5-23-1997

1997 - The Second Annual Symposium of Student Scholars

University System of Georgia

College of Science and Mathematics

Undergraduate Research Symposium

May 23, 1997

1997 Undergraduate Research Symposium
College of Science and Mathematics
Kennesaw State University

Program

10:00 a.m. SC Atrium	Welcome, Dr. Herbert Davis Dean, College of Science and Mathematics
	Address, Dr. Betty Siegel President, Kennesaw State University
	Presentation, Dorothy Zinsmeister and Ira Pegues Department of Biological and Physical Sciences
10:30 -12:00 SC Atrium	Students present posters

Organizing Committee:

Dr. Patricia H. Reggio, Chair
Dr. Lisa Adams
Dr. Catherine Beise
Dr. Virginia Rice

Kennesaw State University
College of Science and Mathematics
1997 Undergraduate Research Symposium
List of Posters

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OF CROWS AND "FAST" FOOD
FEEDING BEHAVIOR AND PROBLEM SOLVING IN THE AMERICAN COMMON CROW (*CORVUS BRACHYRYNCHOS*): DO CROWS EXHIBIT INSIGHT?

Debra G. Phillips and Robert C. Paul
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The purpose of this study was to determine whether wild crows would exhibit insight in problem-solving, how they would express any food preferences, and whether feeding vocalizations could be correlated with social behaviors. It was hypothesized that wild crows would: 1) not exhibit insight in problem solving to obtain food and 2) show a preference for easily obtained food over difficult to obtain food. Insight was defined as the ability to solve a novel problem without extensive previous exposure or pre-trial training. During the course of one summer and winter on the KSU campus, one family group of 2-4 wild crows was presented with different types of food. Foods were presented in increasing levels of difficulty: loose on the ground, in paper bags, in plastic bowls with lids, and in plastic boxes with hinged, 2-stage lids. The crows showed a preference for food that was easily obtained over food that was more difficult to obtain. They quickly discerned how to remove a lid from a plastic bowl, but it could not be determined whether this was trial-and-error learning, accidental learning, previous experience or insight learning. Results with the more complex box problem seem to indicate the exhibition of some insight.

MULTIPLE CHROMOSOME REARRANGEMENTS MIMIC DOWN SYNDROME

Tracey Cato, Cytogenetic Intern, Kennesaw State University, Kennesaw, GA 30144 USA
Dr. Kris May, Emory Genetics Laboratory, Decatur, GA 30030 USA

A peripheral blood sample was received at Emory Genetics Laboratory and Cytogenetic analysis was requisited on the sample. The doctor hypothesized that the patient had Downs Syndrome, because she showed clinical signs. Therefore, Downs Syndrome had to be ruled out. A small portion of the sample was combined with a complete media and cultured for 72 hours at 37° C. The specimen was then harvested, and analyzed. The analysis showed rearrangements between the #3 and #11 chromosome and the #2 and #7 chromosome. Also, there was an insertion of material from #2 into the #10 chromosome. We were uncertain of the breakpoints on the #2, because it appears that some information may have been deleted when inserted into the #10. As long as all of the translocations were balanced, then the patient should be phenotypically normal. In conclusion, we were able to rule out Downs Syndrome, but the question of a balanced translocation still exist. At the present, the parents' blood has been requested for analysis to determine if the same translocations exist in one of the parents.

GENETIC POLYMORPHISM IN METHIONINE SYNTHASE: A CONTRIBUTING FACTOR IN NEURAL TUBE DEFECTS

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This study was undertaken to look for mutations in the gene sequence for the enzyme methionine synthase. Methionine synthase is a critical enzyme in the process of neural tube development and plays a role in the prevention of birth defects such as Spina Bifida and Anencephaly. Forty-six samples of DNA from patients with neural tube defects were tested for mutations along the sequence which contained the binding site for B12. Specimens were processed in a series of critical steps for prevention of contamination and to insure quality control of results. These steps include the following:

- extraction of messenger RNA(mRNA) from human lymphocytes
- conversion of mRNA to complementary DNA (cDNA) using the enzyme reverse transcriptase
- amplification of cDNA using the polymerase chain reaction
- use of electrophoresis to determine accuracy of amplification process
- initial search for mutations using ABI Capillary Electrophoresis technology which detects conformational changes in the DNA structure (shape of the DNA molecule)
- DNA purification and ABI PRISM DNA sequencing to confirm mutations found from capillary electrophoresis process

A change in the conformation of the DNA was found by capillary electrophoresis in the sequence containing nucleotide base pairs from 3300 to 3490. This mutation was confirmed by sequencing which detected a change in the nucleotide at the specific point of 3364 base pairs. This mutation was determined to be a known mutation which occurs in the disease population. The degree of occurrence of this mutation can be an important factor which can be used to compare the diseased population to the normal or control groups. Future testing on this mutation as well as use of the above technology in the search for subsequent mutations for neural tube defects as well as other birth defects can be a very useful tool in the etiology and treatment for these disorders.

An Investigation of the Interactions of a Para-Methoxy-Benzylidene Indene with the Cannabinoid CB1 Receptor

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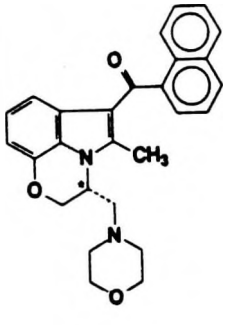
The aminoalkylindoles (AAIs) are agonists of the cannabinoid CB1 receptor. Solution NMR and crystal structure studies have revealed that the AAIs exist in two predominant conformations. In the S-cis conformation, the aroyl group is stacked over the indole ring. In the S-trans conformation, the aroyl group is rotated away from the indole ring. Z and E para-methoxybenzylidene indenes are rigid analogs of the AAIs which lack the carbonyl oxygen, but still mimic respectively the S-cis or S-trans conformations of the AAIs. The goal of the work presented here was to characterize (E) p-methoxybenzylidene indene in order to investigate possible interactions for this ligand at the CB1 receptor. The E isomer was chosen because recent experimental results for a similar indene have indicated that the E isomer has 52 fold higher CB1 affinity than the corresponding Z isomer (H.H. Seltzman, M.L. Roche, A.F. Gilliam, B.F. Thomas, R.G. Pertwee and P.H. Reggio, International Cannabinoid Research Society, Abstract 7, 1997).

The characterization of the (E) p-methoxybenzylidene indene was begun by optimizing its structure and then performing a complete conformational analysis (i.e. a Conformational Search) of the molecule using the semi-empirical method, AM1. 108 conformers were identified. An AAI Receptor Essential Volume (REV) Map calculated previously was then used to eliminate those E-indene conformers that were not shaped properly to bind to the CB1 receptor. The remaining conformers were considered accessible conformations at CB1. The lowest energy conformer from this set was taken as a representative structure for docking into a previously constructed computer model of the CB1 receptor transmembrane bundle. Docking studies revealed that the E-indene is able to interact with aromatic amino acids on Helices 3, 4 and 5. These interactions are hypothesized to contribute to the affinity of the E-indene for the CB1 receptor. [This work was supported by NIDA grant DA- 03934.]



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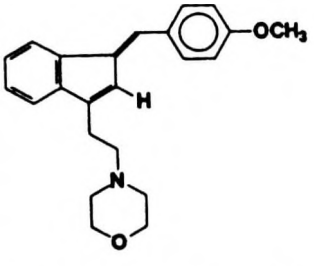

(E)-p-methoxy-benzylidene indene

DESIGNING A CALIBRATION MATRIX FOR HEAVILY OVERLAPPED SIGNALS FROM ELECTROCHEMICAL DATA

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The analysis of multicomponent systems using chemometrics approaches such as multivariate linear regression, factor analysis, partial least squares and other related techniques, require that the profiles (absorbances, voltammograms, etc) of the individual components be significantly different. This difference is lacking in profiles from electrochemical data, because by the nature of electrolytic techniques, the profiles of most electroactive substances are very similar: they are gaussian shaped. In this study, we have attempted to demonstrate that properly designed calibration matrices play a major role in obtaining easily analyzable data.

Two matrix designs (A and B) were formulated and tested using known compositions of test samples. The test samples contained Zn, Cr, and Ni, since the ultimate objective was to develop a method for analyzing Centrum tablets for these metals. The first design was chosen such that the concentrations of the calibration matrix were of a narrow range, around the actual concentrations of the test samples. The other design had the concentration ranges of the calibration matrix more expanded from the actual concentrations in the test samples. The goodness of the designs was evaluated by calculating the correlation coefficients of the calibration solutions. Predictions of the concentrations in the test samples were obtained using target factor analysis.

Despite the similarities of the Zn, Cr, Ni profiles, proper calibration matrix design leads to better predictions. The off-diagonal correlation coefficients of design A ranged from 0.57 to 0.99, while those of design B ranged from 0.47 to 0.94. Design A gave a prediction range of 68% - 106%, while design B gave a range of 97% - 105%, showing that design B was a greater improvement over design A.

PURIFICATION OF P-GLYCOPROTEIN FROM BOVINE ADRENAL GLANDS

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P-glycoprotein (PGP) is a 170-180 kDa transmembrane protein associated with multi-drug resistance (MDR) when overexpressed in cells. PGP seems to act as a non-specific transport protein utilizing ATP to export hydrophobic molecules, such as chemotherapeutic agents, out of cells. It has previously been shown by others that human and mouse PGP are expressed under normal conditions in many different tissues within these species, but in lower amounts than in MDR cells. The normal function of this protein is not yet known, although many ideas have been proposed. Purification of this protein from cell lines transfected with the MDR gene has been shown by other groups. The goal of our group is to determine if PGP is also present in bovine tissues and, if present, purify this protein. Using tissue obtained from adrenal glands (obtained from a local slaughterhouse), we separated the adrenal medulla from the cortex and used a combination of homogenization and centrifugation techniques, including a density gradient centrifugation, to obtain membrane fractions from both medullae and cortex. Samples were kept from various points in the procedure to determine amount of protein present and thus monitor the purification progress. Solubilization of the membrane proteins was achieved using the published methods of purification. Data obtained thus far will be reported. If the protein is identified, future studies will focus on purification techniques.

USING EXCITOTOXIC CELL DEATH AS A MEASURE OF *N*-METHYL-D-ASPARTATE RECEPTOR ACTIVITY

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N-Methyl-D-aspartate (NMDA) receptors are naturally occurring glutamate receptors found in the central nervous system. The over-activity of these receptors has been linked to cellular death. Since excessive glutamate is present during periods of ischemia such as stroke or seizure, this is a likely mechanism to account for the permanent cellular damage that is often seen following such episodes. It has been proposed that ischemic-induced acidosis may actually serve to protect cells from damage by either blocking NMDA receptor activation or by suppressing cellular metabolism. The change in activity of different subtypes of the NMDA receptor as a function of change in pH has been reported in literature and varies slightly for different subtypes of these receptors. In this study we wished to monitor the activity of these receptors in transfected HEK293 cells as extracellular pH was varied by using a routine lactate dehydrogenase (LDH) assay as a measure of % cell death. Cells were transfected using the routine $CaCl_2$ method with DNA for either 1A/2A or 1B/2A heteromeric receptors. Approximately 24 hours after transfection, cells were used in experiments. Cells were treated with a solution containing 200 μM glutamate and 60 μM glycine at various pH values (6.0 - 8.4) for a period of 30 minutes at 37 °C. This solution was replaced with standard media and cells were incubated at 37 °C for an additional 12 hours. Aliquots were removed and analyzed with the LDH assay. The % cell death in each well of cells was calculated. Our data shows a decreased % cell death at lower pH values in the range of 6.0 - 7.2. This is what would be expected with lower activity of the NMDA receptors at a more acidic pH. However, this data shows a slight decrease in % cell death as pH is changed from 7.2 to 7.7. This was not expected since NMDA receptors show an increase in activity in this pH range. More data need to be obtained, however, due to the high % error seen with this assay procedure.

PLANNING, DESIGN, AND IMPLEMENTATION OF A WEB SITE TO AID IN REMOTE ADMINISTRATION AND COORDINATION OF GROUP PROJECTS.

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Group projects are part of our everyday life. Projects at work and at school require a great deal of time and effort. A large percentage of students at Kennesaw State University are nontraditional students with jobs and families. For these students, it is difficult to coordinate group activities around work, class, and family responsibilities. The objective is to contribute to the success of team projects by providing a user-friendly web site which will communicate information to aid students in effectively completing a team project through electronic means. The web site will provide instructions on how to use the tools that aid in the coordination and administration of group activities remotely. The use of technology to complete group tasks is a vital skill that will be beneficial to any student of any major. The site contains group information, instructions, links, and downloadables for students to effectively complete a team project. The resources demonstrated are either a resource available in the Academic Computing Lab or can be obtained via the World Wide Web.

EXPLORATION OF EFFECTIVE WEB-BASED COMMUNICATION FOR STUDENTS ENGAGED IN TEAM PROJECTS FOR COMPUTER SCIENCE AND INFORMATION SYSTEMS COURSES AT KENNESAW STATE UNIVERSITY

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Numerous courses offered by KSU's Department of Computer Science and Information Systems require teamwork on student projects. Since many of the students taking these courses are non-traditional students, teams frequently encounter difficulty scheduling face-to-face meetings and exchanging information. Web-based communication may be used to support the goals of the student teams by allowing them to upload and download documents and graphical models, view each other's drafts, discuss and modify drafts, as well as allow review by and feedback from the instructor.

A survey was designed, administered to students enrolled in the CSIS courses mentioned above in Fall 1996, and responses were compiled to determine students' assessment of communication problems among team members. Although student response revealed that most students are more comfortable with and find face-to-face meetings more effective, Web-based communication is attractive to many students and instructors should encourage its use. Equipment to support Web-based communication is available to the CSIS Department. Software useful to faculty and students for Web-based communication was assessed and documented. Software evaluated include WebMagic, FrontPage, Photoshop, and NetMeeting. Research was conducted into student renting and/or leasing of computers from vendors in the Atlanta area, since student access to a computer away from campus is essential to success of Web-based team communication.

A PROJECT IN LINEAR PROGRAMMING TECHNIQUES: USING LINEAR PROGRAMMING TO SCHEDULE EMPLOYEE TRAINING WHEN A FIRM FACES DEMAND THAT CHANGES OVER TIME

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Linear Programming is a tool used for solving optimization problems. The Simplex Algorithm was developed to make the complex task of solving Linear programming problems more efficient. Since the development of the Simplex, many different industries have utilized the algorithm to solve their optimization problems. The following is an example of a company that wishes to minimize training costs of new employees; KSM is a chain of appliance service stores. Over the next five months, KSM will require skilled repair time that will vary from month to month (KSM and the above scenario are fictitious). Utilizing the big "M" method of the Simplex will be the appropriate method based on the structure of the constraints. Calculating this problem by hand turns out to be a tedious process mainly due to the high number of constraints. The optimal solution is difficult to interpret because the number of employees changes from an integer one month to a fraction during the next month. However, the solution provides valuable insight to the optimization problem at hand.