SCIENCE EDUCATION

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ABSTRACTS

What Can You Do with One Sheet of Paper? VINCENT A. DINOTO, JR., Jefferson Community College, Southwest Campus, Louisville, Kentucky 40272.——This paper will discuss two of the projects which I use with my introductory physics classes each year. Both of the projects use an 8.5 by 11 inch sheet of paper (memo weight). The first project is a paper structure contest. The student is given 8 inches of 'Scotch' tape along with the piece of paper to build the tallest free standing structure possible in one hour. The structure may *not* be taped down to the table top. Structures of over 197 cm have been constructed. The second project is a paper airplane contest. The students are given one sheet of paper and may use one staple or paper clip with the plane. The goal is for the student to design a plane which will have a maximum hang time and a long straight flight. Students in this project have had planes fly for 10 seconds and 20 meters. Why do these projects? Mainly to get the students to develop a experimenting nature by working on improvements of the projects at home before the contests. Yet the final project used in each contest must be built in the class.

Teaching Genetics to Gifted Junior High Girls. THOMAS A. FOGLE AND KARILEE WATSON, Department of Biology and Education, Saint Mary's College, Notre Dame, Indiana 46556.——The Paula program is a collection of summer enrichment courses designed to supplement the learning experience of girls who have scored in the top 3 to 5% in the Midwest Talent Search. The program stresses development of the higher cognitive and affective levels. Science courses, which emphasize inquiry and problem solving skills, can function to help foster achievement of these goals. Two inventories were designed (science interest and knowledge/conceptual understanding of genetics) and both were given before and after the one week (7 hours) course.

Much of the traditional genetics information taught to junior high and high school students focuses on Mendelian problems alone and thereby reinforces a false dichotomy between genes and the environment. To avoid this problem, tallness in humans (in addition to several other examples) was discussed prior to teaching Mendelism, to show that phenotypes derive from many genes that mutually interact within a complex environment. Discussion of Down's syndrome enabled students to learn about chromosome structure and the role of cell division in generating genetic defects without overwhelming them with the technical terminology of cytogenetics or meiosis. Preparation of a karyotype and the analysis of student fingerprints was used to reinforce learning of chromosome structure and population variation, respectively. Finally, a simplified overview of the molecular process of gene expression was given so that a round-table discussion of several articles on recombinant DNA technology would be meaningful. Because there is no easy or clear-cut solution to evaluating the societal costs versus

benefits to applying genetic technology, students found it exciting to venture their own philosophical view on a topic that was born with their generation.

Students' Conceptions of the Particulate Nature of Matter. DOROTHY L. GABEL AND K.V. SAMUEL. School of Education, Indiana University, Bloomington, Indiana 47405.——One of the fundamental premises on which chemistry is based is the particulate nature of matter or the Kinetic Molecular Theory. Although students are taught that matter is made up of moving particles very early in introductory chemistry courses, they do not appear to apply the theory when balancing chemical equations or solving mole and molarity problems.

In order to study students' perceptions of the particulate nature of matter, a 14 item Nature of Matter Inventory was devised. Each item consisted of a drawing in which matter was depicted on the molecular level. Students were asked to draw another picture using circles to represent atoms and molecules when the matter depicted underwent a chemical or a physical change. The instrument was administered to elementary education majors enrolled in an introductory science approximately 50% of whom had high school or college chemistry. Data analysis indicated that there were few differences in scores between those who had and those who did not have chemistry. Either chemistry courses do not include sufficient instruction in this area or students are unable to grasp the concepts is the conclusion drawn from the study.

Holography in the High School Classroom. UWE J. HANSEN, Department of Physics, Indiana State University, Terre Haute, Indiana 47809.——The Physics Department of Indiana State University currently is preparing 11 high school physics teachers to introduce holography into the high school classroom. The project is supported by the Indiana Commission for Higher Education with federal Title II funds. A series of three workshops which include training, in-service and curriculum implementation support, is conducted during the fall semester, spring semester and immediately after the end of school respectively. The philosophy of this effort is based on the idea that holography as a representation of contemporary science will bring an element of excitement to the hands-on laboratory as well as to the classroom. It is hoped that this approach will stimulate increased student science participation.

A Visually Dynamic Method to Investigate Enzyme Characteristics: Chymotryptic Digestion of Milk. E.J. HOLT AND R.R. HALL, Indiana University-Purdue University at Fort Wayne, Fort Wayne, Indiana 46805.——These laboratory procedures utilize the enzyme alpha-chymotrypsin to hydrolyze 0.5% powdered milk to a transparent, colorless solution. Progress of the reaction is monitored by placing the enzyme/substrate mixture in the cuvette of a colorimeter and simply observing the movement of the meter. Relative velocity of the enzyme is quantitated at 500nm by measuring the time to reduce the absorbance by half. The absorbance halving-time is constant; therefore, the student is allowed some freedom in timing the velocity of the reaction.

Students quantify 'worst-case' versus 'best-case' conditions by beginning with a mixture having a low concentration of enzyme, non-optimal pH, and low temperature. Students then change one parameter at a time, noting the corresponding change in relative velocity. The final mixture is extremely fast having a high concentration of enzyme, optimal pH, and high temperature. Results show the additive effects of these parameters.

Competitive and non-competitive inhibition are discriminated by checking for linearity of the absorption halving-time. Enzyme specificity is also demonstrated by this reaction. Chymotrysin, specific for aromatic residues, does not produce signifi-

cant amounts of free amino-acids from casein. In contrast, the enzyme carboxy-peptidase does produce free amino-acids. Using the ninhydrin test, students observe how the two enzymes act in concert to produce large quantities of free amino-acids.

Results from student laboratories are reproducible and expected trends in plotted data (time in sec.) are easily identified.

Science Instruction Designed to Help Young Children Understand the Nature of Change. SUSAN M. JOHNSON AND MILDRED T. BALLOU, Ball State University, Muncie, Indiana 47306.——An old maxim states that nothing in the world is constant except for change. Recent evidence, however, suggests that even change is changing—changing in the sense that it is accelerating at an unprecedented rate. Individuals are called upon to make physiological, psychological, technological, and even moral adaptations to rapid changes in the social milieu. But the documentation shows that many people are overwhelmed by the changes and suffer what has been termed "future shock."

There is a very real need for science educators to explore the role that sciencing can play in preparing students to adapt to change. Investigating patterns of change is inherent in science. Through science, students have the opportunity to sense the ubiquity of change in the natural world, as well as to experience a sense of control over some types of changes.

The authors used observations of changes over time as a major theme during an intensive science workshop for teachers of grades K-3 in the Fort Wayne Community Schools, sponsored by a grant from the Indiana Commission for Higher Education. The paper describes the rationale for dealing with change in primary grade children, the types of natural changes observed, the development of process skills in teachers, and the degree to which the teachers are implementing the ideas.

Science Career Options for Rural Environment Students. JANE BUTLER KAHLE, Department of Biological Sciences and Education, Purdue University, West Lafayette, Indiana 47907.——SCORES is a sustained intervention model program geared to remediate the lack of formal and informal participation in science by rural students.

The SCORES project includes teaching strategies to encourage girls to participate in the sciences. Laboratory activities, ideas for incorporating community and industrial resources into the biology classroom, as well as career option activities and information are provided.

Three schools have been identified as full intervention, limited intervention and control. Pilot studies were completed in high school biology classrooms during the 1984-85 school year. These studies confirmed the need to increase science options for rural youth, particularly girls. Data will be presented concerning high school student attitudes toward science and scientists; knowledge of careers in science and involvement in past, current and future scientific endeavors. The project will continue through December 1985, and results will be analyzed by April 1986.

The Preparation of a Vat Dye and Its Application to Cotton: An Experiment Suitable for the Introductory Chemistry Laboratory. WILSON B. LUTZ, Manchester College, North Manchester, Indiana 46962.——Indanthrene Brilliant Orange is a vat dye that can be readily prepared in the introductory chemistry laboratory. The dye is also easily "vatted" i.e. converted to a soluble form that allows the dye to be efficiently applied to cotton fibers.

The freshly dyed cloth is a greenish-black color in the vat. When the wet cloth is exposed to air, oxidation occurs and the dye is changed to its final orange or red form. The dye is of high quality, being very fast to light and resistant to washing.

The experiment illustrates: (1) the chemistry of amide formation, (2) the solubilization of a dye by reduction and its reconversion to the insoluble form by oxidation, (3) the great effect that the oxidation state of a molecule can have on its absorption of light, (4) the technique of centrifugation, and (5) the great ease with which cyclic systems can form in organic chemistry.

Chemical Education in the Peoples Republic of China. JOHN A. RICKETTS, Department of Chemistry, DePauw University, Greencastle, Indiana 46135.——At the invitation of the Chinese Association of Science and Technology and under the auspices of the Division of Chemical Education, Chinese Chemical Society, a group of seven American professors of chemistry met with their Chinese counterparts at the following universities, Beijing Normal University (Beijing, China), Shanxi Normal University (Xian, China), Sichuan University (Chengdu, China), and Yunnan Normal University (Kunming, China). During these exchanges the topics discussed included the curriculum, the training of chemistry teachers, teaching methods, establishing a high school-university interface for improving instruction at the secondary level and motivate students to consider chemistry as a career, etc. As a member of the group I will present my reflections concerning these exchanges.