

SELECTED ABSTRACTS OF OTHER JUNIOR ACADEMY PAPERS

The Effects of Testosterone and Gonadotropin on Chicks

THOMAS AVERY, Donart High, Stillwater

The purpose of this project was to test hypotheses regarding the effects of testosterone and gonadotropin on female chicks. The hypothesis was that testosterone would cause male secondary sex characteristics to appear and cause a decrease in ovary size. The gonadotropin was expected to offset the inhibitory effect of the testosterone on the ovary. Many experiments have been made on the effects of testosterone alone, gonadotropin alone, and the effects of removal of the pituitary, site of the production of gonadotropin. There are no recorded results of experiments of the effects of the combination of the two hormones. This work could then have been valuable as a guide for other experiments of this type.

Data were collected on comb growth, change in body weight, and weight of ovaries in sacrificed animals. The results as regards the hypotheses tested were not conclusive. Certain departures from the literature indicate a need for additional basic investigation of the two hormones in question at various levels of treatment.

Isolation of Phosphatidyl Inositol

BOBBY BARTON, John Marshall High, Oklahoma City

Phospholipids, or phosphorus-containing lipids, have recently come to the forefront in the attentions of medical researchers. The isolation of one of these phospholipids, phosphatidyl inositol, was attempted by means of a procedure of solubility differentiation and extraction, and then by column chromatography on silicic acid. The results of the column fractionation yielded a pure sample of phosphatidyl serine and quantities of what may be phosphatidyl inositol. As yet, the presence of the latter substance is not certain, but work is continuing to extract the substance if it is present.

An Electrochemical "Nerve"

PATRICK BRILEY, Harding High, Oklahoma City

In this project an electrochemical model of a nerve was developed to illustrate with non-living material the membrane theory of nerve fibers. The model was an iron wire placed in strong nitric acid. An iron oxide which formed on the wire prevented any further reaction with the acid. When the oxide was removed, a reaction (electrochemical reduction) was set up and swept down the wire. The oxide on the wire was immediately restored after the reaction. This model illustrated the action potential, the threshold, the refractory period, and the membrane properties of a nerve fiber. When the wires were coated with collodion solutions impregnated with positive and negative ion-exchange resins, it was found that the coatings satisfactorily replaced the oxide film on the wire, reduced the refractory period, maintained the same potential values, and protected the wire from any visible reaction with the acid.

Aerodynamics of the Air Resistance of Shapes as Applied to Subsonic Rocket Flight

DAVID BROWN, Blackwell High, Blackwell

An experiment in two phases was conducted in an effort to determine the best shape to use in building a rocket for subsonic flight. A multiple purpose wind tunnel was designed and constructed for the tests. The intake tunnel, an elongated rectangular prism, was used to study the effect on a 3,300 FPM air stream of variously shaped wedges having congruent sagittal design fit snugly into the floor of the tunnel.

A battery of fifteen calibrated and connected manometers was used to study the pressure along the tunnel and over the surface of each model.

Model "nose cones" were then made having circular cross section but whose sagittal design was correlated to the wedges described above. These were suspended in the vertical exhaust of the device. The exhaust was restricted and collimated by a circular collar and developed a velocity of 8,020 FPM. Air resistance and stability were recorded and correlated to the data recorded from the first phase.

An inverted secant-15° cone-secant shape was apparently optimum in producing the least resistance and greatest degree of stability.

The Effects of Phenethyl Alcohol on the Life Cycle of Mammalian Cells

SUSAN CROW, Donart High, Stillwater

The purpose of this investigation was to study the effect of a blocking agent, phenethyl alcohol, on the DNA synthesis phase of a mammalian cell. A radioactive tracer, H³-thymidine, was used to label and detect the cells that were in the DNA synthesis phase. Concentrations of 0.0%, 0.05%, and 0.5% phenethyl alcohol were used to treat L cells that had been grown in suspension cultures. The percentage of cells in DNA synthesis decreased from 46% in the control to 27% in 0.05% and 4% in 0.5% phenethyl alcohol. This shows that phenethyl alcohol does act as an inhibitor or blocking agent in mammalian cells.

The Effects of Calcium Lignosulfonate on Young's Modulus of Cement

PAUL DERBY, Duncan High, Duncan

Dynamic and static calculations of Young's Modulus were made on cement cylinders to determine the effects of an additive, calcium lignosulfonate.

Dynamic values were determined from the fundamental transverse resonant frequency of the specimen. Static values were calculated by measuring the load applied by a compressive strength device, and simultaneously measuring the amount of longitudinal deformation of the sample.

Five different blends of cement were made, each doubling the amount

of additive. Length, diameter, cement to water ratio, and humidity of the surroundings were all kept constant in each sample.

Two of each specimen were selected to test. The static values were plotted, and no definite change in elasticity was noted. The dynamic values seemed to be greater than the static values by a factor of 2.7.

A Study in Predictive Psychotherapy

DAVID B. DIGGS, John Marshall High, Oklahoma City

In numerous studies, instigated by John C. Whitehorn, it has been shown that therapists can be classified according to their scores on but twenty-three items of the Strong Vocational Interest Inventory and that the resultant classifications can be correlated to the improvement rates of the therapist's patients. A therapist scoring high in the Lawyer and C.P.A. divisions (typed as an "A" therapist) apparently works most effectively with the schizophrenic patient. The therapist scoring high in the Mathematics-Physical Science Teachers and Printers divisions (typed as a "B" therapist) apparently works most effectively with the neurotic patient. Further studies by Robert C. Carson and David E. Kemp have been made concerning the attitudes of the patient toward the therapist and the therapist toward the patient.

These particular studies are important in that they suggest a possible matching of therapist to patient with resulting greater effectiveness and efficiency in treatment.

The Cybernetic and Inductional Analysis of the Fibonacci Sequence

KEN DILL, Putnam City High, Oklahoma City

Early in the thirteenth century, an Italian mathematician by the name of Leonardo Pisano, better known as Fibonacci, published a famous mathematical volume, *Liber Abaci*. Besides providing an early basis for arithmetic and algebra, a set of positive integers was included which has some very strange properties. In this set, every term is the sum of the two immediately preceding terms. The converse is also true.

In this report, several interesting properties of the Fibonacci numbers were defined and proved. Their first "n" cases were tested with the IBM 1620 computer.

Detection and Analysis of Mercury Vapor in the Air

MARTHA RUTH FEARON, Central High, Tulsa

Mercury vapor, a general protoplasmic poison which affects the human liver, kidneys, spleen, and central nervous system, occurs widely in human environments. It is found in hazardous quantities in dental offices, laboratories, and many industries. Air containing more than one milligram of mercury in ten cubic meters of air is injurious to health if breathed for long periods of time. Many existing methods of analysis for mercury vapor in air are either very expensive or lack sensitivity.

A simple, inexpensive method of mercury vapor detection and analysis was designed and tested. Preliminary tests indicate that the design is effective and may result in a more economical method of control, hence greater use of measures to prevent mercurial poisoning.

The Effects of the Electron Configuration of the Atom on the Magnetic Properties of Matter

ROBERT FRANKLIN, Donart High, Stillwater

The purpose of this research was to explain the magnetic properties of matter experimentally observed with conventional theory of electron behavior and atomic configuration. Two experiments were conducted: 1) an electron paramagnetic resonance absorption spectroscopy experiment to obtain a quantitative description of a paramagnetic electron in a magnetic field, 2) an experiment to give a qualitative description of the Hysteresis curve relation between the magnetizing force and the flux density of a ferromagnetic material. Theoretical explanations of these two effects, as well as the diamagnetic effect, were proposed.

An Electron Bombardment Ion Engine

BRUCE GADDIS, Central High, Tulsa

In this study an electron bombardment ion engine was constructed and tested for the purpose of studying some of the basic and applied principles for the operation of a positive ion space-borne accelerator.

The constructed accelerator was operated on helium, argon, and nitrogen. The following tests were performed with each gas: exhaust velocity determination, total beam current, current density saturation level, total beam power, engine thrust, kinetic energy per ion, and rate of acceleration. Helium produced the highest readings in most of the tests because a greater number of gas molecules were contained in a given unit than with nitrogen or argon.

It was felt that, if the author had used an equal molecular fuel flow rate for each of the gases, argon would have produced the highest readings, followed by nitrogen and helium. In the study it was found that ion beams composed of heavy particles are not space-charge limited to the same extent as ion beams composed of light particles. This would, then, indicate that it would be most desirable to use heavy particle ion beams for the propulsion of a space vehicle. If a light particle beam were used, the accelerator would have to be much larger in order to compensate for space-charge effects on the ion beam.

Ion propulsion provides a practical answer to the problem of propelling space vehicles on long interplanetary flights. More research may possibly lead to a functional and operational accelerator by the end of this decade.

Walleye Spawn in Canton Reservoir

DONALD S. GARVIN, JR., John Marshall High, Oklahoma City

Oklahoma lakes have been faced with the problem of overpopulation of many fish such as the sunfishes and rough fishes. Thus, to combat the problem of small prey fish, a new predator, the walleye, *Stizostedion vitreum vitreum*, was introduced into Oklahoma waters. This was done in the hope of reducing the number of rough fish and to provide Oklahoma anglers with another hard-fighting game fish such as the popular large-mouth bass, *Micropterus salmoides*.

Early in the spring of 1964, several reports were made to the rangers in the Canton area of small young-of-the-year walleye being taken by

minnow seiners both in the lake and in the river. This is the report of an investigation made by the Oklahoma Fishery Research Laboratory concerning the spawning of walleye in Canton Reservoir in which successful breeding was positively verified.

Utilization of Sugar by *Fusarium vasinfectum*

JO LYNN GREEN, Donart High, Stillwater

Fusarium vasinfectum has demonstrated an unusual tolerance for high concentrations of sucrose. This study was undertaken to determine whether this tolerance extended to other sugars and which of the test sugars would be a better carbon source. Five to fifteen flasks of Czapek's sucrose nitrate solution (pH 5.9) with uniform agar plugs and with varying concentrations of sucrose, glucose and fructose were inoculated and incubated.

Maximum growth was at 10% for glucose and fructose and at 3% for sucrose. Imperfect drying of the agar plugs as the concentrations of sugar increased prevented determination of a minimum, but there was no evidence of reverse osmosis even at 50%. An order of efficiency of the carbon sources was established: glucose > sucrose > fructose.

X-Ray Diffraction: Experimentation Versus ASTM

JAMES FRANKLIN HADDOCK, Central High, Tulsa

A duplication of Bragg's investigations on X-ray diffractions in gold revealed two rather striking discrepancies in the expected relationship between values for d and θ as computed by the equation, $n\lambda = 2d \sin \theta$, and values from the ASTM tables. One may be explained by the lack of sufficient sensitivity in the instrumentation used to record over normal background. The other, however, suggests that the pounding necessary to prepare a gold foil sample may dislocate crystalline structure, thus introducing error in this and similar work.

(Editors note: This young scientist checked his equipment thoroughly to find that the X-ray tube used contributed the error. This was reported by the author at the annual meeting after his paper had already been screened and selected for publication.)

The Effects of Radiation on Native Grass Seed Germination

MARK HANSEN, Donart High, Stillwater

The effect of cobalt radiation on native grass seed germination was investigated by the author. The results showed that the radiation effected the seeds quite radically with large drops and rises in seed germination percentage of all the varieties used.

A low in the mean germination percentage of the six varieties of seed used was reached at 15,000r of radiation. At levels higher than 15,000r, a rise in germination percentage up to 40,000r, which was the highest level tested, resulted.

The Effects of Radiation on the Growth of Bean Seeds

DIRK HUTCHINSON, Enid High, Enid

Eight groups of bean seeds with twenty-five selected seeds in each were exposed to a hospital X-ray machine. Dosages were from 0-1734r. The seeds were then planted and measurements of plant height were re-

corded for 60 days. Light, temperature, humidity, nutrients, and depth of planting were controlled. Growth was apparently stimulated in groups in which seeds received less than 700r and retarded higher levels of irradiation. 1734r did not prevent germination and growth.

Heart Rotation Evaluation Making Use of the Dilution Curve of an Isotope

MICHELE JUNGERY, Putnam City High, Oklahoma City

The electrocardiogram and X-ray give some general information about the rotation of the heart, but there is no method for the determination of the exact anatomical rotation. Such rotation drastically effects cardiac output and efficiency, hence is of interest in medical diagnosis. The radiocardiogram with its two dilution curves on recorded sides of the heart offers the possibility to evaluate the anatomical heart rotation. The purpose, then, of this paper is to evaluate the accuracy of this information by making use of the dilution curve of an injected isotope as recorded by surface counting. The experimental details were studied in models of dog and human hearts and *in vivo* in dog hearts. Treatment of the data indicates a close correlation between recordings from the dog heart model and from *in vivo* dog hearts as well as between those from the dog heart model and the human heart model.

Determination of Terrestrial Albedo

EDWARD WAYNE MERRY, Enid High, Enid

In determining the albedo (reflecting power) of the earth, it is necessary to use an indirect method consisting of a comparison of the light transmitted from the sun to the moon and thence reflected to the earth with that which travels from the sun to the earth, is reflected to the moon and is then returned to the earth again. By attaching a photometric apparatus to an astronomical telescope, readings of the different lights can be recorded. In my experiments the earth's albedo was found to be 0.37 which compares with 0.41 and 0.42 as found by the Smithsonian Institution.

The Effects on Tryptophan on Phenylketonuric Hamsters Receiving a Monoamine Oxidase Inhibitor, Marsilid

MARY LOU OSTER, Clinton High, Clinton

The purpose of this project was to determine the effects of tryptophan on phenylketonuric hamsters receiving a monoamine oxidase inhibitor, *Marsilid* (isopropylisonicotinyl hydrazine phosphate), and subsequently, to deduce permanent damage to the serotonin mechanism of the brain caused by the inducement. Five groups of two hamsters each were used and were given saline, *Marsilid* (150mg/kg), and tryptophan (500mg/kg). Both phenylketonuric and normal hamsters reacted with the same characteristics as human patients—hyperreflexia, clonus, drowsiness, loss of coordination, hyperactivity to hypoactivity. All reactions ceased within one hour, whereas in humans twenty-four hours are required for complete recovery. It is evident that the serotonin mechanism is not affected by the inducement of phenylketonuria. Therefore, the actual brain damage does not result from this mechanism's malfunction permanently, and further experimentation with active phenylketonurics should clarify the actual role of serotonin in phenylketonuria.

Six New Organic Semiconductors And Their Electronic Behavior

ELAINE POHL, Donart High, Stillwater

Eight organic semiconductors were synthesized, and a study of their electronic properties was made. These highly purified semiconductors have resistivities ranging from 10^2 — 10^4 ohm/cm. The properties investigated included resistivity in relation to temperature and light, and thermoelectric power. The thermoelectric power measurements showed a range from -250 — $+2,500$ and that the polymers were p-type and n-type.

The Effects of Detergents on Fish

EDWIN R. REAVIS, Miami High, Miami

The purpose of the study was to find the effects and related symptoms of detergent pollution on fish. Two main groups were used, those in liquid form and those in powdered form. The majority of the liquid detergents produced five major immediate effects resulting in the death of the fish in a comparatively short time. The powdered detergents killed the fish slowly and did damage while the fish apparently appeared to be normal. Through various tests the stomach was established as the major place of damage by the detergents. The experiment shows that detergents might be doing greater damage to the fish in our streams than has been comprehended.

A Chromatographic Comparison of the Normal *Drosophila melanogaster* with its Irradiated Counterpart

JUDITH DIANNE ROSE, John Marshall High, Oklahoma City

The purpose of this study was to learn more about the biochemical composition of *Drosophila melanogaster* and to detect any variations that may exist between the chromatograms of the normal *Drosophila* and the irradiated *Drosophila*.

Chromatography is a method of separating a sample into its components by making use of the varying solubilities of the components. In this study, paper chromatography was utilized. The tests failed to produce the desired results, because none of the solvent systems used in the tests brought about the resolution of the fly extracts.

Continued studies might or might not show that differences exist. If they do, the next problem would be to determine the biochemical changes which caused this difference by means of continued chromatographic studies and other qualitative and quantitative analytical tools.

The Vibrational Energy Imparted to Selected Gaseous Diatomic Molecules by Light Energy Quanta as Related to the Absorption Spectra of the Molecules

KENNETH MICHAEL STROUT, Central High, Tulsa

To investigate this topic, I based my calculations primarily on the absorption spectra of the gases used. In this way I was able to determine, in a qualitative manner, that the amount of vibrational energy or activity imparted to a diatomic molecule by a quantum of light is dependent upon the bond strength between the atoms in the molecule and is largely a function of the atomic mass unit ratio between the atoms in the molecule.

The Optical Activity of Solute 2-Methyl-1-Butanol in the Two Isomers of Pentanol

WALTER P. STUERMANN, Central High, Tulsa

The purpose of this project is the investigation of the effect which the two isomers of amyl alcohol have on the optical activity of another alcohol. This optically active alcohol is 2-methyl-1-butanol, and the measurements were taken at concentrations of one and two molar. The hypothesis that there exists a mathematical relationship between the specific rotation and some other quantity of the solution was tested. Results indicated that these following relationships may be true:

As the concentration of the solute is increased in these two isomers, the ratio of the sines of the specific rotation angles for the first vector approach the negative ratio of the index of refraction of the two isomers in the same order as a limit. As the concentration of the solute is decreased, the ratio of the sines of the specific rotation angles of the second vector approach the ratio of the index of refraction of the two isomers in the reverse order as a limit.

Photosynthesis of Amino Acids in Relation to the Origin of Life

CONNIE TILLMAN, Donart High, Stillwater

When a solution containing paraformaldehyde, ferric chloride, potassium nitrate and water was exposed to light, amino acids were formed. The substitution of formaldehyde for paraformaldehyde in the solutions increased the quantity of amino acids produced. The variation of the cation associated with the nitrate used had no effect. Omission of ferric chloride from the mixture reduced the yield of amino acids, but some amino acids were still formed. The amino acids were identified using ascending chromatography and proved to be primarily of the aliphatic type. These results verified the hypothesis that amino acids are formed when an elementary source of carbon, such as paraformaldehyde or formaldehyde, is put in solution with a nitrate and water and is exposed to a source of energy, such as sunlight or an ultraviolet lamp.

The Effects of Some Commercial Additives in 30W Lubrication Oil

STANLEY C. VESTAL, Central High, Tulsa

The purpose of this research was to test the validity of recent claims made concerning additives in crankcase lubricants. Three major brand additives were tested in two concentrations with three high quality commercial lubricants, with respect to flash and fire point, cloud and pour point, Saybolt viscosity index, Conradson carbon residue, and specific gravity. It was found that none of the additives substantially improved all qualities tested, but for some specific uses of the lubricants, the use of additives would be beneficial.

An Apparatus for Studying the Crystallization of Solutions Frozen on a Mercury Surface

DOUGLAS WALKER, Harding High, Oklahoma City

The crystallization patterns of ice are greatly affected by the nature of dissolved substances in the water and by the environment. The thought occurred that something approaching an ideal environment could be provided by a clean surface of mercury from which air was excluded. Since the molecules of mercury are in continuous random motion, they do not present any rigid lattice pattern that might influence the growth of ice crystals; and, since a surface of mercury offers little frictional resistance to moving particles, the forces of crystallization act unhindered.

A system was designed consisting of a small chest-type freezer in which is placed a shallow glass trough of mercury supported on a square copper block. This block stands on four cork feet and acts as a heat sink to stabilize the temperature of the mercury. Ideal environment and refrigeration is provided by carbon dioxide emitted from dry ice. Minute crystallization effects on all of the salt solutions tested were observed with a microscope.

The theory was verified that when all of the tested mixtures cool, crystals of either salt or ice will begin to form a specified temperature. Their growth during subsequent cooling changes the concentration by removing either salt or water from solution. When complete freezing occurs, and crystals of salt and ice form simultaneously, eutectic concentration then exists.