ABSTRACT SECTION

Thermoelectric Cooling

PATRICK B. BRILEY, Senior Harding High School, Oklahoma City

(Karl M. Hasman, Teacher)

Thermoelectric refrigerating devices and the application of thermoelectric, Peltier, cooling theories were described.

n- and p-Type bismuth telluride semiconductors tinned with indium-tin solder were used in the construction of thermoelectric modules. Two refrigerators were constructed. A cascaded one, consisting of two thermoelectric modules and a water-cooled heat sink, were built to reach low temperatures near —60 C and another to operate near 32 C with a large cooling capacity for practical applications. Input and output parameters such as current and per cent ripple, voltage, cooling capacities, and temperature differences were determined by experimentation.

The disadvantages of cost and low efficiency in such cooling systems were shown to be offset by compact size, no moving parts, and accurate temperature control useful for electrical and biological experimentation.

Analysis of a Base Twelve Number System

DAVID R. BUCK, Senior, Donart High School, Stillwater

(James R. Earl, Teacher)

It is possible to get more depth in the analysis of our familiar decimal system by the study of another number system. I chose the duodecimal, or base twelve, system. The purpose of the study was to find which of the methods used in computation in base ten are universal to all systems and which are just special cases. Assuming commutative and associative principles to hold in the new base, I proceeded to prove that the principles of long multiplication and division and logarithms held. Even the method used for extracting square roots works for the base twelve. Many short-cuts, such as divisibility tests and "quicky" multiplications, involving the decimal or duodecimal point have to be revised for new bases.

Relationship Between Amino Acid Content and the Regenerative Properties of the Planarian, Dugesia dorotocephala

FRANK CARGILL, Junior, Drumright High School, Drumright

(Alma Friend, Teacher)

The amino acid content of four cut sections of planarias was determined by the one-dimensional ascending chromatographic method. The acid content was compared with that of similar sections allowed to regenerate at the normal rate. The order of growth rates from greatest to least was section one, section two, section four, and section three. The R_f values and the fluorescence of an ultraviolet light on the strips of paper indicated similar results. These results showed that the amino acid content is responsible for the regenerative properties of planarias, but did not explain the abnormalities of growth in the third sections.

Multicolor Observations of Variable Stars and a Program for Reduction of Data by Computer

JEAN CHRISTENSEN, GEORGIA WYKOFF, GERALD SMITH, ALAN MATHIS, and STEVE GLASSER,

Seniors, Enid High School, Enid

(Mary Evelyn Adams and Jim Smeltzer, Teachers)

Observations of variable stars were made and reduction of raw data effected by an IBM 1620 computer. The observations were taken with an 8-inch Tinsley Cassegrain reflector, using three-color photometry. Results from a recorder were then corrected for sky conditions and punched on cards for use by the computer. The use of the computer was needed, since it takes about one hour to complete the calculations by hand for each observation. Meaningful results were obtained only from many observations, and the computer aided immensely in producing the results.

Immunology

CAROL CREWS, Senior, Edison High School, Tulsa

(Naomi Pedersen, Teacher)

The experiments described show that if the blood of two animals is mingled together in the early embryo stage, they will later accept a skin graft from each other. The body's rejection of foreign matter is both good and bad. When we understand more about the lymphoid cells and their workings of accepting or rejecting foreign cells, we will more nearly understand the body's rejection or acceptance of foreign cells.

The Isolation of Chromosomes from Cancerous Cells

SUSAN CROW, Senior, Donart High School, Stillwater

(George W. Woodruff, Teacher)

Chromosomes in the metaphase stage from cancerous mouse fibroblast cells (L-M strain) grown *in vitro* were isolated using a technique first developed by Somers, Cole, and Hsu for the few and large chromosomes of the Chinese hamster. Since the L-strain is the oldest and most widely used strain of cancer cells in research today, it was important to determine whether the chromosomes of these more common cells could be isolated for further study. The cell membrane was broken by pressure, and all the cellular material was layered over increasing concentrations of sucrose to create a density gradient layering. This was followed by repeated centrifugations at slow speeds for extended periods of time. It was determined microscopically that the chromosomes were completely isolated, making further extensive study possible.

Investigation and Comparison of the Mobility of F-Centers Produced by Electrolytic Injection and those Produced By Irradiation with X-rays

MARADA DECKER, JR., Senior, U.S. Grant High School, Oklahoma City

(Bradley Brauser, Teacher)

Although literature is available on F-centers produced in crystals by additive coloration as compared to those produced by electrolytic injections, no references on similar comparisons with X-ray induced centers were found. Procedures for creating F-centers by injection and by X-ray bombardment were described and compared. No differences in the color or mobility of the variously produced F-centers were evident.

Calculus by Computer

BILL DEVIN, Senior, Edison High School, Tulsa

(A. R. Lutman, Teacher)

Computer programs were designed to allow the IBM 7094 computer to obtain functional solutions to problems of the calculus. The specific problem considered is that of obtaining indefinite integrals of certain functions. Its solution makes use of the MAD and WDL2 computing languages.

The Effects of Sleep Loss on Physical Capabilities

RAY HAND, JR., U.S. Grant High School, Oklahoma City

(Bradley Brauser, Teacher)

The effect of 70 hr. of acute sleep loss on six subject-paced general visual and motor capability tasks was to increase the possibility for impairment. Occasionally during the sleep-deprived period the subject was able to alert himself mentally as well as physically and perform on the baseline level. As the sleep-loss time increased, the frequency of bad test results nearly always increased. The data cannot be comprehensively interpreted without considering the time of day or diurnal cycle, but, when time of day and the wide fluctuation in test results are considered simultaneously, the sleep loss seems to be the greatest factor in possibility and frequency of bad performance.

Plasma Jet

MARK HANSEN, Senior, Donart High School, Stillwater

(George W. Woodruff, Teacher)

A plasma jet was constructed and tested. The plasma process was definitely carried out in the operation of the jet. The setup was operated at 48 v. During operation this fell to 25 v at 24 amp, which might be considered a minimum for operating a jet of this type. This was obtained by using a cerium oxide core carbon rod. A current to 100 amp is needed

to operate a solid carbon rod cathode. Spectrography showed that the light given off by the jet extended into the ultraviolet range. This supports the theory behind the plasma jet that the excitation is vigorous since it is most likely that this is the source of the ultraviolet light.

The Identification of Aerobic Bacteria of the Mouth

JANET G. HELLER, Senior, Donart High School, Stillwater

(Russell Martin, Teacher)

The causes of decay and diseases of the oral cavity are unknown. Support for two of the more popular theories, the Miller theory of dental decay involving *Lactobacillus,* and a theory pertaining to *Streptococcus* and *Staphylococcus* in relationship to pyorrhea was sought.

Isolation and identification of bacteria from four classifications of mouth conditions were made. Conditions were variable; poor, good, average, and diseased. The identification was made from the results of tests run on the bacteria. The tests included litmus milk, Gram staining, fermentation of three carbohydrates.

The results supported the Miller theory and the theory on pyorrhea, although, the same bacteria were found in opposite mouth conditions. This is explained by the individual body defense mechanism, buffering action of the saliva, and individual resistance of the patient.

Critical Temperature Alterations by Induced Hyperthyroidism in the Golden Hamster

DAVID H. HILLSHAFER, Senior, John Marshall High School, Oklahoma City

(Mart Woods, Teacher)

Concentrations of iodothyroglobulin (thyroxin) were injected into shaved male and female golden hamster in order to stimulate hyperthyroidism. With the addition of 10^{-3} g of thyroxin (per gram of body weight) the oxygen consumption was found to be significantly higher with a proportional decrease in the mammal's critical temperature. From this information, it is hypothesized that the thyroid gland exhibits a controlling influence in the regulation of a mammal's oxygen consumption and its metabolic functions.

The Concept of the Moton

JESS HOLLENBACK, Senior, Altus High School, Altus

(Maxine H. Lockhart, Teacher)

Efforts were made to show that the concept of a gravitational field is one of discontinuity and to extend the concept of a particle to the description of certain effects in the spatial continuum. Of prime importance in the development of this concept was the idea of three-dimensional points and curves in space. By utilizing the fact that Einstein's description of a gravitational field must be interpreted as representable by three-dimensional curves in space (no force acts in less than three dimensions), I was able to develop logically the concepts of "moton" and "enexesis."

Game Theory in Dual-Interest, Repeating Games Against Nature

KENNETH M. HOWELL, Senior, U.S. Grant High School, Oklahoma City

(Bradley Brauser, Teacher)

The study of dual-interest, repeating games against nature suggests the possibility of improving Game Theory by the use of knowledge of the opponent's previous strategies in playing the game. In games against nature, the probabilities for nature choosing each of the possible strategies open to her can be used to determine the expectation of each of the strategies open to the player. Once these expectations for each strategy are determined, it is necessary for the player merely to choose the strategy with the best expected payoff and use this every game. If nature's probabilities for picking her strategies are not known, her actions in previous games can be used for these probabilities.

The Effectiveness of Fungicides on Aspergillus flavus

DIRK HUTCHINSON, Senior, Enid High School, Enid

(Jim Smeltzer, Teacher)

Five fungicides, Phalatan, Captan, Difolate, TH214F, and TH265F, were tested at seven concentrations each: 50, 100, 150, 200 250, 300, and 350 ppm. Moisture, including fungus spores and fungicide, was added to peanuts to bring them to normal field condition. The percentage of peanuts contaminated was used as a measure of the effectiveness of the fungicides. The data indicates that Phalatan, used at a strength of 250 ppm, is most effective in destroying the mold *Aspergillus flavus*.

Aspects of the Dive Reflex

JIM KIMBALL, Sophomore, Harding High School, Oklahoma City

(Herberta Newton, Teacher)

The effects of water, temperature, and sex on the dive reflex in man were investigated. The amount of reaction varied with distraction. Temperature affected the amount of reaction. Males reacted more in cool than in warm water, whereas the opposite was true in females. The results were not conclusive, however, because of the small number of trials, but they did show a significant response to the stimuli tested.

Adhesion

KENNETH K. LANDIS, JR., Junior, Duncan High School, Duncan
(Marion N. Nottingham, Teacher)

For two substances to make intimate contact, according to the adsorption theory, the adhesive must have a lower surface tension than the adherend. Epoxy did not bond polyethylene because its surface tension is greater than that of polyethylene.

Hardened epoxy was bonded successfully with molten polyethylene because the surface tension of the latter is less than that of epoxy.

The Effects of Air Pressure on a Replacement-Type Chemical Reaction

LEONARD MAGNUSON, Senior, Alva High School, Alva

(Conrad Knox, Teacher)

Various metals and acids were reacted under controlled conditions. In all experiments tried pressure was inversely proportional to reaction time. By studying the results and certain facets of the experiments, it can be deduced that the main thing the air pressure affects is the surface area of the reaction. It can be concluded that air pressure affects many replacement-type reactions which produce a gas. It is possible that air pressure affects other types of chemical reactions and could conceivably be used as a catalyst.

Mutational Hemophilia in Oklahoma

DONNA K. OFFICER, Senior, Douglass High School, Oklahoma City

(Berry Hempstead, Teacher)

The National Hemophilia Foundation reports 65,000 hemophiliacs annually in the United States. Of these 32,500 victims report no hemophilic ancestry. The lack of hemophilic ancestry in some hemophilic families possibly indicates mutation. The purpose of this investigation was to detect mutation in humans by two methods. The indirect methods of Newcastle (1931), Boggs (1934), and De Lacey (1939) were applied to 57 hemophilic families from the Oklahoma Medical Center that came from various regions of the state. Fifty-four % were concluded to be mutations and 46% hereditary. Direct experimentation yielded no mutational hemophilic families, although one potential carrier investigated was concluded to be a carrier. This indicates that further investigation may be fruitful.

The Effects of Chloropromazine on the Learning of White Rats

JELORIA OWENS, Senior, Edison High School, Tulsa

(Naomi Pedersen, Teacher)

Chloropromazine, a synthetic, acts primarily on the hypothalamus which plays a part in mobilizing reactions to an emergency. Chloropromazine increases the amount of ATP, the primary source of energy for metabolic activity of brain cells. Chloropromazine, given to white rats in a controlled experiment to test intelligence, has a calming effect, inhibits new learning, and blocks the memory by placing a block between the environment and its influence on the mind. There is apparently no permanent loss of learning with the use of chloropromazine.

The Effects of Ethyl Alcohol Upon White Mice

PAMELA SUE PEARSON, Junior, Edison High School, Tulsa

(Naomi Pedersen, Teacher)

Two white mice were taught to run through a maze at approximately the same speed. One mouse, the experimental animal, was forced to drink solutions of alcohol instead of his water rations. As the daily alcohol intake was increased, the time required for solving the maze increased. At the end of the test, he preferred alcohol solution to water when offered a choice.

Isolation of Antihemophilic Globulin

RICKEY R. RAMOS, Senior, Midwest City High School, Midwest City

(Carmen Mace, Teacher)

An attempt was made to contrast two methods of isolating AHG, one of the blood factors responsible for the normal clotting of the blood. It was hoped that the AHG could have been injected into the bloodstream of the hemophilic individual and the amount of effectiveness the concentrate had on his AHG-poor blood determined. However, it was not possible to maintain complete sterility at all times, making it necessary to conduct the tests in a tube. Graphs of dilution curves were made, along with clotting plots, to compare the methods used.

The concentrate proved to be extremely effective in both cases. A normal clotting time was approximately 10 sec. The hemophiliac's clotting time was more than 20 sec. When the concentrate was mixed in a 1:1 ratio with his blood, it brought the clotting time to about 9 sec.

Second Year of Study of the Biological Effects of Alkyl Benzine Sulfonate on Bony Fishes (Osteichthyes)

EDWIN R. REAVIS, Sophomore, Miami High School, Miami

(Lois Q. Shipley, Teacher)

The effect of this chemical, present in synthetic detergents, was noted on the gills of various species of Osteichythes. In fishes that died, the gills suffered extensive damage to their mucous layers. Fishes that survived the concentration showed similar damage proportional to the concentration of ABS. A 3 mg/liter concentration proved fatal, a 2 mg/liter was tolerated by the majority of fish, and a 1 mg/liter produced no drastic results. Crappies, along with the usual gill destruction, showed unusual black spots on the gill filaments. However, it appears that the attack on the gill tissue is not only related to the ABS concentration, but also to the sensitivity of the individual fish.

A Quantitative and Qualitative Polarograph Chemical Analysis

LARRY RODGERS, Junior, Southeast High School, Oklahoma City

(Virgil Nichols, Teacher)

A polarograph accurate to a dilution of 0.0001 mole of test solution per liter of supporting electrolyte was constructed and tested.

Design and Construction of an Ultra-High-Speed Precision-Gated Binary Counter

JAMES R. SHELTON, Sophomore, Ardmore High School, Ardmore

(Estaline Waters, Teacher)

An ultra-high-speed binary counter with a precision gate was designed and constructed. This counter will read out the total count of events over any period controlled by the manual gate, read out the total count of events over the period controlled by the time base, and measure time intervals between successive events to 0.00001 sec. The counter will count these events over the range of 1 count in 10 minutes to over 1,000,000 counts per second with an accuracy of $\pm$ 1 count.

Dielectrophoresis of Dry Dielectric Particles

RONALD G. TATE, Senior, Donart High School, Stillwater

(Ronald Schnee, Teacher)

A study of dielectrophoresis, the behavior of neutral particles in a nonuniform electrical field, was made to determine whether or not particles of different materials could be separated by this effect. The particles did separate, their dielectric constants were related to their behavior, and the general relationship of behavior was the same at varied maximum field intensities.

Differential Thermal Analysis of Geological Specimens

C. DOUGLAS WALKER, Senior, Harding High School, Oklahoma City

(J. E. Schull, Teacher)

The differential thermal analysis of geological core samples may be obtained by heating the specimens in a steel chamber with a high-intensity furnace and plotting their temperature deflections against an inert substance as a function of the furnace temperature. The mineralogical composition may be determined by comparing this graph to the graph of reactions of relatively pure mineral specimens. The exothermic and endothermic reactions are identifying characteristics of this particular type of core specimen.