, the direct effect of MIF on morphine-induced antinociception and its effect on the acquisition of tolerance were examined. Administration of MIF prior to morphine sulphate did not attenuate morphine-induced antinociception or the acquisition of tolerance to morphine-induced antinociception, as measured by the latency to hindpaw lick in the hotplate test of nociception. Morphine-tolerant animals tested 72 hr. later without the MIF pretreatment displayed longer pawlick latencies indicative of a loss of tolerance. These data suggest that MIF may act as a conditioned stimulus in the acquisition of morphine tolerance and that its removal may interfere with the performance of tolerance to the antinociceptive properties of morphine.

STIMULUS PROPERTIES OF A NEW DESIGNER DRUG: 4-METHYLAMINOEX ("U4Euh"). B.R. Misenheimer, R.A. Glennon, Department of Medicinal Chemistry, MCV/VCU, Richmond, VA 23298. 4-Methylaminorex is a central stimulant like other phenylisopropylamine derivatives. The cis isomer of 4-methylaminorex ("U4Euh") has appeared on the clandestine market as a novel designer drug and was recently classified as a Schedule I substance. This study investigated the stimulus properties of racemic cis, racemic trans, and all four optical isomers of 4-methylaminorex in rats trained to discriminate 1 mg/kg of S(+)-amphetamine sulfate from saline. The S(+)-amphetamine stimulus generalized to all of these agents, and consistent with established structure-activity relationships, the trans(4S,5S) isomer (ED50=0.25mg/kg) is more potent than the cis isomers, (cis 4S,5S ED50 = 1.2 and cis 4R,5S, ED50 = 1.5mg/kg) which are more potent than the trans(4R,5R) isomer. The trans(4R,5R) isomer did not completely substitute for S(+)-amphetamine unless a longer (i.e., 60-min) pre-session injection interval was used, suggesting that it has a longer duration of onset than the other isomers of 4-methylaminorex. The results demonstrate that the trans(4S,5S) isomer is similar in potency to S(+)-amphetamine (ED50 values=1.4 and 1.7 nmoles/kg, respectively) in drug discrimination studies and suggest that the trans racemate (which has not been scheduled) might also be an amphetamine like agent subject to abuse. The pharmacology of this compound, particularly its human pharmacology, needs to be examined in greater detail. (Supported in part by USPHS grant DA01642).

THE EFFECTS OF CHRONIC ADMINISTRATION OF Δ -9 THC ON FREE INTRACELLULAR CALCIUM AND ADENYLATE CYCLASE IN MOUSE WHOLE BRAIN SYNAPTOSOMES. K.G. Olson, P. P. Bass, S. P. Welch, and B. R. Martin, Dept. of Pharmacology, MCV-VCU, Richmond, VA 23298.

B6C3F1 mice were treated daily, 5 days per week, for 8 or 67 weeks with orally-administered corn oil (vehicle) or 250 mg/kg or 500 mg/kg Δ -9 tetrahydrocannabinol (THC). Synaptosomes from whole brain were evaluated for changes in intracellular calcium $[Ca^{++}]_i$ levels and adenylate cyclase activity. Those mice treated with chronic (67 week) Δ -9 THC at 500 mg/kg had significantly ($P < 0.05$, Dunnett's test) higher levels of basal $[Ca^{++}]_i$ when compared to vehicle-treated mice (445 versus 275 nM), but this effect was not seen in the chronic (8 week) treatment. However, changes in $[Ca^{++}]_i$ upon administration of KCl (50mM) did not differ between the vehicle and the Δ -9 THC-treated mice. Chronic (67 week) treatment with Δ -9 THC at 250 mg/kg did not significantly alter basal cAMP levels, but chronic (8 week) treatment with 500 mg/kg Δ -9 THC doubled basal cAMP in the vehicle and tripled basal cAMP in the 500 mg/kg Δ -9 THC group. Forskolin (1 μ M) significantly increased cAMP levels in both the vehicle and the chronic (8 and 67 week) Δ -9 THC groups. Δ -9 THC (1 μ M) did not alter cAMP levels in the vehicle-treated mice but produced a 50% increase in cAMP levels in the Δ -9 THC (67 week) mice. These data indicate that adenylate cyclase is activated and/or that intracellular calcium levels are altered following chronic (8 or 67 week) Δ -9 THC treatment. The mechanisms for such changes are yet to be determined. [Supported by NIDA grants DA03672, DA06031, and the Commonwealth of Virginia Center on Drug Abuse Research.]

ROLE OF NEWLY SYNTHESIZED STEROID HORMONE ANTAGONISTS ON GLUCOCORTICOID- AND MINERALOCORTICOID-INDUCED HYPERTENSION IN RATS. Justicia Opoku and *Mohammed Kalimi, Dept. of Physiol., Medical Col. of Va., Richmond, Va. 23298. Excess adrenocorticosteroid hormones such as glucocorticoids and mineralocorticoids is well known to induce hypertension in several animal species as well as in humans. Therefore, the development of potent and specific glucocorticoid and mineralocorticoids antagonists with antihypertensive effects is clinically necessary. Recently, two new exciting adrenocorticosteroid hormone antagonists have been synthesized. RU 486 as a potent glucocorticoid antagonist and mespirenone, as a mineralocorticoid antagonist. We have studied the antihypertensive effect of RU 486 and mespirenone in rats with dexamethasone- or aldosterone/DOCA-salt-induced hypertension. We report that RU 486 administered simultaneously with dexamethasone prevented the hypertension induced by dexamethasone treatment. The administration of the antiminerlocorticoid mespirenone, in combination with aldosterone successfully prevented aldosterone-induced hypertension but not dexamethasone-induced hypertension. In conclusion we have shown here for the first time that RU 486 has a clinical potential use in the treatment of Cushing's Syndrome and mespirenone in the treatment of mineralocorticoid-excess diseases.

EFFECT OF OXIDATION OF *cis*-UNSATURATED FATTY ACIDS ON THEIR INHIBITION OF PHOSPHOLIPASE A₂ ACTIVITY. Ramesh Raghupathi* and R. Franson*, Dept. of Biochem. and Mol. Biophys., Va. Commonwealth Univ., Richmond VA 23298. *Cis*-unsaturated but not *trans*-unsaturated and saturated fatty acids inhibit phospholipase A₂ (PLA₂) activity *in vitro* and may function as endogenous suppressors of lipolysis. The 12-hydroxyl analog of oleic acid, ricinoleic acid, was not as inhibitory with an IC₅₀ 10-fold lower than that of oleate. To further probe the importance of the environment of the *cis*-double bond, arachidonic acid was oxidized by exposure to a) air at 37°C, and b) free radicals generated by the Fe²⁺-ascorbate system. Both autoxidation and peroxidation drastically decreased the inhibitory potency of arachidonic acid. Thus, arachidonate exposed to air for 24 hrs. (pH 6.0) lost 84% of its inhibitory potency; a similar loss (85%) was observed in 60 min. in the presence of 100 μM FeSO₄ + 100 μM ascorbate (pH 7.0). In contrast, peroxide(s) of linoleic acid were more potent inhibitors of PLA₂ activity than the unmodified fatty acid. These data, while stressing the importance of the environment of the *cis*-double bond of the fatty acids, illustrate the diverse role of lipid peroxidation in the regulation of PLA₂ activity *in vivo*.

DEVELOPMENT OF POTENT 5-HT_{1A}-SELECTIVE AGENTS. R. Raghupathi*, M. Titeler[#], R. A. Glennon[#], Dept. of Medicinal Chemistry, MCV/VCU, Richmond, VA 23298; [#]Albany Medical College, Albany, N.Y. 4-(2-Methoxyphenyl)-1-[4-(2-phthalimido)butyl]piperazine, (NAN-190), an agent developed in our laboratory as a high affinity 5-HT_{1A} serotonin antagonist (K_i = 0.6 nM), lacks selectivity by being almost equipotent at α-1 adrenergic receptors (K_i = 0.8 nM). A series of analogs was designed, synthesized and tested in order to explore the influence of structural features on 5-HT_{1A} and α-1 affinities and thereby improve selectivity for 5-HT_{1A} sites. Modification of the phthalimido end of NAN-190 has led to the following observations: (a) the phthalimido portion can be replaced by benzamide (aromatic) groups with widely varying substituents with retention of 5-HT_{1A} affinity, but no enhancement of selectivity, (b) replacement by aliphatic amide moieties enhances selectivity for 5-HT_{1A} sites, (c) replacement by aliphatic amide groups branched at the α position greatly enhances selectivity, (d) analogs with bulky aliphatic substituents not only retain high affinity at 5-HT_{1A} sites, but confer a vastly improved selectivity for 5-HT_{1A} over α-1 sites. Thus, beginning from a lead compound showing no selectivity, we have introduced modifications that result in a > 100-fold selectivity for 5-HT_{1A} over α-1 sites. (Supported in part by PHS Grant NS 23523.)

THE EFFECTS OF TRAUMATIC BRAIN INJURY ON MOTOR AND SPATIAL MEMORY TASKS. Amrita K. Singha, D. White, Hamm, R. Dixon, C. and Hayes, Depts. Neurosurgery, Rehab. Medicine, and Psychology, Va. Commonwealth Univ., Richmond Va. 23298. Cognitive and motor deficits are prominent sequelae of human traumatic brain injury (TBI). The purpose of this study was to investigate the nature of motor and cognitive deficits following experimental TBI to rodents employing a cortical contusion model. Rats were injured at a moderate level (6 m/sec, 2.0 mm compression, n=8) or underwent sham-injury procedures (n=8). Following surgery, animals were assessed for motor and cognitive deficits using beam walk, beam balance, and Morris water maze. The beam walk and beam balance tests for motor impairments where the latency of the animal to walk or balance on the beam is measured. The Morris water maze measures spatial memory deficits indicated by the latency of the rat to locate a hidden platform. Results of this experiment indicate that injured animals exhibited significant deficits ($p<.05$) on the beam walk and beam balance for 1 day post-injury. In addition, injured rats also showed significant spatial memory deficits ($p<.05$) up to 30 days post-injury in the absence of motor deficits. Thus, it appears that deficits seen in this cortical contusion model produces motor impairment along with long-term cognitive disruption similar to that observed following human head injury.

DOPAMINERGIC TERMINAL D-2 AND POSSIBLY D-1 AUTORECEPTORS REGULATE DOPAMINE SYNTHESIS IN THE RAT. F.L. Smith, Dept. of Pharm./Tox., MCV-VCU, Richmond, VA 23298, & W.H. Lyness*, Dept. of Pharmacol., Texas Tech Univ., Health Sci. Ctr., Lubbock, TX 79430. The gamma butyrolactone (GBL) induced *in vivo* presynaptic terminal model (GBL (750 mg/kg s.c.) + NSD 1015 (100 mg/kg i.p.)) was used to determine the presence of D-1 and D-2 autoreceptors, and whether they interact to affect dopamine (DA) synthesis. Alone, GBL and d-amphetamine (AMPH) (0.5 mg/kg) independently increase 3,4-dihydroxyphenylalanine (DOPA) accumulation in the striatum (STR), while quinpirole (QUIN) (0.5 mg/kg) reduces DA synthesis in the STR and nucleus accumbens septi (NAS). SKF 38393 (7.0 mg/kg) and SCH 23390 (0.05 mg/kg) are without effect in any region. QUIN (0.5 mg/kg) combined with AMPH (0.5 mg/kg) significantly reduces DOPA accumulation from GBL controls and AMPH values in all three regions. SKF 38393 (7.0 mg/kg) combined with AMPH (0.5 mg/kg) significantly reduces DA synthesis from AMPH values only in the prefrontal cortex (PCX). SCH 23390 (0.05 mg/kg) combined with AMPH (0.05 mg/kg) is without effect in any region. In other experiments, SKF 38393 (7.0 mg/kg) or SCH 23390 (0.05 mg/kg) combined with QUIN (0.5 mg/kg) fails to alter DA synthesis from QUIN values in any region. These data indicate the presence of D-2 synthesis modulating autoreceptors in the STR and NAS, and possibly release modulating autoreceptors in the PCX. D-1 autoreceptors may exist in the PCX, although their role is yet undetermined.

EFFECT OF DELTA-9-TETRAHYDDROCANNABINOL ON MACROPHAGE PROTEIN EXPRESSION. Amy Stinnett, Guy Cabral*, John Bailey*, and William Slikker, Jr*. Microbiology/Immunology Dept., Med.Col. of VA/VCU, Richmond, VA 23298 and Div. of Reproductive and Developmental Toxicology, Nat. Ctr for Toxicological Res., Jefferson, Arkansas, 72079. Delta-9-Tetrahydrocannabinol (THC), the major psychoactive component of marijuana, decreases host resistance to infection. THC also alters the function of macrophages. These cells play a critical role in host resistance, during which they undergo activation, each stage marked by defined functions and expression of specific proteins. The purpose of this study was to assess the effect of THC on macrophage protein expression following *in vivo* chronic exposure to marijuana smoke. Marijuana (MJ) cigarettes (2.6% THC) were provided by the National Institute on Drug Abuse. Male rhesus monkeys were assigned to 4 groups (n=6/group): High dose animals (HI) were exposed 7 days/week to the smoke of 1 MJ cigarette/day; low dose animals (LO) were exposed on 2 weekend days to the smoke of 1 MJ cigarette/day placebo animals (EM) were exposed to the smoke of 1 ethanol extracted MJ cigarette/day for 7 days/week sham animals (SH) were exposed to sham smoking conditions 7 days/week. Following 1 year exposure and a 7 month rest period, purified lung macrophages, cultured in the presence or absence of LPS, were processed for analytical PAGE. Protein profiles of macrophages from EM, LO, and HI animals showed marked differences when compared to those of SH animals. A restructuring of SH macrophage proteins was observed following *in vitro* "activation" with LPS. Similar restructuring was not seen for LPS treated macrophages of LO and HI animals. These results indicate that chronic THC exposure induces alterations in protein expression and consequently may modify the capacity of macrophages to respond to external stimuli.

INVESTIGATION OF THE ROLE OF LIPOPHILICITY IN CANNABINOID QUANTITATIVE STRUCTURE-ACTIVITY RELATIONSHIPS. Brian F. Thomas and Billy R. Martin, Dept. of Pharmacology and Toxicology, Med. Col. of Va./Va. Commonwealth Univ., Richmond, Va. 23298-0613. Quantitative structure-activity relationships were derived by partial least squares analysis of electrostatic, steric, and lipophilic structural parameters and biological data in the form of log ED₅₀ values in four behavioral assays, and in-vitro binding affinities (log IC₅₀) of 15 cannabinoid compounds. Comparative molecular field analysis (Tripos Associates, Inc., St Louis, Mo.) was used in order to obtain the electrostatic and steric fields of each cannabinoid compound whose molecular geometries were minimized with respect to energy and aligned with respect to the phenol carbons. The results of this analysis indicate that lipophilicity does not contribute significantly to the model's ability to predict the potency of these compounds in producing: 1) decreases in spontaneous activity; 2) decreases in body temperature; 3) increases in tail-flick latency, or; 4) increased catalepsy (ring immobility); nor did lipophilicity appear to contribute to binding affinities. Electrostatic properties contributed approximately 8 % to the model's ability to predict activity and affinity, whereas steric factors were heavily weighted (> 90%) in all equations. The r-squared values for the equations predicting biological activity were all above 0.90. Expansion of the model to include more cannabinoid compounds is ongoing in order to minimize the potential for erroneous dependence of the model on the presence of one compound. Supported by DA 03672, DA 07027, the Commonwealth of Va. Center on Drug Abuse.

A COMPARISON OF THE DECOMPOSITION OF PHENOBARBITAL AND AMOBARBITAL N-GLUCOSIDES. F.B. Vest^{*}, W.H. Soine, and R.B. Westkaemper, Dept. Med. Chem., Va. Commonwealth Univ., Richmond, Va. 23298. Phenobarbital N-glucosides (PBG-R and PBG-S) and amobarbital N-glucosides (AMG-R and AMG-S) are urinary excretion products of phenobarbital (PB) and amobarbital (AM), respectively. It was observed that PBG-R and PBG-S decompose via ring opening under conditions in which no decomposition of PB occurs. The pH-rate profile (pH 6-13) was determined for both PB and AM N-glucosides and indicated hydroxide-ion-catalyzed degradation of unionized and ionized glucosides. The observed rate constants of decomposition at pH 7.4 (37°C) were $4.1 \times 10^{-5} \text{ s}^{-1}$ and $3.4 \times 10^{-5} \text{ s}^{-1}$ for PBG-R and PBG-S, respectively, and $3.1 \times 10^{-6} \text{ s}^{-1}$ and $3.0 \times 10^{-6} \text{ s}^{-1}$ for AMG-R and AMG-S, respectively. The values for the PB N-glucosides are 580 times that of PB and 13 times that of the AM N-glucosides under comparable conditions. Ring opening of the AM N-glucosides and the PB N-glucosides in both cases occurs at C-6 of the barbiturate ring. The rapid breakdown of the PB N-glucosides suggests their decomposition could be occurring in the plasma and urine, whereas decomposition of AMG-R and AMG-S does not appear to occur to a significant extent under these conditions. (Supported by NIH grant GM 34507.)

DIFFERENCES BETWEEN HYOGLYCEMIC RESPONSES INDUCED BY INTRATHECAL MORPHINE AND INSULIN. C.R. WARD, D.A. BRASE AND W.L. DEWEY, DEPT. OF PHARM./TOX., MCV-VCU, RICHMOND VA 23298.

During studies of the hypoglycemic effect of morphine given to unanesthetized mice by the lumbar i.t. route (JPET 245: 187, 1988; 249: 688, 1988), it was found that i.t. insulin (0.02-0.08 U/mouse) also produced a dose-related hypoglycemia. In the present study, the effects of various antagonists on hypoglycemia induced by morphine (40 ug/kg, i.t.) and insulin (0.08 U, i.t.) were compared, and the distribution of i.t. and s.c. [¹²⁵I]insulin to blood was determined. Pretreatment with atropine (2 mg/kg, i.p.), mecamlamine (2 mg/kg, i.p.) or methysergide (2mg/kg, i.p.) failed to antagonize either morphine or insulin. Mecamlamine itself caused a moderate hypoglycemia which tended to be additive to that of morphine, but not insulin. Naloxone (20 mg/kg, i.p.) pretreatment inhibited hypoglycemia caused by morphine, but not insulin. Serial blood samples (54-72 ul) taken from the retro-orbital sinus 15-180 min. after s.c. [¹²⁵I]insulin administration contained 473-2419 cpm (mean of 1.76-2.64% of administered ¹²⁵I/ml), but after i.t. administration, they contained <8 cpm (mean of <0.009% of administered ¹²⁵I/ml). It is concluded that i.t. morphine-induced hypoglycemia involves an opioid mechanism, whereas i.t. insulin induced hypoglycemia does not involve opioid, cholinergic or serotonergic mechanisms and is not due to systemic absorption of i.t. insulin. (Supported in part by a Commonwealth of Virginia Center Grant for Drug Abuse Research, and by USPHS grants DA-00490 and DA-01647.)

THE FATE OF INTRAVENOUS ^{14}C -GLUCOSE AFTER INTRATHECAL MORPHINE INJECTION IN MICE. C. W. White, D.A. Brase, C.R. Ward and W.L. Dewey, Dept. of Pharmacology & Toxicology, Virginia Commonwealth University/Medical College of Virginia, VA 23298.

Morphine injected intrathecally into mice has been shown to cause precipitous lowering of blood sugar. Preliminary experiments are underway to find the fate of the glucose. In experiments trapping expired CO_2 , as much as 25% of the ^{14}C injected as glucose into the tail veins of mice is found converted to CO_2 . There is a tendency for less CO_2 to be found in morphine-treated than in control mice. Tissues were solubilized and assayed for radioactivity. There were not enough differences to account for the hypoglycemia observed. Lactic acid levels were also measured in blood and other tissues. There was no correlation between blood glucose and blood lactic acid levels. Other laboratories have shown a connection between stress and the appearance of lactic acid in the brain and blood. Consistent and non-stressful handling of the mice appears to be crucial in such metabolic experiments. (This work supported by the Virginia Commonwealth Center for Drug Abuse).

Microbiology

CHEMOTACTIC AND CHEMOKINETIC RESPONSE OF NAEGLERIA FOWLERI TO B-103 NEUROBLASTOMA CELLS. C. Brinkley* and F. Marciano-Cabral, Dept. of Micro./Immunol., Va. Commonwealth Univ., Richmond, VA 23298-0678. Naegleria fowleri, a free-living amoeba, causes a rapidly fatal central nervous system disease. Amoebic trophozoites enter the nasal passages, migrate through the olfactory neuroepithelium and spread to more distant regions of the brain. Directed cell motility or chemotaxis is important in pathogenesis because it may enable organisms to accumulate in particular host tissues. The chemotactic and chemokinetic responses of Naegleria amoebae were studied using two alternative techniques. A method using ^3H -uridine labeled amoebae was developed to assess the migratory response of amoebae to B-103 cells. The radiolabel assay or the leading front method using light microscopy were compared to measure cell migration. Highly pathogenic and weakly pathogenic strains of N. fowleri were compared for their locomotory response to nerve cells in vitro. Nerve cell extract, the putative chemoattractant was placed in the lower well, the upper well or in both wells of the Boyden chamber. A double filter system was used to separate the upper and lower compartments of the chamber: an upper polycarbonate filter (UF) with pore size 5 or 8 μm ; and a lower nitrocellulose filter (LF) with pore size of 5 μm . Radiolabeled amoebae were placed on the upper polycarbonate filter and allowed to migrate to the lower filter for 1.5 h at 37°C. Following incubation, the counts per minute (cpm) were determined and the percent of amoebae migrating toward the putative chemoattractant was calculated. The motile response of highly pathogenic N. fowleri to nerve cells was chemotactic while the response of weakly pathogenic N. fowleri was chemokinetic. Chemical cues from the brain possibly facilitate the invasion of the central nervous system by these amoebae. (Supported by the Virginia Power Co.)

THE IDENTIFICATION OF NEW MHC CLASS II-LIKE GENES LINKED TO THE I-A REGION. S. Cho*, M. Attaya and J. J. Monaco, Dept. of Micro. and Immunology, Va. Commonwealth Univ., Richmond, VA 23298. The genes encoding key proteins for immune function are tightly linked as a cluster in the major histocompatibility complex (MHC). Recently, the genes for the Low Molecular weight Polypeptide (LMP) antigens have been mapped in the region between the murine MHC $A_{\beta 3}$ and $A_{\beta 2}$ genes. In an attempt to clone cDNAs representing LMP antigens, we have analyzed four overlapping genomic cosmids spanning this region and identified eight transcribed sequences. The sizes of mRNAs are between 1.5 and 3.7 Kb. One cDNA clone (5.22-C), corresponding to a 1.5 Kb transcript, has been isolated from a WEHI-3 cDNA library and sequenced. One long open reading frame encoding 261 amino acids was defined from the translated sequences of 5.22-C. The predicted protein sequence of 5.22-C shares homology with the membrane proximal domain of MHC antigens, and to immunoglobulin molecules, suggesting that 5.22-C is a member of the immunoglobulin gene superfamily. The most significant homology is observed with $\beta 2$ domains of MHC class II antigens. The hypothetical domain structure of 5.22-C encoded protein and its comparison with other MHC class II antigens will be reported.

OXIDATIVE CHARACTERISTICS OF THE MEMBRANES OF *GLUCONOBACTER OXYDANS*. DEBORAH E. EDWARDS and G. W. CLAUS. Dept. of Biol. VA Polytechnic Inst. and St. Univ., Blacksburg, VA 24061. *Glucobacter* species rapidly oxidize a wide variety of substrates by removing two hydrogens and releasing the product into the medium. Membrane-bound dehydrogenases (MBDHs) are thought to be primarily responsible. We wish to learn the number and type of substrates oxidized by the constitutive MBDHs of these bacteria and, ultimately, to study the substrate specificity and regulation of these enzymes. To begin this study, *G. oxydans* ATCC 621 cells were grown on glycerol, harvested by centrifugation, and broken with a French-pressure cell. Unbroken cells were removed by centrifuging at 40,000 x g, and a crude membrane fraction was prepared from the resulting supernatant fluid by centrifuging at 272,700 x g and washing once with buffer. The ability of the MBDHs in this membrane fraction to oxidize each substrate was measured spectrophotometrically at 301 nm by coupling it to the reduction of the artificial electron acceptor potassium ferricyanide [$K_3Fe(CN)_6$]. To date, we have tested 34 substrates selected from six categories (aliphatic monoalcohols, aliphatic diols, aliphatic polyalcohols, monosaccharides, disaccharides, and aldehydes), and only nine of these were not oxidized. Of the 25 substrates oxidized, there appears to be no correlation with substrate category, rates of oxidation, or number of carbons in the substrate. Glycerol (the growth substrate) was oxidized at a rate of 55 μ moles/min/mg protein. Seven compounds were oxidized at rates higher than glycerol; for example, D,L-1,3-butanediol and acetaldehyde demonstrated oxidation rates of 76 and 73 μ moles/min/mg protein, respectively. Fifteen substrates showed lower oxidation rates than glycerol; for example, D(+)-mannose and isobutyraldehyde were oxidized at rates of 20 and 21 μ moles/min/mg protein. To date, our evidence suggests that this bacterium either constitutively synthesizes many different substrate-specific MBDHs or a few MBDHs that can oxidize many different substrates.

CHANGES IN SPECTRAL ABSORBANCES OF BLOOD PLASMA IN DOGS INFECTED WITH *STAPHYLOCOCCUS INTERMEDIUS*. Lyle Evans, J. Melia, and G. Colmano (Sponsor), Dept. Biomed. Scis, VMRCVM, VPI & SU, Blacksburg, VA 24061. Blood plasma samples were taken from 7 dogs before surgery, which involved intramedullary infection in all tibiae with 1.8×10^7 colony forming units (C.F.U.) of *Staphylococcus intermedius*. After five days, during which a febrile infectious state was evident, blood plasma samples were again taken. The spectral absorbances of blood plasma were measured in the UV-Visible between 190.2 nm and 650nm at 0.2 nm intervals. The measurements were performed over 3 ranges, with samples diluted with distilled water, so that the absorbance did not exceed 1.2 Absorbance. The difference between pre and post infection samples showed a number of changes including a number of very narrow bandwidth (>2 nm) peaks in the 250-290 nm range. The precise interpretation of these peaks is not known. Other changes included increased absorption at 413 nm (in the Soret band of Hemoglobin) and in the 200-240nm region.

PHYSIOLOGICAL STUDIES OF COPPER BINDING PROTEIN PRODUCTION IN *VIBRIO ALGINOLYTICUS*. Valerie Harwood-Sears and A. S. Gordon, Dept. of Biological Sciences, Old Dominion University, Norfolk VA 23529. Micromolar levels of copper added to batch cultures of *Vibrio alginolyticus* cause a lag in growth. During the copper-induced lag phase, supernatant proteins which complex and detoxify copper are produced. The dominant proteins in immobilized metal ion affinity chromatography (IMAC) fractions from copper-challenged culture supernatants are a 21 kD (CuBP1) and a 19 kD (CuBP2) protein. CuBP1 is also a major protein in supernatants of copper-challenged chemostat cultures, and is barely detectable in controls. A 14 kD protein is also amplified in supernatants of copper-challenged chemostat cultures. Preliminary data suggest that the yield in chemostat cultures decreases in proportion to the concentration of added copper. This strain of *Vibrio alginolyticus* carries a ca. 30 kb plasmid which may encode copper-inducible proteins with affinity for copper.

CHARACTERIZATION OF A PUTATIVE SECOND HUMAN *c-myb* PROMOTER. Sarah M. Jacobs, Karen Gorse, Eric Westin, Division of Hematology/Oncology, Medical College of Virginia, Richmond, VA 23228.

An alternatively spliced human *c-myb* cDNA has recently been characterized and has been found to contain unique 5' end sequences consistent with usage of an alternative promoter. These unique sequences were mapped by restriction analysis to intron 1. Primer extension studies map the potential transcription start site downstream of exon 1, indicating that this unique transcript is not an artifact of cloning. This start site may therefore reflect the utilization of a second promoter which is downstream from transcription pausing sites identified previously in intron 1 of the murine *c-myb* gene.

Preliminary sequence analysis of human *c-myb* intron 1 reveals that the unique 5' region is located directly adjacent to exon 2. In addition, comparison of human and murine sequences shows a high degree of homology directly upstream of exon 2 in the putative promoter site. Included within these upstream sequences is a potential *jun/AP1* binding site and CAAT promoter sequences. Further sequence analysis and comparison with mouse intron 1 is underway. Functional characterization of the putative promoter region using chloramphenicol acetyl transferase assays is in progress.

Therefore, primer extension data, analysis of genomic *c-myb* clones and sequence comparison between man and mouse indicates the presence of a possible functional promoter within intron 1 of the human *c-myb* gene downstream of the transcriptional pause sites identified in the mouse.

A FIBROBLAST FACTOR INDUCES MAST CELL PROLIFERATION AND DIFFERENTIATION

J.J.Ryan, D.L. Jarboe, Ana Kukolja, R.I. Ashman, J.A. Leftwich, and T.F. Huff.

Virginia Commonwealth University, Richmond, Virginia 23298

The mast cell committed progenitor (MCCP) is a nongranulated cell which can be isolated from the mesenteric lymph node of mice infected with *Nippostrongylus brasiliensis* (Nb). We have shown that MCCP can be stimulated to proliferate and differentiate into mature, connective tissue type mast cells in the presence of a fibroblast derived factor. We have demonstrated the production of this factor by several fibroblast lines. The activity of the factor cannot be duplicated by any known growth factors, although recent evidence indicates phorbol esters can mimic the activity of the factor. The fibroblast factor has also been shown to be active on mast cell progenitors in the naive peritoneal cavity; thus the MCCP may be present not only in Nb-infected mice, but may play a role in normal mast cell development.

RESISTANCE OF HIGHLY PATHOGENIC *NAEGLERIA FOWLERI* AMOEBAE TO COMPLEMENT-MEDIATED LYSIS. Denise M. Toney & Francine M. Cabral, Dept. of Micro./Immuno., Va. Comm. Univ./Med. Col. of Va., Richmond, VA 23298. *Naegleria fowleri*, an opportunistic pathogen, is the causative agent of Primary Amoebic Meningoencephalitis. A highly pathogenic strain of *N. fowleri*, LEEmp, activates the alternative complement pathway but is resistant to complement-mediated lysis. In contrast, nonpathogenic *Naegleria* amoebae are complement sensitive. Treatment of highly pathogenic *N. fowleri*, LEEmp, with papain or trypsin renders the amoebae susceptible to complement-mediated lysis. Resistance is restored after treatment with papain if the amoebae are allowed to incubate in assay medium prior to addition of complement. Treatment with phosphoinositol-specific phospholipase C (PIPLC) also increases susceptibility to complement. However, resistance to complement after PIPLC treatment is not restored if the amoebae are allowed to incubate in media prior to complement addition. To characterize surface components or mechanisms which play a role in resistance of *N. fowleri* to complement-mediated lysis, we have subjected the amoebae to several experimental regimens. Treatment of *N. fowleri* amoebae with the nonionic detergent Nonidet P40, increases the ability of these amoebae to resist complement lysis, but has no effect on complement lysis of the nonpathogenic amoeba, *N. gruberi*. We have determined also, that *N. fowleri* amoebae are more resistant to complement-mediated lysis when grown in enriched growth medium when compared to amoebae grown in a minimal medium. Although enzymatic treatment, detergent treatment, and variations in growth medium alter susceptibility of amoebae to complement, resistance is not abolished completely by any one of these factors alone. These results indicate that in addition to complement regulatory proteins, additional mechanisms play a role in *N. fowleri* resistance to complement-mediated lysis. (supported by The Virginia Power Co. and NIAID grant 25111)

PURIFICATION AND PARTIAL CHARACTERIZATION OF SORBITOL DEHYDROGENASE FROM THE PLASMA MEMBRANE OF *GLUCONOBACTER OXYDANS*. IAN VAN LARE and G. W. CLAUS. Dept. of Biol. VA Polytechnic Inst. and St. Univ., Blacksburg, VA. 24061. *G. oxydans* is an obligate aerobe that derives its energy from the single-step oxidation of over 80 polyols catalyzed by [NAD(P)-independent] dehydrogenases located in the plasma membrane. The two hydrogens removed from the polyol are passed through the electron transport chain, producing a proton gradient, and the oxidation product is released into the medium. Knowledge of the structure and function of these enzymes and prosthetic groups involved in the catalysis of these oxidations are thus of eminent importance for the understanding of the energy metabolism of the gluconobacters. This report summarizes the data obtained from the purification of the membrane-bound sorbitol dehydrogenase (mSDH) from ATCC strain 621. Crude cell-free extracts of sorbitol-grown cells exhibited a mSDH specific activity of 1,300 (μ moles sorbose formed min^{-1} mg protein $^{-1}$). The particulate fraction obtained by ultracentrifugation contained 100% of the mSDH activity and had a specific activity of 2,547. Treatment of the particulate fraction with 1.5% octyl-glucoside resulted in the complete solubilization of mSDH, and this solubilized fraction had a specific activity of 6,997. When the solubilized proteins were separated by 5% native polyacrylamide gel electrophoresis (PAGE) then subjected to an activity stain, only one of approximately 14 bands was stained. When this active band was eluted from the native gel and subjected to SDS-PAGE, three bands were formed of which only one exhibited mSDH activity. All three bands had apparent molecular weights between 60 and 70 kdal. To date, it appears that the mSDH of *G. oxydans* exists in the membrane as part of an aggregate containing two other proteins. We are attempting to isolate larger quantities of these proteins so that all three may be characterized.

Psychology

COPING WITH STRESS DURING A VISIT WITH A CHRONIC MENTALLY ILL FAMILY MEMBER. Gina L. Bankes & B. A. Winstead, Dept. of Psychology, Old Dominion Univ., Norfolk, Va, 23529. Coping techniques and perceived amounts of stress were examined in eight parents surrounding a visit with their mentally ill son or daughter. The Lazarus Ways of Coping scale was completed within five days prior to the visit, and the Multiple Affect Adjective Checklist, a Visit Appraisal Scale, and a general appraisal scale were completed within five days following the visit. Correlations were computed for four of the eight scales on the Lazarus Ways of Coping scale, two representing emotion-focused coping (EFC) and two representing problem-focused coping (PFC) with appraisal and affect. The EFC scale entitled Escape/Avoidance was positively related to overall situational distress, whereas the two PFC scales entitled Confrontive Coping and Planful Problem Solving were negatively related to hostility and depression respectively.

INCREASING SAFETY BELT USE IN COMMUNITY SETTINGS: AN EXAMINATION OF DIFFERENT INTERVENTION STRATEGIES. Kimberly S. Bergholz, John Wangler, Russell Fleenor,* Tim Ludwig,* Dept of Psychology., Virginia Polytechnic Institute., Blacksburg, Va 24060. Two different interventions—feedback and competition were used to determine their effectiveness in increasing safety belt use. Over the course of an eleven week reversal design, safety belt use increased significantly during the overt observation phase, and then remained slightly above the initial baseline throughout the rest of the experiment. Feedback and competition had no significant effects in increasing belt use after the second baseline period.

EXPECTATIONS OF RESIDENTIAL INDEPENDENCE AS A PREDICTOR OF FAMILY DISCORD. Glenn A. Callahan, Dept. of Psych., Old Dominion Univ., Norfolk, VA. 23508. The degree of correlation between attitudes of student's and their parent's on the topic of the student moving into his or her own domicile before marriage, or premarital residential independence, was examined. It was hypothesized that students who came from homes of greater socioeconomic and/or urban background, those that were first-born, and male children would demonstrate differences among generations about the acceptability of leaving home before marrying. Results of surveys on the subject show that socioeconomic background and subject sex were, indeed, significant indicators of premarital residential independence; however, birth order and family background were not.

LIFE CHANGE AND ILLNESS IN TRADITIONAL AND NON-TRADITIONAL COLLEGE STUDENTS. William N. Campbell, Dept. of Psychology, Old Dominion University, Norfolk, VA 23508. Sixty undergraduate students from Old Dominion University and Tidewater Community College took part in a study to compare the relationship between life change, perceived social support, and illness among traditional (18-23 years of age) and non-traditional (26 years or older) college students. Subjects were administered the Social Readjustment Rating Scale (SRRS) to measure "life change stress", the Interpersonal Support Evaluation List (ISEL) to reflect the perceived availability of social support, and the Seriousness of Illness Rating Scale (SIRS) to quantify the incidence and severity of illness experienced. Results revealed that males reported significantly less illness during the preceding 12 months than did females. It was further revealed that no significant differences were found between the traditional and non-traditional students with respect to their scores on any of the three dependent measures used. There was no interaction between sex and traditional or non-traditional status. These results were discussed in terms of factors that may help explain the main effect found for sex and the absence of significant differences between the traditional and non-traditional groups on the scales administered.

EFFECTS OF NUTRITIVE EXPECTANCY VERSUS GASTRIC DISTENTION ON INTAKE SUPPRESSION BY CCK. Rodger B. Cook, Dept. of Psychology, Washington & Lee University, Kenneth L. Marcella and T. L. Davidson, Dept. of Psychology, Va. Military Institute, Lexington, VA 24450. It has been suggested that intake suppression by cholecystokinin (CCK) is mediated by nutritive expectancies. Alternatively, it has also been proposed that gastric distention induced by CCK in combination with feeding is the basis for CCK's suppressive effect. The present experiment directly compared these two hypotheses. Food deprived rats were given six presentations each of noncaloric, unsweetened, grape or orange flavored solutions. The flavor presented alternated daily. One flavor was always mixed in a 5% ethanol solution (to establish a nutritive expectancy) while the other was not mixed with ethanol. The flavor mixed with ethanol was counterbalanced. A two-bottle choice test showed that the rats preferred the flavor previously paired with ethanol. Next, capacity of CCK (2 ug/kg) to suppress intake of each flavor was tested following a 20 ml/kg gastric loading by gavage (to produce stomach distention) of a 0.9% saline solution or following gavage without gastric loading. The results indicated that both nutritive expectancy and stomach distention produced stronger suppression of intake by CCK. However, gastric distention appeared to produce more suppression than did nutritive expectancy.

VESTIGIAL BODY IMAGE: A MULTIVARIATE COMPARISON AMONG NORMAL WEIGHT, OVERWEIGHT, AND FORMERLY OVERWEIGHT WOMEN. Charlie B. Finch, Jr. and Thomas F. Cash, Old Dominion Univ., Norfolk, VA 23508. The purpose of this study was to examine the relationship between body weight and body image in terms of Stunkard's hypothesis of vestigial body image (that a successful return to normal weight among overweight women may not fully restore a satisfying body experience). College women completed multiple, standardized measures of their fear of fat and attitudinal body image. Based on their current weight and information from a structured weight history questionnaire, three groups were constructed: normal-weight women without an overweight history (NW, $n = 34$), normal-weight women with a formerly overweight history (FOW, $n = 8$), and women who were currently overweight (OW, $n = 9$). Group comparisons revealed, as expected, that OW women reported more weight related anxieties and more negative body experiences relative to the NW women. Contrary to Stunkard's original hypothesis, group comparisons did not reveal any significant differences between the NW and the FOW women. Possible implications are discussed.

CORRELATES OF NUMBER OF RESPONSES TO SOUTHWESTERN VIRGINIA FEMALE PERSONAL ADS: WHAT SELLS? Chet H. Fischer, Dept. of Psy., Radford University., Radford, Va. 24142. There are 63 million single adults in the U.S. Of considerable interest to this group is how to meet other appropriate singles. Accumulating evidence suggests that personal ads are a useful method for connecting with potential partners. Given that the ads have utility, the next step involves determining which ad variables produce the greatest number of replies. All women who placed personal ads in two issues of Roanoker magazine were sent questionnaires which assessed the personal characteristics of the advertiser and the results of the ad. Correlational and multiple regression analysis were used to determine the relationship between the number of replies an ad produced and fourteen ad content variables. The results suggest that none of the content variables was significantly related to the number of replies. However, specifying age, physical characteristics, occupation and placing a long ad tended toward producing more replies.

HELP-SEEKING BY MALES: EFFECTS OF INTERNAL VS. EXTERNAL LOCUS OF NEED ATTRIBUTION ON HELPER CHOSEN. Michael Freeman, Dept. of Psyc., Old Dominion Univ., Norfolk, Va. 23529. The masculine stereotype may have an effect on how males react to situations that require them to seek help, depending on the problem's locus and on reciprocity. Thirty-three male subjects received the Bem Sex Role Inventory (BSRI) along with three help-seeking scenarios; one consisted of a problem with an internal locus, one with an external locus, and one dealt with reciprocity. All of the problems required subjects to choose one of four specific people from whom to receive help, a male or female friend or a male or female stranger. The subject's BSRI masculine sub-scale score was used to divide the subjects into high and low masculinity groups. For each problem, the two groups were compared by which person the subjects said they would ask for help. The subjects consistently reported preferring help from a friend over a stranger. In addition, a significant negative correlation was found between the masculine sub-scale scores (higher are more masculine) and the frequency of reciprocal help-seeking the subjects said they would show. The lack of significant effects regarding problem locus indicates that it may not be a strong factor for self-predicted behavior.

ATTRIBUTIONS OF INTRAMURAL TEAM ATHLETES: THE EFFECTS OF PERCEIVED ABILITY AND GENDER DIFFERENCES. Catherine Q. Greenwald, Dept. of Psych., Old Dominion Univ., Norfolk, Va., 23508. Attributions of intramural basketball team athletes were measured using the Wingate Sports Achievement Responsibility Scale (WSARS). Subjects were 13 male and 9 female athletes from 21 randomly selected intramural basketball teams at Old Dominion University, between 18 and 25 years old. Subjects who agreed to participate received two questionnaires. The first questionnaire measured their basketball team experience and their perceived abilities for their own playing performance (high and low ability) as measured on a seven point scale. The second, the WSARS, measured the athletes' locus of causality with their score on a five point scale for 10 positive events and 10 negative events. A 2 x 2 analysis of variance found no significant main effects for perceived ability and gender. Low return rate of the packets and possible biases of the questionnaires contributed to the lack of significant findings. Better controlled attribution research with intramural athletes could point to new directions in research with college varsity athletes.

IS HANDWRITING A RELIABLE INDEX OF ALCOHOL IMPAIRMENT? Sharon Hall*, Johann Lee*, & Kent Glindemann*, Dept. of Psyc., Va. Polytechnic Inst. & S.U., Blacksburg, Va. 24061. Sponsor: E. Scott Geller. The use of writing samples as indices of alcohol impairment was explored. Students at a campus fraternity party (n = 74) wrote a sentence before and after consuming alcohol (in beer and mixed drinks). [Subject's BACs ranged from .000 to .205]. Before subjects wrote the post-party stimulus sentence, one half of the subjects were told that the writing sample would be compared to the writing sample they had provided upon entering the party in an attempt to discern their levels of intoxication. Later, undergraduate and graduate students (n = 20) attempted to discriminate between pre- and post-party handwriting samples, and then classified the presumed post-party samples into three categories of increasing blood alcohol concentration (BAC). Results indicated that the raters were fairly good at discriminating between pre- and post-party handwriting samples of the partiers, but were not very adept at discerning the level of intoxication of the partiers. The experimental manipulation had a marginal effect on the data. Implications of these findings for reducing DWI-risk are discussed.

NEW STRATEGIES FOR ASSESSING INTOXICATION IN THE FIELD. Craig Schumpert*, Maria Lugo*, & Kent Glindemann*, Dept. of Psyc., Va. Polytechnic Inst. & S.U., Blacksburg, Va. 24061. Sponsor: E. Scott Geller. A computerized critical tracking task (CTT) was developed to assess drinkers' blood alcohol concentration (BAC). Combinations of five parameters were investigated. Dependent measures included response time and error rate. Data were obtained in naturalistic settings from subjects (n = 232) who reached a wide range of BACs. Subjects were of legal drinking age. Subjects' performance was consequently correlated with their BAC. With CTT performance, mean response time and mean error rate were both reliable indicators of intoxication, and results stood up fairly well under a signal-detection approach to the data analysis. The CTT proved most effective at identifying subjects whose BACs were at or above a level of .120. Implications for use of the instrument in real-world settings are discussed.

CHOLECYSTOKININ AND SUBSTANCE ABUSE: TURNING OFF THE CENTRAL REWARD SYSTEM. Stephen E. Imel, Christopher K. Bish, Dept. of Biology, and T. L. Davidson, Dept. of Psychology, Va. Military Institute, Lexington, VA 24450. Cholecystokinin (CCK) is a gut peptide reported to reduce the rewarding effects of feeding. The present experiment investigated whether or not CCK administered by injection or endogenous CCK released by feeding would reduce the rewarding effects of cocaine. Three groups of 17 hr food and water deprived rats (N=6) were given IP injections of CCK (2 ug/kg) or saline (0.9% NaCl), or 12 gms of food plus saline, 10 min prior to a 40 min presentation of an unsweetened, noncaloric, orange or grape flavored drink. One flavor was followed by an IP injection of 5 mg/kg of cocaine hydrochloride, the other by injection of saline. Injections were counterbalanced with respect to flavor. The rats were given orange on days 1 and 3 and grape on days 2 and 4. All rats were then given a preference test. Although rats injected with CCK consumed less of the flavor paired with cocaine, so did saline controls. Hence, there was no evidence that CCK reduced the rewarding effects of cocaine. However, rats preferred prior to cocaine administration developed a very strong preference for the cocaine-paired flavor. This result suggests that feeding may serve to prime the reward system for the reinforcing effects of cocaine.

CHOICE REACTION TIME TO POSITIVE STIMULI IN A TASK COMBINING B AND C REACTION TIME. Barbara M. Keiser and Raymond H. Kirby, Old Dominion Univ., Norfolk, VA, 23508. Choice reaction time (CRT) studies have concluded that the size of the positive set of stimuli presented to a subject increases CRT; however size of the negative set has not seen as much research addressed to it. The current study used a task that combined b and c-reaction time, and thus permitted variation of the number of stimuli in the positive and negative sets. Sixty female undergraduate students from Old Dominion University participated in this study. The subjects were presented a CRT task in a 2(positive set size) x 3 (negative set size) factorial between-group design. The dependent variable was the CRT for each trial. A significant main effect for size of the positive set was found, $F(1,54)=8.46$, $p<.01$, with the faster times in the smaller set. No significant effect was found for size of the negative set, $F(2,54)=3.02$, $p>.05$, nor was there a significant interaction effect $F(2,54)=2.52$, $p>.05$. Since a trend toward a significant effect was found for size of the negative set, further research increasing set size is warranted.

LEARNING ABOUT INTEROCEPTIVE AND EXTEROCEPTIVE STIMULI WHEN BOTH ARE CONCURRENT DISCRIMINATIVE SIGNALS FOR SHOCK. Paul B. Kubin, Dept. of Biol., Va. Military Institute (VMI), Leonard E. Jarrard, Dept. of Psych., Washington & Lee University, & T. L. Davidson, Dept. of Psych., VMI, Lexington, VA. 24450. The relative salience of internal and external cues were compared using blocking and overshadowing procedures. Two groups of rats (n=8) were placed on an alternating 0-hr and 24-hr food deprivation schedule. In Phase 1, rats in Group I were trained for 6 days to use cues arising their deprivation state as signals for mild shock. Half the rats were shocked under 0-hr and not under 24-hr food deprivation--the remaining Group I rats had a reversed deprivation level-shock contingency. The second group (Group E) received no Phase 1 training. In Phase 2, both groups received an external cue and a deprivation cue as compound signal for shock (i.e., 0-hr/tone, 24-hr/clicker). When training was completed fear of external cues was compared to that of internal cues in both groups. Videotaped observation (absence of skeletal muscle movement) served as the index of conditioned fear. The results showed (1) learning that internal cues signaled shock was not overshadowed by concurrently relevant external cues; (2) prior training with internal cues can block learning that external cues are signals for shock.

THE EFFECTS OF TEMPERATURE ON READING COMPREHENSION. Carlo E. Orlando, Dept. of Psych., Old Dominion University, Norfolk, Va., 23508. Human ability to adapt to the environment is rarely questioned. Yet the cost, in terms of performance, needs further study, as does the issue of gender differences in human performance. To this end, an experiment using 8 male and 12 female college students was conducted to determine the effect of increased ambient temperature (either 70 F or 85 F) on reading comprehension. Performance decrements associated with increased temperature were not found. As expected, there were no gender differences. Finally, the interaction between the temperature variable and the gender variable was not significant. Directions for future study are suggested.

A STUDY OF THE EFFECTS OF NEED FOR DOMINANCE ON SELF DISCLOSURE RECIPROCALITY. Scott H. Peterson, Department of Psychology, Old Dominion University, Norfolk, VA 23517. The effects of subjects' need for dominance on self disclosure intimacy and self disclosure reciprocity were investigated. The subjects used were 13 female and 12 male students at Old Dominion University. They were administered the Social Accessibility Scale to test for self disclosure intimacy, and the Edwards Personal Preference Scale to test need for dominance. Each subject took the self disclosure scale a second time to measure differences resulting from his or her reciprocating disclosure. Subjects were separated into two groups according to their tested need for dominance. The results of these measures were analyzed using a t-test to determine experimental effects. The results of this statistical analysis were not significant. One possible explanation for this finding is the low number of subjects.

RECOGNITION MEMORY FOR COMPLEX SPATIAL LOCATIONS. Timothy Place, Beth Stutzmann*, Tom Thompson, Cathy Hunt*, Heather Logan*, J. B. Thompson*, and D. G. Elmes, Dept. of Psychol., Washington and Lee Univ., Lexington, VA 24450. Subjects participated in a "spy school" game in which they played the role of a secret agent who was to report back to his or her government those cities of a fictional country that were to be bombed. There were two groups of special interest: The name and places group (N and P) first learned a list of names and a group of locations on a grid map. The names in places (N in P) group learned the same names and locations, but the names appeared in the locations. Prior to a recognition test, the subjects saw either a list or a map of a subset of the cities that were to be bombed. Targets were presented once, or they were presented twice under conditions of either massed or distributed practice. During original learning, the N and P group learned all the map locations faster than the N and P group. However during recognition of the target places, the N and P group did much better. Both city names and city locations were remembered better under massed than distributed practice.

LIFESTYLE AND RISKY BEHAVIOR: DIFFERENCES BETWEEN STUDENT LEADERS AND THE GENERAL STUDENT BODY. Bryan E. Porter, James. E. Healy*, & William F. Lawless*, Sponsor: Dr. E. Scott Geller, Dept. of Psychology, Virginia Tech, Blacksburg, VA 24061-0436. This study attempted to determine whether or not student leaders at a large southeast university differed from the general student body along certain dimensions of risky behavior, social support, and lifestyle. Leaders were hypothesized to have more positive social support structures, to engage in fewer risky behaviors, and to have a more conservative lifestyle. 109 Introductory Psychology students and 6 of the top student leaders representing organizations involved with student programming, governance, and Greek life participated. However, because the small sample size of the leader sample lends suspicion to any result, 14 of the Introductory pool were identified as leaders from a question in the questionnaire employed. These 14 and the original 6 were combined into a group termed "officers" and were compared with the remaining 95 students. The data were provided by a questionnaire containing selected items from established risky behavior and social support scales, plus two complete sub-scales of leadership behavior. After indentifying 9 factors through factor analyses, a MANOVA was performed which significantly showed that officers and non-officers indeed differed. However, after closer inspection of the factors, no differences existed in risky behavior and social support between the two groups. Officers, though, did show a more conservative lifestyle in that they scored lower on sensation seeking. Further, two factor scores for controlling others and leadership were higher for the officers.

ACQUISITION OF CONDITIONAL DISCRIMINATIONS IN THE RAT: ENTORHINAL VERSUS HIPPOCAMPAL FORMATION LESIONS. Matthew C. Pross, Dept. of Psych., Washington & Lee University (W & L), T. L. Davidson, Dept. of Psych. Va. Military Institute, Leonard E. Jarrard, Dept. of Psych., W & L, Lexington, VA, 24450. Rats with aspiration lesions of the hippocampal formation or ibotenate lesions of the entorhinal cortex were trained on two concurrent Pavlovian conditional discriminations. In both discriminations, a visual stimulus (a diffuse steady or a flashing light) signaled when an auditory stimulus (a tone or clicker) would be followed by food reinforcement. The discriminations differed in that one had a 5-sec trace period between light offset and auditory stimulus onset, whereas in the other the light preceded, overlapped, and coterminated with the auditory cue. Hence, the trace problem required the rat to remember the visual stimulus whereas the other problem did not. Headjerk performance of rats with hippocampal formation lesions did not differ from controls on either discrimination problem. However, rats with damage to entorhinal cortex were impaired on the trace problem relative to both control and hippocampal rats. These results suggest that (1) neither hippocampus or entorhinal cortex are necessary to solve Pavlovian conditional discriminations; (2) the entorhinal cortex may be involved in the retention of information over short intervals.

APPETITIVE PAVLOVIAN CONDITIONED INHIBITION IN THE RAT. Robert J. Robertson, Andrew B. Manson, Dept. of Psych., Washington & Lee University (W & L), T. L. Davidson, Dept. of Psych. Va. Military Institute, Leonard E. Jarrard, Dept. of Psych., W & L, Lexington, VA, 24450. Rats (N = 8) were trained to solve a Pavlovian discrimination problem of the form T2+, L1T2- in which an auditory stimulus (T2) was followed by food (+) when presented alone but not when presented in simultaneous compound with a diffuse light (L1). The rats were also given trials in which a different auditory stimulus (T1) was always presented alone and followed by food. Six presentations of each of these trials types were given on each of seven training days. The videotaped behavior of each rat during each trial was scored for incidence of headjerk (short, rapid movements of the head), which served as the index of learning. The rats solved the discrimination in that they headjerked more on T1+ and T2+ trials than on L1T2- trials. The conditioned inhibitory power of L1 was then assessed. Conditioned inhibition was indicated in that (1) L1 reduced headjerk to T1 when both were presented in simultaneous compound; (2) acquisition of headjerk to L1 was retarded relative to a novel light stimulus (L2) when each was made a signal for food. The results show that conditioned inhibition can be obtained with rats in appetitive Pavlovian conditioning.

ODOR AND COGNITIVE ALTERATION OF THE CONTINGENT NEGATIVE VARIATION. Melissa Roberts and Tyler S. Lorig, Department of Psychology, Washington and Lee University, Lexington, VA 24450. Amplitude of the contingent negative variation component of the EEG was assessed in 18 subjects exposed to several odor conditions. Three primary odors were used as well as a mixture of the primary odors. Subjects were led to believe that the odor mixture was actually three different odors which were low concentrations of each of the primary odors. CNV amplitude changed as a function of subjects' expectations about this mixed odor rather than the direct physiological effects of the odor stimulus. These results suggest that EEG changes to odors may be the result of cognitive mediation rather than direct CNS changes induced by the odors. And further indicate that interpretation of EEG findings in odor experiments is highly problematic.

EXTRAVERSION, CIRCADIAN RHYTHM, AND MENTAL ARITHMETIC EFFECTS ON CARDIOVASCULAR REACTIVITY. Patrick M. Ulmen, Dept. of Psychology, Old Dominion Univ., Norfolk VA. 23508, F. G. Freeman, Dept. of Psychology, Old Dominion Univ., Norfolk, VA. 23508. The purpose of this study was to examine the relationship between extraversion, circadian rhythms, and cardiovascular reactivity to a mental arithmetic task. Eight extraverts and eight introverts, as assessed using the Eysenck Personality Questionnaire, were asked to perform a moderately difficult mental arithmetic task at two different times of day: either at 8 AM or at 8 PM. In addition subjects were administered the Activation-Deactivation Adjective Check-list to assess their subject state of arousal. Following a 10 minute relaxation period, heart rate was monitored during a three minute baseline and during the two minutes of task performance. Analyses of variance were performed on the difference scores between baseline and task heart rate, on the activation check-list scores and on performance of the mental arithmetic task. Heart rate difference scores were found to be significantly greater for subjects run in the morning. In addition there was a strong trend for performance to be differentially affected by time of day and whether the subject was an introvert or extravert.

Statistics (No Abstracts Submitted)