

ABSTRACT SECTION

The Tower of Hanoi: Theme and Variations

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(Paul Jones, Teacher)

The Tower of Hanoi is a mathematical game consisting of n disks stacked on one of three pegs. The object is to move the stack to another peg. Only one disk can be moved at a time and a larger disk can never be placed on a smaller one. The formula for the number of moves is $2^n - 1$. Variation I is played with a stack of disks of two alternating colors. The stack of disks is separated, each color piled on a different post. The formula for the number of moves is $2^1 + 2^2 + \dots + 2^{n-1}$. Variation II is played with n stacks of disks and k disks on each stack. Each stack is moved to the next post. The formula using $k + 1$ is n ; $k + 2$ is $3n$; $k + 3$ is $5n + 1$; $k + 4$ is $7n + 4$; $k + 5$ is $9n + 8$. The coefficient of n will be $2k - 1$. I cannot predict the number added to n ($2k - 1$).

A Behavior Study of *Spermophilus tridecemlineatus*

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(Carmen Mace, Teacher)

In two similar populations of *Spermophilus tridecemlineatus*, one with (Plot A) and one without (Plot B) visual blocks, males occupied larger territories than did females, but both sexes occupied less territory as summer advanced. Agonistic behavior in Plot A lessened as summer progressed. When the population in Plot B was augmented, agonistic behavior increased and was greatest in areas of territory overlap. Squirrels in both pens subsisted mainly on insects and grasses. Grooming and sun bathing occurred frequently.

The Effects of Ultraviolet and X-Ray Radiation

on *Mus musculus*

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(Naomi Pedersen, Teacher)

Three groups of mice were used. One was exposed to x-rays, one to ultraviolet irradiation, and one was not irradiated. Doses were given at a steadily increasing rate. Small doses produced little or effect, but with increased dosage growth was impaired and the skin dulled. By the time of the final doses it was evident that the metabolic rates had been definitely slowed in the ultraviolet and x-ray groups as compared to the control.

Effect of an Antidiuretic Thiazide, Diazoxide, on Lipolysis in Isolated Rat Fat Cells

**ANDREW C. GIN, Senior, Northwest Classen School, Oklahoma City
(Betty Willsey, Teacher)**

Fat cells were prepared by a modified Rodbell technique from the epididymal fat pads of male rats (180-200 g) fasted over night, and incubated in a Krebs-Ringer bicarbonate buffer (pH 7.35) with 3% albumin for 1 hr after addition of the drugs. Free fatty acid (FFA) was determined by the Duncombe colorimetric method, and triglyceride concentrations were determined by the Van Handel - Zilversmit method. Both norepinephrine and diazoxide increase the release of FFA in isolated rat fat cells. The lipolytic action of diazoxide is essentially proportional to the concentration (5-500 $\mu\text{g/ml}$) of the drug. A combination of diazoxide (500 $\mu\text{g/ml}$) and norepinephrine (0.1 $\mu\text{g/ml}$) markedly potentiates lipolysis. A concentration of propranolol (0.5 $\mu\text{g/ml}$) is sufficient to totally block the lipolysis caused by norepinephrine (0.1 $\mu\text{g/ml}$) but is not capable of suppressing completely the lipolysis caused by diazoxide (500 $\mu\text{g/ml}$). These observations concur with those of Schultz in liver. Multiple biochemical actions of diazoxide may result from the direct inhibitory action of diazoxide on phosphodiesterase in liver and adipose tissue and be followed by homeostatic biochemical regulation in different systems. This conclusion is based upon the inability of propranolol (0.5 $\mu\text{g/ml}$) to inhibit lipolysis caused by diazoxide (500 $\mu\text{g/ml}$) as it had inhibited totally that by norepinephrine (0.1 $\mu\text{g/ml}$).

An Investigation of Liesegang Phenomena in Potassium Dichromate and Silver Nitrate

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(Kay Van Valkenburgh, Teacher)**

The Liesegang phenomenon is a form of periodic precipitation. When a drop of a saturated solution of silver nitrate is placed on a gel impregnated with potassium dichromate, the resulting precipitate forms in concentric rings. The purpose of this experiment was to investigate the effect of the concentration of the gel upon the formation of Liesegang rings, of temperature on rhythmic banding in a gelatin solution, of increased acidity of the gel, and the differences in Liesegang phenomena as the types of gel are varied. The conclusions generally indicated that, as a factor increased the size of the pores of the gel, the rings became further apart and more numerous. Factors that produced this effect are lowered concentration of the gel, higher temperatures, and increased acidity.

The Marmur Method of DNA Isolation

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(Mary Metscher, Teacher)**

The Marmur technique permits isolation of DNA from a heterogeneous group of microorganisms and involves lysis of cells with sodium lauryl sulfate, removal of cell debris and protein by denaturation and centrifugation, extraction of RNA with ribonuclease, and precipitation of DNA with

2-propanol. This relatively simple procedure was tried on *E. coli* culture and yielded high purity DNA. Approximately 50% recovery was realized in about 8 hr of work time.

Cardiovascular Effects of Arteriovenous Fistula on Systemic Circulation and Ventricular Function Curves in Dogs

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The purposes of this study were to report on the effects of arteriovenous (A-V) fistulas of different severities on systemic circulation, and to compare the effects of increases of cardiac output produced by A-V fistulas and by blood transfusion on the ventricular function curves. The increase in total cardiac output probably results from a simultaneous increase in venous return and decrease in total peripheral resistance. The heart is capable of performing a great deal of work without decreasing cardiac efficiency, and there is no depression in the left ventricular function curve during A-V fistula, even when stroke work more than doubles. Enhanced sympathoadrenal activity plays an important part in maintenance of the circulation in acute A-V fistula, since it not only improves ventricular function but also increases venous return.

Reduction of Detergent Concentration by Adsorption on Activated Charcoal and Clays

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Activated charcoal is efficient in lowering the concentration of detergent molecules by adsorption. Efficiency is increased when the charcoal is dispersed in sand. As the detergent concentration increases, the charcoal's efficiency decreases, but still allows bacterial treatment to destroy the remaining molecules. Clays, especially bentonite, are effective as adsorption agents. Bentonite, however, appears to be concentration-dependent until the maximum adsorption capacity of the system is reached, that is when one gram of bentonite will adsorb one gram of detergent, provided the detergent concentration is sufficient. Until this capacity is reached, equilibrium exists between the amount of detergent molecules adsorbed and those not adsorbed, depending on the original detergent concentration.

Computer-aided Engineering Design

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(Estaline Waters, Teacher)

The number of calculations required in many design problems is so great that often it is impossible to fully evaluate every detail of a design using manual techniques. Several programs were written to show ways

in which computers may be used to speed up computation and evaluation. A program was written which rapidly evaluates the design of a transistor bistable multivibrator, making the necessary computations. Although several problems were encountered, the program was successfully run on the G-15 computer at the University of Oklahoma and all design calculations and evaluations for each problem were completed in less than 2.5 min.

Photosynthesis of Amino Acids

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(Paul Jones, Teacher)

Four flasks, each containing 10% molybdenum trioxide, 5% paraformaldehyde, and 200 ml distilled water were prepared. These mixtures were subjected to different amounts of light for a 600-hr period. Two samples were placed 45 cm below a 500-watt electric light bulb, one was covered with black paper, and the fourth was kept in complete darkness. At the conclusion of the period a chromatographic analysis was made of each sample and compared to preliminary tests. Amino acids were photosynthesized in amounts varying with the amount of light each sample had received. These results support the hypothesis that paraformaldehyde fixes atmospheric nitrogen when in the presence of water and molybdenum trioxide.

Laboratory Simulation of Clear Air Turbulence

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(Bradley Brauser, Teacher)

Two laboratory approaches to studying clear air turbulence, a problem in aviation, were made. The first apparatus used was a tank containing three salt solutions of different densities separated by two easily removable partitions or baffles. A model plane was suspended in the center compartment containing a solution of intermediate density. The baffles between this and the other two compartments, one containing a less and the other a more dense solution, were then removed to observe the effect on the model. The method was not successful because of difficulties in measurement. Better results were obtained by suspending the model in a wind tunnel fitted with baffles which could be varied in position to provide degrees of turbulence.