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of the

ALABAMA ACADEMY OF SCIENCE

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Advancement of Science

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The Impact of the United States Rubber Company Plant Upon Lee County, Alabama

Homer S. Fisher, Jr.*

Auburn University

In July 1962, the United States Rubber Company announced its decision to locate a tire manufacturing plant near Opelika, Alabama. The prospect of this large rubber plant locating in the area aroused speculation as to the impact its coming would have upon the community. What does happen when industry moves into a small town or county on a large scale? What is happening now in Lee County prior to the arrival of U. S. Rubber? How will the county be affected when the plant begins operations? What changes will occur over an extended period?

The answers to these questions may be obtained by examining changes in these primary factors: (1) employment levels; (2) construction volume; (3) wage rates; (4) population growth; (5) the extent of unionization; (6) land values; (7) wholesale and retail business conditions; and (8) social patterns. Various secondary factors will also be considered, but in less detail.

The results of an economic change in one community cannot be accurately predicted on the basis of the findings of case studies of other communities. Therefore, case studies have been used in this report only to indicate possible areas of impact and directions of change. Data for this paper have been obtained through interviews with various city and county officials, examination of municipal records, and review of local newspapers.

One basic difficulty in the study resulted from the need to predict future events. Accurate projections of wage rates, population figures, or related statistics have not been possible. Because of this limitation, the report presents only general observations as to the extent of the impact, not specific measurements.

THE IMMEDIATE IMPACT

The first noticeable influence of the new industry was on local land values. Prior to U. S. Rubber's decision to locate a plant in Lee County, the Opelika Industrial Development Board had ac-

*Appreciation is expressed to Dr. Ellsworth Steele and several other associates at Auburn University for the benefits of their reviews at various stages in the study, with the usual reservations of responsibility.

quired options to purchase 400 acres of land southeast of Opelika. After the company had agreed to locate in Opelika, the Board exercised most of these options and purchased 383 acres. This land, with the exception of the plant site¹, was sold to the rubber company. The original tract, not considered suitable for agricultural purposes, was purchased for \$100 per acre. At the time of the purchase this was considered a very good price. Since that time, however, speculation has prompted increases in land values throughout the surrounding area. Land adjacent to the plant site in early 1963 cannot be purchased for less than \$200 per acre. Indeed, many people will not sell at this price because of the general belief that additional industry will move into the area and further increase land values.

Plant and road construction are nearing completion. A Birmingham firm is erecting the plant itself, but local firms have become sub-contractors for much of the work. Several new roads are being constructed and existing roads are being repaired to make the plant more accessible to main highways. Central of Georgia Railroad is building a siding which will connect the plant with a main line of the railway. After the plant has been completed, Alabama Power Company will construct a substation and install nine miles of line, along with the required transformers, to meet the plant's requirements for electricity. The capital investment of the railroad and power companies will be subject to state and local taxes.

THE SHORT-TERM IMPACT

The short-term period, for purposes of this report, begins with the opening of the rubber plant and ends when either the plant facilities are expanded and additional employees are added, or when new industry moves into the county.

When the plant is completed, it will employ approximately 500 semi-skilled workers. This additional employment represents a three per cent increase in total county employment and a 12.5 per cent increase in county manufacturing employment.² The impact of this increase in employment is difficult to measure because the number of persons who will be hired from within the county is uncer-

¹ The Industrial Development Board will retain title to the plant and the ground on which the plant is erected. The building and this land will be leased to the rubber company.

² Statistics are calculated from Labor Market News: Lee County. Department of Industrial Relations. Alabama State Employment Service. February, 1962-63.

tain. Although the rubber company has indicated that it will hire as many local people as possible, the number of persons within the county who have the necessary qualifications is unknown. Actually, the number to be employed is more significant than their present location, for many workers hired from outside the county will eventually relocate within the county.

The employment multiplier theory suggests some of the results of the increase in employment. The employment multiplier concept refers to the tendency of a net increase in employment in one sector of the economy to increase income throughout the economy and, thus, stimulate additional increases in employment.³

The first substantial employment multiplier effect of the rubber plant will begin as soon as the new employees are paid. A large portion of the wages will be spent within the county. Local businesses will hire new employees to handle the resulting increases in sales. Thus, county employment will be increased above the original 500 employees required by the rubber plant. Sales will continue to multiply as the second and succeeding rounds of employment increases lead to greater income within the county.

County wage levels will probably rise after the plant has begun operations. The length of time before any change would occur and the extent of change are dependent upon several factors. Officials of U. S. Rubber have expressed a desire to pay wages comparable to those currently paid within the county to semi-skilled workers. However, wages paid in Lee County are below those paid to workers in the tire and tube section of the rubber industry. In 1962, semi-skilled to skilled workers in Lee County were paid an average of \$2.15 per hour, whereas tire and tube workers are currently receiving an average hourly wage of \$3.22⁴. Actually these figures understate the wage differential because the average wage for Lee County covered semi-skilled and skilled workers only, whereas the rate for the rubber workers included unskilled laborers.

If the local plant attempts to maintain the Lee County wage

³ What Happens When a Community Gains Manufacturing Jobs, Monthly Review. Federal Reserve Bank of Boston. March 1955. P. 2; and HILDEBRAND, GEORGE H. AND MACE, ARTHUR, The Employment Multiplier in an Expanding Industrial Market: Los Angeles County, 1940-47. Institute of Industrial Relations. Reprint No. 16. Los Angeles, University of California. 1950. P. 241, as reprinted from The Review of Economics and Statistics. XXXII. No. 3. August, 1950. Pp. 241-49.

⁴ United States Bureau of Labor Statistics. Monthly Labor Review. 86: - 222. February, 1963.

level after the workers are trained, the workers may consider their wages to be too far below the industry level and agitate for increases. Thus, management may be forced to pay wages in line with the industry. If the wages of the rubber workers do, in fact, rise above prevailing rates in the county, other firms employing semi-skilled workers may be pressured to increase their wages. Thus, the wage level of all industry within the county may be raised.

Wage rates will be significantly affected if the rubber plant becomes unionized. Although no manufacturing firm in Lee County is now organized, the final decision on this issue will be made by the employees. Since unionization is prevalent throughout the rubber industry, strong pressures to unionize the employees of the Lee County plant may be expected. If unionization leads to substantially higher wages for the rubber workers, dissatisfaction on the part of workers in other county industries could lead to their unionization.

U. S. Rubber is establishing outlets in the county for distribution of tires. As soon as production is begun, these outlets will be utilized in an effort to gain control of the local tire market. Intense competition will result as other tire manufacturers attempt to maintain their sales positions in the county.

Since many of the workers and executives of the plant will require housing facilities, a rise in the volume of housing construction may be expected as the plant nears completion. In fact, housing starts have increased steadily in Opelika since the announcement of the coming of the rubber company, and plans for several subdivisions are being made. If the number of workers moving into the county is large, apartment construction may also be increased.

THE LONG-TERM IMPACT

The discussion thus far has been concerned with factors that are being affected now and those that will be affected in the near future. Now, attention is focused on events that will occur after plant facilities have been expanded or new industry has moved into the county. The major long-run effects on the county will include: (1) further industrial development; (2) changes in agricultural employment; (3) population changes; (4) expansion and modernization of business districts; (5) social changes; and (6) increases in educational facilities.

The coming of U. S. Rubber to Opelika has received much publicity, locally and nationally. Included in this publicity have been statements concerning the method of financing and the desirability of

Opelika as a plant site for firms contemplating the construction of plants in the South. The Opelika Industrial Development Board is negotiating with several additional companies that may locate plants in the area. Thus, it is logical to expect that Lee County may develop into a substantial industrial center.

Agricultural employment in the county has been gradually decreasing as farm workers have moved into urban areas seeking better jobs. As the county becomes more industrialized, the decline in agricultural employment will be intensified. More industrial jobs requiring unskilled and semi-skilled labor will be available. Thus, employment opportunities for the relatively untrained farm workers will be increased, attracting these workers to the cities. However, the availability of industrial jobs within Lee County will reduce the number of agricultural workers moving out of the county to find other employment.

The county population will be affected only slightly immediately after the plant begins operations. Many of the 500 employees will be hired from outside the county proper. It is probable, however, that most of these workers and their families will move into the county; nevertheless, the resulting increase in population would not be great. Over the long run, however, the introduction of additional industry may lead to substantial population increases through the growth of industrial employment and subsequent increases in the number of retail employees, educational personnel, and professional people.

The population increases will result in the building of new stores and shopping centers, and a general expansion of business districts to meet higher consumer demand. Several new buildings are already under construction near the downtown business area of Opelika and other buildings are in the planning stage. As a direct result of the new industry and the expectation of further industrial development, the Opelika City Commission has authorized a five million dollar, ten year program for the purpose of modernizing the business area of Opelika and financing other urban renewal projects. The funds, provided primarily by the Federal Government under provisions of the Urban Renewal Act, will be used for a complete face-lifting of the downtown business district, the widening of city streets, construction of new parking areas, and beautification of residential areas.

As the population increases, the number of school children in the county will grow. Many classrooms in Lee County are crowded at present, and most schools have an insufficient number of teachers.

The coming of additional industry will aggravate these problems. As a result, the county will be forced to build additional schools and to hire more teachers.

Although the social impact will be gradual, numerous social changes will occur as the county becomes more industrialized. Industrial development within a county generally increases the number of middle-income group families. Thus, the standard of living for many persons within the county may be raised. The county may be faced with social problems stemming from inadequate recreational facilities and increased leisure time. As the county grows, many of the towns will have to direct more attention to city planning, prevention of adult and juvenile delinquency, and health and sanitation problems.

SUMMARY

Lee County will experience many changes as a result of the new industry. Some of these changes have already begun, others will come in the near future, and further changes will occur over a more extended period. The county will experience increases in land values, employment, construction volume, population, wage rates, and business volume. The decline in agricultural employment will be intensified.

These changes, in turn, will increase local economic and political problems. Unionization may spread throughout the county's manufacturing firms, bringing problems resulting from labor disputes. The need for city services will be increased. The county will need more policemen and firemen, as well as additional educational and medical facilities. Even though the standard of living will improve for many people, the need for programs to avoid welfare problems will grow.

Social changes will accompany the material changes. Towns within the county will become more cosmopolitan as new people and ideas flow into the communities. If the people vigorously resist new ideas and customs, the social order of the county will be disrupted. However, if the present inhabitants are able to assimilate the new people, ideas, and customs, the new rubber plant may result in the county's achieving a more complex cultural pattern.

A B S T R A C T S

Section II—Chemistry

Effect of Cholic Acid Derivatives on Pancreatic Lipase

Paul J. Fritz and Paul Melius
Auburn University

The role of cholic acid derivatives in the hydrolytic action of hog pancreatic lipase on glycerides has been investigated. The study was carried out using an enzyme preparation that was at least 80 times more concentrated than that obtained from fresh hog pancreas. Evidence is presented to show that the activating effect of the bile salts arises from the ability of these salts to split lipoprotein complexes. In particular, when lipase combines with a triglyceride a fast reaction occurs splitting off a fatty acid and leaving an enzyme-diglyceride complex which in the absence of bile salts undergoes further, slow hydrolysis to form monoglyceride.

In the presence of bile salts, the enzyme-diglyceride complex is split, freeing the enzyme for further reaction with a triglyceride by a fast reaction.

The Isomeric Forms of the Niobium(V)-oxy-tricupferron Complex

Jose Sanchez-Caldas and James E. Land
Auburn University

The niobium (V)-oxy-tricupferron complex when crystallized rapidly from absolute ethanol was noted to be a white crystalline compound. However, if the white compound so prepared is dissolved in chloroform or acetone and recrystallized or if it is recrystallized from ethanol by slow evaporation, a yellow colored product results. Using differences in the ultra-violet spectra of these substances it was postulated that the white and yellow colored isomers differ in regard to the position of a double bond in the organic ligand.

Relations Between Electronic Distribution and Auxin Activity in Analog of 3-Indoleacetic Acid

Karl Wiegand
Auburn University

Calculations of electronic distributions in substituted indoleacetic acids have been made by the LCAO-MO method using the Huckel approximation. It was possible to correlate the "Frontier electron densities" of several positions with biological activity. Such information should allow *a priori* prediction of biological activity in substituted indoleacetic acids.

Investigation of Phenylenthiazole Polymers for Heat-Resistant Fibers

Thomas B. Cole
Southern Research Institute

As a result of the work of C. S. Marvel and his co-workers, phenylenthiazole polymers appeared to hold promise for the production of textile fibers of high thermal and chemical stability. It remained to be shown that the phenylenthiazole polymers actually could be made into fibers and whether the fibers would have desirable properties. The work at Southern Research Institute was directed toward the formation of phenylenthiazole fibers having the desired qualities of strength and thermal stability.

Seven different phenylenthiazole polymers were prepared and their utility for making high-temperature fibers was appraised. The polymers were prepared by condensing *p*-bis(bromoacetyl) benzene with the following dithioamides: oxadithioamide, malonodithioamide, succinodithioamide, adipodithioamide, sebacodithioamide, terephthaldithioamide, and isophthaldithioamide. The polymers made from sebacodithioamide and from adipodithioamide had good fiber-forming properties. The other polymers studied did not have good fiber-forming properties because of their low molecular weights. Methods for increasing the molecular weights of the polymers were studied.

Fibers with high tenacity were spun from the polymer made from adipodithioamide by melt-, wet-, and dry-spinning methods. The properties of the fibers are discussed.

**Comparative Studies on the Sensitivity of Sarcoma 180
and Adenocarcinoma 755 in Cell Culture
to Certain Anticancer Agents**

Elizabeth A. Dulmage and G. J. Dixon
Southern Research Institute

Ca 755 is inhibited *in vivo* by the purine analogs, 6-mercaptopurine and 8-azaguanine, to a much greater extent than is Sa180. Azaserine markedly inhibits Sa180 *in vivo* but is completely inactive versus Ca755. In cell culture, 6-mercaptopurine and 8-azaguanine are of the order of 10 times more cytotoxic for Ca755 cells than for Sa180 cells. Azaserine is equally cytotoxic for both cell lines. Inhibition reversal studies were carried out using purines as reversal agents. Hypoxanthine completely reversed 6-mercaptopurine inhibition of both Sa180 and Ca755 cell cultures; adenine partially reversed the inhibition and xanthine and guanine were inactive. 8-Azaguanine inhibition of both cell lines was reversed by guanine and partially reversed by hypoxanthine; xanthine and adenine were essentially inactive. Hypoxanthine consistently reversed azaserine-inhibited cultures of Ca755 and Sa180, and adenine partially reversed the inhibition of both cell lines; xanthine and guanine were essentially ineffective. These data indicate that the different *in vivo* response of Ca755 and Sa180 to anticancer agents is due to a metabolic difference between the two tumor cells and not a host effect. The inability of xanthine to reverse the inhibitory action of these drugs supports previous evidence that mammalian cells exhibit a very low activity of the enzyme which promotes the reaction of xanthine with 5-phosphoribosyl-1-pyrophosphate.

**The Identification of Galactose and Lactose in Urine
by Electrophoresis**

Walter H. Johnson
University of Alabama Medical Center

A method has been perfected whereby a mixture of glucose, galactose, and lactose can be separated by means of yeast and zone electrophoresis in a borate buffer. Identification of the carbohydrates is accomplished by means of aniline-hydrogen-phthalate. This

method requires only a total of about six hours. Concentrations of galactose and lactose in the range of 5-100 gamma have been identified. There are possibilities that even lower concentrations can be picked up with refined techniques in careful hands. Glucose was removed to the extent that it did not interfere.

Studies on the Activity of Some Antiviral Drugs Utilizing the Agar Plate Assay Technique

Charlotte M. Maxwell and G. J. Dixon
Southern Research Institute

Several compounds were tested for antipolio activity utilizing a modification of the agar plate assay method formulated by Herrman, *et al.* This technique involves an application of the filter paper disc feature used in microbial assays. KB cell monolayers were grown in pyrex baking dishes on a standard cell culture medium for 48 hours. Following the infection of the cell cultures with Type 2 poliovirus, an agar overlay containing growth medium was applied. Filter paper discs impregnated with various concentrations of test agents were placed on the surface of the cooled agar. The dishes were incubated for a suitable length of time to allow for plaque development. After incubation, a second agar overlay containing stain was applied. Since only the living cells were stained, an evenly stained area around any disc denoted antiviral activity. These plaque-free zones were measured in mm, thereby setting a criterion for activity. Several compounds, which had been tested previously by the procedure of Rightsel, *et al.* involving the use of vinyl panels, were submitted to the agar plate procedure, and the results were compared. Among these were actidione, guanidine, and several crude antibiotics. In general, the compounds which were active in one system showed activity in the other system. Likewise, materials inactive in one system were inactive in the other system.

Section III—Geology and Anthropology

Early Archaic Burials in Stanfield-Worley Bluff Shelter

David L. DeJarnette
University of Alabama

The Stanfield-Worley Bluff Shelter is a stratified, multi-compound site in Colbert County, Alabama. It was excavated during the summer of 1961 by the University of Alabama as a field course in archaeology. The excavation was sponsored by the Archaeological Research Association of Alabama, a non-profit corporation organized to finance special key archaeological sites.

Four natural zones were discernible at the shelter. The first zone, containing Mississippian and Woodland materials, included the entire range of ceramic types known from the Tennessee Valley excavations. The other zones were pre-ceramic in age. The lowest occupational zone at the site contained a Dalton-Big Sandy I complex of projectile points and an assemblage of uniface tools. This level has been dated by the University of Michigan Memorial Phoenix Radiocarbon Laboratories as being $9,640 \pm 450$ years before present.

Three of the twelve burials found in the site were of special interest. They were found in the pre-ceramic level but above the earliest zone. All of these burials had in association a cache of projectile points similar to the Gypsum Cave variety. These points called Morrow Mountain in the Eastern United States also have been found stratigraphically in an early pre-ceramic phase in North Carolina. This is the first time that they have been found as intentional associations with burials.

A Progress Report of Archaeological Salvage Operations in the Walter F. George Basin

Edward B. Kurjack
University of Alabama

The Walter F. George Basin is located along the Chattahoochee River south of Phenix City, Alabama. The University of Alabama excavated four sites in the basin during the 1960 and 1961 seasons. This work was financed by a grant from the National Park Service.

Site 1Br 15, located near Eufaula, consisted of a pyramidal mound and the surrounding village site. Two major ceramic com-

plexes were present. (1) Deptford wares including *Cartersville Check Stamped* and the related types—*Dunlap Fabric Marked*, *Deptford Bold Check Stamped*, and *Deptford Linear Check Stamped*. Large tetrapodal supports are common among the sherds of this complex. (2) Pottery from the Lamar Period including *Ft. Walton Incised*, *Lake Jackson Plain*, and *Lamar Complicated Stamped*. The mound dates from this occupation.

Site 1Br 35, situated just south of Br 15, is a historic site occupied around 1750. *Ocmulgee Fields Incised*, *Kasita Red Filmed*, and *Chattahoochee Brushed* are the principal pottery types. Glass beads, wine and rum bottle fragments, gunflints, claypipe fragments, and miscellaneous metal fragments were also collected.

Site 1Br 37 is a multicomponent village area with an Ocmulgee Fields, Lamar, and Deptford occupation. This site is north of Br 15.

Site 1Ru 66 is found near Holy Trinity, Alabama. This site is close to Ru 101, the supposed remains of Fort Apalachicola. Ocmulgee Fields pottery and trade materials were recovered.

Historic Sites in North Alabama

Jewel C. Green
University of Alabama

Three sites in the Guntersville Basin were occupied during the Historic Period. Ethnohistorians have tentatively identified one of the sites, Ms^v32, the McKee Island Site, as the Tali town visited by De Soto. The specific tribal or linguistic affiliation of this town or of the other sites has not been determined. Trade goods at these sites show occupation extending into the Historic Period; however, Webb and Wilder concluded that the absence of certain European artifact types found on later southeastern sites would indicate that the Guntersville Basin components date from the early phase of contact with the traders.

The problem being considered is to discover by re-examination of the material the tribal connection of the McKee Island group and, consequently, of other historic towns in the basin. This re-examination would also yield a general date for the historic occupation in the area.

The investigation of the problem was accomplished in the following ways:

1. The cultural remains on McKee Island were compared

with material from sites representative of those tribes which may have lived in the area.

2. Trade materials were examined to determine the presence of datable items.

3. Ethnohistorical summaries were consulted to integrate the established historical and archaeological facts.

The Hickory Bend Site, 1Mt 100 (Montgomery County, Alabama)

John W. Cottier
Auburn University

The site is located in Range 20 East, Township 17 North and Section 34, on the Tallapoosa River. The exact extent of the site is unknown, but the area under cultivation provides an ample display of ceramic material. A surface pottery sample of some 500 sherds was used in the classification of the site. Pottery types *Swift Creek Complicated Stamped*, *Mercer Checked Stamped*, *Lake Jackson Plain*, *Lamar Bold Incised*, *Ocmulgee Field Incised*, *Chattahoochee Brushed*, and a possible new type of red filmed ware, *Tallapoosa Red Filmed*, composed the bulk of ceramic material. Using these pottery types as a criteria, the site was inhabited during at least two periods, with the most interesting feature of the site being that of the introduction of the pottery type *Tallapoosa Red Filmed*.

An Early Historic Site in the Logan-Martin Basin

L. Ross Morrell
University of Alabama

Preliminary excavation of Ta^v 107 was made by the University of Alabama and sponsored by the Alabama Power Company in the Logan-Martin Dam Reservoir. The site is situated on Ogletree Island in the Coosa River at the Mouth of the Chocolocco Creek.

Excavation consisted of one exploratory trench which revealed the clay floor of a rectangular house. A central clay-lined fire basin was present in the floor area.

The recovered material consisted of shell-tempered pottery, miscellaneous iron fragments, and one glass trade bead. Noteworthy is the fact that this trade bead is possibly the first excavated artifact of European manufacture that can be attributed to the DeSoto expedition. The bead is a Neuvo Cadiz twisted which dates *circa* 1550.

A Proto-historic Site in South Central Alabama

Tandy Bozeman and Wilburn Cockrell
University of Alabama

Advanced archaeology students at the University of Alabama carried out preliminary excavations at a burial urn site (Wx*1) on the Alabama River near Camden, Alabama.

This preliminary work is planned as the first stage of a systematic and professional exploration of what seems to be an unusually rich site.

Contributions in Anthropology at the Tenth Pacific Science Congress

Paul H. Nesbitt
Aerospace Studies Institute, Air University

More than 220 papers dealing with anthropology and the social sciences were presented in the Anthropology Section of the Tenth Pacific Congress which convened in Honolulu, Hawaii, from August 21 to September 6, 1961. The principal symposia dealt with geochronology, current research in Pacific Islands archaeology, research in Indonesian languages, human microevolution, social structure in the lowland Philippines, Ethnohistory in the Pacific, Migration and Pacific peoples, and induced cultural change in the Pacific. Discussions had two objectives: to advance theoretical concerns and to provide opportunities for exchange of information on specific cultural areas. There emerged from these discussions and deliberations a coordinated plan for undertaking archaeological surveys and excavations in the Pacific Islands and for publishing the results, for implementing the study of local traditional cultures, and for conducting long-range anthropological research in New Guinea and Melanesia.

The Post-Ripley Lacuna in Central Alabama

George F. Brockman, IV
University of Alabama

A lacuna between the Ripley and Prairie Bluff formations in Wilcox County, Alabama, is generally recognized in the literature. The evidences presented for this contention are: (1) an angular

relation between the beds in outcrop; (2) induration of the uppermost bed of the Ripley; (3) borings in the top of the sand filled with chalk; and (4) phosphate in the bottom of the chalk. These criteria are often cited in textbooks as classic symptoms of a stratigraphic break. On close examination, however, an alternative explanation is found.

The Ripley sand was deposited by longshore currents from the east, while chalky materials was precipitated, partly through organic action, from water sweeping inshore from great depths and over a broad, shallow shelf—rich in dissolved silica, carbonates, iron, and phosphate. Variations in carbonate content of the Ripley is seen as reflective upon changing balance between these current components, and the locally sharp lithologic break represents attainment of an equilibrium in which the longshore currents are eradicated. Induration of the uppermost Ripley sand bed is attributed to chemical reaction to a boundary condition, possibly an abrupt pH change, at the contact. Granting the contact, the borings are only natural, and have attracted attention only because of the high contrast, while those within each formation are more or less obscured by lack of contrast.

Angularity is found, both in the subsurface and at the surface, to be that of beds, not of formations, and establishes an original dip in the sand, not post-deposition tilting. The dip of the base of the Ripley is essentially parallel to that of the Prairie Bluff.

The Development of Small Stacked Harmonic Folds in Thin Layered Rocks

William Don Maples
University of Alabama

In some instances small stacked folds with double harmonic wave lengths can be observed in deformed thin-layered rocks in the crystalline area of Alabama. The folds form sinusoidal waves in which the upper sets have twice the wave length of the lower sets.

These folds, as previously described, have been referred to in the geologic literature as "crumpling" and their strikes have been measured and recorded as lineation.

The amplification and selectivity of wave lengths are discussed in this paper. The examples studied are in alternately banded late quartz schist. The bands are about 1 mm in width.

Ground-Water Resources of Bullock County, Alabama, a Reconnaissance Report

John C. Scott
U.S. Geological Survey

Bullock County occupies an area of 615 square miles in southeastern Alabama, in the northern part of the Coastal Plain province, and has a population of 13,462, according to the 1960 census. It is primarily rural, the only incorporated towns being Union Springs, the county seat, and Midway. The economy of the county is chiefly agricultural.

The county is divided physiographically into the Black Prairie, the Chunnennuggee Hills, and the flood plains. The terrain in the northern part of the county is flat to gently rolling and in the southern part is hilly and rugged.

Bullock County is underlain by sedimentary deposits of Cretaceous age, which rest on a basement complex of metamorphic and igneous rocks ranging in age from Precambrian to Triassic. The Cretaceous deposits consist of the Tuscaloosa Group undifferentiated, the Eutaw Formation, and the Selma Group, which comprises the Mooreville Chalk, the Blufftown Formation, the Demopolis Chalk, the Ripley Formation, and the Providence Sand. All but the Tuscaloosa Group crop out in Bullock County. The Clayton Formation, the basal formation of Tertiary age in Alabama, occurs as outliers capping hills in the southernmost part of the county. Alluvial deposits of Quaternary age occur along the larger streams in the county.

The chief sources of ground water in the county are aquifers in the Tuscaloosa Group, the Eutaw Formation, and the Ripley Formation. Small supplies of water for domestic and stock use also are obtained from the Blufftown Formation, the Providence Sand, and the alluvial deposits. The most productive aquifers in the county are those in the Tuscaloosa Group; yields of 500 gpm (gallons per minute) or more can probably be obtained from this group in most areas. Yields of 100 gpm or more can be obtained from the Eutaw and Ripley Formations in some parts of the county. Flows can be obtained from wells tapping the Ripley Formation in low-lying areas in the southwestern and southeastern parts of the county.

Ground water of good quality can be obtained in most sections of the county. Water from the Tuscaloosa Group is probably of

good quality throughout the county. Water from the Eutaw Formation is generally of good quality, but is moderately hard to hard in the northern part of the county and, near Mitchell, has a chloride content objectionable for some uses. Water from the Ripley Formation is moderately hard to hard and, in some areas, contains excessive amounts of iron, but is otherwise of good quality. Water from the Providence Sand is of good quality generally, but is reported to contain excessive amounts of iron in some areas.

Moderate to large quantities of ground water are available for future development in Bullock County. Moderate to large supplies can be obtained from the Tuscaloosa Group, and small to moderate supplies can be obtained from the Eutaw and Ripley Formations.

Roadbuilding Material in the Birmingham Area

John W. Jones

State Highway Department

Within recent years the depletion of known sources of road-building material, coupled with higher design standards and an increasing need for construction material, has almost doubled the demand for sand, sand-clay, chert, sand-gravel and quarryable stone in Alabama. Realizing this, the highway engineer has called upon the geologist to apply his science to materials location. This has resulted in a great deal of study on the road-building characteristics of most of the geologic formations found within the state. Therefore, it is believed that future research and exploration, based on geologic mapping and engineering experience, will enable us to keep abreast with the expanding demand for suitable construction materials.

The Potentialities of Kyanite in Alabama

Thomas A. Simpson

Geological Survey of Alabama

The undifferentiated Talladega Series or Wedowee Formation of Precambrian Age contain kyanite-bearing veins and mica schists associated with pegmatitic minerals. The veins and schists strike generally northeast and dip generally southeast. Crystals of kyanite have been collected from Cleburne, Randolph, Clay, Coosa, and Chilton Counties. The extent and nature of occurrence indi-

cates that substantial reserves of kyanite are probably available.

Experimental treatment of 6 to 9 per cent kyanite ore showed that beneficiation by classifiers and controlled tabling methods produced a 90 per cent concentrate. Additional beneficiation of the ore by flotation increased the concentrate yield to 95 per cent.

Kyanite has been used chiefly as a superduty refractory in the manufacture of mullite. Recently, domestic mullite producers have resorted to synthetic mullite production owing to the increased price demands of kyanite producers and a decrease in high-grade African sources of kyanite. With the increasing use of synthetic mullite in metallurgical refractories and a scarcity of massive domestic kyanite ores, it appears unlikely that kyanite will attain much favor in the refractory industry. However, as a result of improvements in technology, it has been possible to reduce the grade of ore for alumina plants. This decrease in grade and continued improvements in beneficiation methods should make the kyanite deposits in Alabama a valuable source of alumina.

Salt in Alabama

Thomas J. Joiner

Geological Survey of Alabama

Some of Alabama's greatest potential salt resources from salt domes are in the southwestern part of the state in an area representing the eastern limits of the Gulf Coast Salt Basin. This area is crossed by a vast network of navigable streams connected to tide waters, thus making the potential resource readily available throughout the southeast and nation. At present, the McIntosh salt dome is the only known piercement type dome in the state. The salt in this dome lies within 450 feet of the land surface and is being mined for the production of chlorine and caustic soda.

Several gravity minima occur in southwestern Alabama that possibly indicate the presence of other salt domes. These structures could be piercement type domes suitable for chemical exploitation or they could be deep-seated, non-piercement type domes such as those at Citronelle and South Carlton that serve as traps for the accumulation of oil and gas. These structures, if present, have a brine and petroleum potential and should be thoroughly explored for future development.

Additional geophysical and geological studies are needed that

will encourage test drilling and possible development of these resources. A program of this type is under way by the Geological Survey of Alabama.

Some Observations on the Low Flow of Streams as Related to Geology

Charles F. Hains and L. B. Peirce
U.S. Geological Survey

In Alabama, the low flow of streams is derived almost entirely from ground-water sources. Each type of geologic formation has certain physical properties that determine its ability to store and to transmit ground water to surface streams. Based on a recognition of these properties and a study of stream-flow records, various areas of the State are defined in which there is a general correlation between geology and the low flow of small to moderate-sized streams. Delineation of these areas on a map serves as a basis for useful inferences regarding the probable low-flow characteristics of ungaged streams. Such inferences, however, must be made with caution and verified by actual measurement, as frequent exceptions to the general correlation are noted. In general, these exceptional cases can be explained on geologic grounds.

Should Geologists Become Registered as Professionals?

Jack E. Morris
U.S. Pipe and Foundry Company

For the past few years geologists have been increasingly interested in a means of improving their status as professionals. Engineers, mining engineers, and foresters are registered as professionals in most states. This means that most men listed in the professional registry are competent and are men of integrity. In the geological profession this is not so, and many incompetent men pass themselves off as geologists. This harms the legitimate, professional geologist.

The geological profession needs to publicize its job. Many people do not know what a geologist is, or what he does. Naturally, there are diversified fields in geology, but publicity and education through the newspaper and television media would be of great help.

The purpose of this paper is to present a review of what pro-

gress is being made in the other states and to form a base for study of forms of registration and the qualifications necessary to police our profession.

A survey of 48 state geologists has been conducted. Forty-seven responses were received. The five questions asked and a summary of findings were:

1. Are geologists presently registered in your state?
Arizona and Nevada were the only two.
2. If yes, please state requirements for registration.
Arizona: Twenty-five years of age or older, good character and repute. Eight years of work satisfactory to the board. Up to 5 years approved schooling or teaching credited on the 8 years. Oral examination.
Nevada: Graduate from an approved course in geology of 4 years or more, 4 years or more of active experience in geological work, and proof that applicant is competent to be placed in charge of geological work. Written examination.
3. If no, please state what progress your state is making toward recognition and licensing of professional geologists.
Most states report little, if any, progress. Illinois was an exception.
4. Are geologists registered along with professional engineers?
Most states report that a mining engineer can be registered.
5. Do you think registration will give geologists recognition and standing equal to that of the professional engineer?
Twenty-seven states reported "yes"; eight states, "no"; seven states, "no opinion"; three states, "no need"; and two states had mixed opinions.

A Challenge to Geologists of the Future

Philip E. LaMoreaux
Geological Survey of Alabama

During the past generations of man there is a history of unsuccessful attempts by previous generations to solve the water problems controlling the very existence of civilization itself. There has been a series of catastrophies caused by peoples unable to control water flooding, water logging, concentration of chemicals in the soil, and declining water levels. Even though the amount of water on the earth has remained relatively stable over the entire period, man has been unable to cope with the many riddles

of meteorology, hydrology, geology, chemistry, and physics that would unlock the answers to these ever-present problems. As a result, civilizations have come and gone along the Euphrates, the Nile, in our ancient Southwest and other parts of the world, leaving barren unproductive lands as evidence of these failures.

During the past few generations there has developed the science of hydrogeology, and many important principles and ideas have developed which will contribute to our knowledge and help us solve water problems of the future. During this same period we have seen the geologists, chemists, engineers and other professionals "put their heads together" for the first time and jointly develop methods and solve problems. During this same period hydrologists were developing new principles and equipment to study surface water flow, storage and use, and at the same time meteorologists were learning more about how moisture forms, moves and discharges from the atmosphere.

As short a time as 15 years ago there were but a few hundred professionals employed in the field of Hydrology and our government spent less than a million dollars a year on ground water studies. There were only three universities giving a course in Ground Water and there was only one textbook in this field. Though the other coordinate and associated professions employed more manpower, spent more money on studies and had more textbooks, there was little coordination of effort between these disciplines to solve our water problems.

Now over 60 universities give one or more courses in Ground Water and there has recently been started at one university a program giving a Ph.D. degree in the field of Hydrology. There is, in general, more recognition of our water problems and more concern with regard to their solution and almost two thousand years after Christ's birth we finally are recognizing that this area of science needs critical attention for the preservation of man.

The Utley Coal Bed in the Western Warrior Field

Reynold Q. Shotts
University of Alabama

The Utley coal, on which a structure map was made by Sinclair Refining Company and others, may represent a group between the Gwin and the Brookwood groups as mapped by McCalley. McCalley evidently considered the thick, persistent sand-

stone which usually lies under the Utley bed to be the equivalent of the Razburg sandstone in the Coalburg basin, but he seems to map both the Thompson Mill and Gwin beds too far to the east in some areas for such a correlation.

Geology in Highway Engineering

Robert D. Palmore
Alabama Highway Department

Recent years have seen a great deal of emphasis on the application of geology to highway planning, design, location, and construction. The development of this relatively new field in engineering geology, however, has been somewhat hampered by a certain lack of communication between the geologist and highway engineer.

The geologist employed in highway engineering work should keep in mind that he is only as useful to the Roadbuilding Organization as the understandability of his written and oral reports. Therefore, it is believed, that the geologist should make every effort to present his reports in a simple, understandable manner. Much of the technical, geologic language can be alleviated. Engineering characteristics and properties of the area of investigation should be learned and entered, along with the pertinent geologic data, on drawings and illustrations in engineering form.

These efforts by the highway geologist, coupled with a little imagination and keen observation, will make this phase of engineering geology even more valuable to our present and future road building programs.

The Petrology of Some Lower Mississippian Carbonate Rocks of North Alabama

William Everett Smith
Geological Survey of Alabama

Outcrops of the upper part of the Fort Payne Chert, the Warsaw, and St. Louis Limestones were selected and studied with the aid of thin section and insoluble residue data. These stratigraphic horizons are predominantly clastic in nature and were formed chiefly by the accumulation of biochemically-precipitated calcite particles which are classed as: (1) recognizable fragments such as crinoid and bryozoan fragments; mollusk and ostracod

shell particles and foraminiferal tests; (2) carbonate skeletal fragments of unknown affinity; (3) oolites and superficial oolites; and (4) fragments which are the result of erosion of a penecontemporaneous, consolidated carbonate sediment. The principal insoluble residues of these units are detrital quartz, secondary quartz, glauconite, mica, pyrite, and clay-size material.

Evaluation of the data leads the writer to suggest that the St. Louis was deposited in a shallow, well-agitated sea; the Warsaw in a predominantly agitated sea; and the Fort Payne under conditions of slower deposition. On the basis of thin section and insoluble residue data, it is possible to differentiate these units.

Some Persistent Sandstones of the Western Warrior Coal Field

Reynold Q. Shotts
University of Alabama

Nothing has been published on the sandstones in the Western Warrior coal field except for old reports, usually on a county basis, that render correlation over a wide area quite difficult. Butts' Birmingham Folio (1910) names and maps certain sandstones that may be traced west of the Sequatchie anticline. Indeed, Butts maps a considerable area of Breman sandstone west of the anticline. This paper suggests certain beds that may be traced from the Coalburg basin "type area" and points out several other persistent, thick sandstones which are stratigraphically higher. Some accessible localities are mentioned and some stratigraphic relationships suggested.

Report on Strippable Coal in the Fabius Area, Jackson County, Alabama

Thomas W. Daniel, Jr.
Geological Survey of Alabama

Several investigations and explorations for coal have been made on Sand Mountain during the last one hundred years, but no detailed exploratory work had been done in the Fabius area. It is generally believed by technicians and landowners that the coal beds vary in thickness and are not continuous. It is also believed that the coal beds consist of more than one seam.

In December 1960, the North Alabama Mineral Development Company with the assistance of the Geological Survey of Alabama,

began an exploratory drilling program to determine whether the coal beds contained enough recoverable reserves for an economical stripping operation. Preliminary exploration was accomplished by rotary drilling followed by diamond-core drilling from which full sections of the cored coal were collected as a thickness check on the rotary drilling, and for analyses. Exploration required extremely close drilling and the coal was found to be irregular in places. However, comparison of the analyses of the samples from each hole showed them to be similar in quality. Succeeding holes were drilled on the basis of the geologic information obtained from the preceding holes. A structure contour map was constructed from data collected from each hole. The map was based on the elevation at the top of the coal and kept current as drilling progressed. Utilizing the structure map, the elevation of the top of the coal in each succeeding hole was estimated generally within several feet.

As the result of this test drilling program, it is concluded that (1) the coal occurs in one workable seam, (2) the seam is relatively uniform in thickness, and (3) the seam can be economically strip mined.

A Review of the Eocene Archaeocetes of Alabama

Douglas E. Jones
University of Alabama

The toothed whales, or "zeuglodons" of the Eocene of Alabama represent a complex phylogeny which is difficult to decipher due to scarcity of suitable study specimens. The relative abundance of the remains of large archaeocetes in the Upper Eocene strata of Alabama presents a puzzling problem concerning the pre-Upper Eocene ancestors of this group of marine mammals. The majority of archaeocete remains found in the United States has come from southwestern Alabama, principally from localities in Clarke, Choctaw, Escambia, Monroe, and Washington Counties.

A review of archaeocete literature reveals a current classification in which Alabama specimens are assigned to three genera, *Basilosaurus* (Basilosauridae), *Zygorhiza* (Dorudontidae), and *Pontogeneus* (Incertae Sedis). The basilosaurid archaeocetes represent the largest individuals of the group and the most common forms in the Eocene of Alabama.

The discovery and subsequent excavation in 1961 of an essen-

tially-complete specimen of a large archaeocete by the Department of Geology, University of Alabama, constitutes the first such institutional excavation in Alabama since the work of the U.S. National Museum in 1894-96. Preliminary study of these remains places the individual in the basilosauridae. The project is coordinated with the Alabama Museum of Natural History in an attempt to make available for study specimens of marine vertebrates for which Alabama is well known.

Section IX Medical Sciences

Techniques in Electrophysiological Studies of Taste

Kamal Yackzan
Alabama College

A new, simple electrode system for the recording of taste receptor activities by the chorda tympani has been devised. Instead of two separate electrode wire holders, as used by others, the new electrode system combines active electrodes and ground electrode in one holder, thus conserving valuable space and decreasing manipulation. The new wire electrode ensemble may be called the di, tri, or multielectrode holder. It was made of glass tubing drawn to near-capillary size. The capillary tubes were fused together. The number corresponded to the number of electrode wires needed. The diameters of the wires to be used was slightly smaller than the bore of the capillary in which it was inserted. Precise manipulation in various directions of the nerve and the electrodes holding it had been made possible by devising a new electrode manipulator. The advantage of this type of electrode system was the ability to use two of the wires to hold the nerve and one wire for grounding, thus making a push-pull electronic or differential amplification and recording possible. The single-ended method in use, with the nerve held to one electrode, led to one grid only of the preamplifier. The use of two electrodes for recording from the nerve eliminated action potentials of heart, respiratory, and other body muscle activities thus conserving those from taste receptor stimulation. This corresponded to common mode rejection. Another remarkable advantage was the ability to record simultaneously from the peripheral and central portions of the nerve, a

feat difficult to execute by the techniques used by others. Still another improvement to taste studies was the introduction of Rizzo's rat mouth prop or this writer's paper-clip mouth support. Either of these permitted the elimination of the flow chamber, as applied by Beidler, Pfaffmann, and others.

The Development of the Axial Muscles in the Cervical Region of the Rabbit

Raymond F. Gasser

University of Alabama Medical Center

A cervical region composed of seven segments is a characteristic of most mammals. The morphogenesis of the axial muscles in these segments has become increasingly important with recent reports indicating a non-myotomic origin for some of these muscles.

The cervical axial muscles of the rabbit were divided into dorsal and ventral groups which have been subdivided to follow their development. The myoblasts in the 11- and 12-day embryo were restricted to paired myotomes in each cervical segment. After the 13- to 15-day stages, these extended from segment to segment. The myotome region was split into three laminae which unite in a central region. Ventral to this were condensations of cells; few of which have the features of myoblasts. They were in a position medial and lateral to the ventral nerve rami and have ill-defined borders. The number of myoblasts increased considerably in the 16- to 20-day stages, and especially in these ventral regions. Definitive muscles appeared in discrete areas. While the three dorsal laminae arched in a dorso-medical manner to cover the spinal cord and vertebral column, the central regions remained relatively stationary. During the 20- to 27-day stages each of the axial muscles increased in size and assumed the appearance of mature striated muscle.

Development *in Vitro* of a Strain of Poliovirus Resistant to Guanidine

Sara M. Sellers and G. J. Dixon

Southern Research Institute

In a recent paper by Melnick, *et al.*, it was reported that strains of guanidine-resistant poliovirus mutants had been developed in

cell culture systems. The technique employed for this study is a modification of the method devised by Melnick. 1,000 and 10,000 CCID/50 dilutions of poliovirus were carried for five passages in the presence of minimal effective concentrations of guanidine hydrochloride. Like amounts of virus were carried in the absence of guanidine for five passages. KB cell monolayers grown in four-ounce prescription bottles was the cell culture system employed in these experiments. Increasing concentrations of guanidine from 20 (first passage) to 75 micro g/ml in the fifth passage were used. When the infected cells showed 100% cytopathogenic effect, the contents of each bottle were harvested and six ml of the virus preparation transferred to new cell cultures. The test and control materials harvested from each passage were titrated against three concentrations of guanidine. Virus grown in the presence of guanidine showed an increasing resistance to the compound, while the virus grown in the absence of guanidine was still sensitive to the drug. The guanidine-resistant strain in the presence of guanidine gave titers 2 to 2.5 logs higher than did the sensitive strain.

Synergism of Human Sera and Antiviral Agents *in Vitro*

Gussie Arnett and G. J. Dixon
Southern Research Institute

Specific antiserum has proved to be a useful adjunct to anti-bacterial chemotherapy, experimentally. Several investigators have reported chemotherapeutic and serotherapeutic synergy against viruses *in vitro* and *in vivo*. In this study, attempts were made to show such synergistic action of human serum with drugs which had previously shown antiviral activity in cell culture. The experiments were carried out in vinyl panels according to the method of Rightsel, *et al.* Sub-effective doses of type specific pooled human sera and antiviral drug were added to the virus-cell suspension in the panels. Viruses employed for this study included measlesvirus, Type II poliovirus (MEF₁), adenovirus III, herpes simplex, and parainfluenza 3 (HA-1). KB (Eagle) and H. Ep-2 cells were the cell culture systems used. Panels were incubated six days at 37° C and examined microscopically for virus cytopathogenicity. Readings were evaluated by means of a calculated numerical rate. A small measure of cell protection was noted in 25-30% of the materials studied, while 6% exhibited a moderate but reproducible synergistic action with the sera. The technique

used for these experiments could readily be incorporated into an antiviral screening program, either on an empirical or a directed basis.

Robert Archibald Lambert

Emmett B. Carmichael
University of Alabama Medical Center

Robert Archibald Lambert was born in Lamison, Alabama, on October 3, 1883. In September 1900 he entered Howard College, where all students over 15 years of age were in U.S. military uniform. Robert was a first lieutenant of Company A and was the valedictorian of his class when he received the B.A. degree on May 28, 1902. He continued on at Howard College and received the M.A. degree in 1903. After teaching a year at Anniston, he entered the freshman medical class at Tulane University on October 20, 1904. He received the M.D. degree on May 8, 1907, Tulane being a three-year school of medicine at that time.

After two years of postgraduate study at Johns Hopkins University, he joined the faculty of Columbia University as Assistant Pathologist in 1909. He was Associate Pathologist from 1911 to 1917, and was Acting Head of the Department of Pathology from 1917 to 1918. In 1916-1917 he joined the Rice scientific expedition to the Amazon region of Brazil and in 1919 he was Director of Laboratories for the Near East Relief Mission in Turkey and Syria.

During World War I he did research on war gasses in New Haven. No doubt this contact led to Dr. Lambert's accepting an Assistant Professorship in Pathology at Yale in 1919.

In 1923, he accepted the Professorship of Pathology and Anatomy, Faculdade de Medecin de Sao Paulo. After three years he was appointed Pathologist and Director of the Columbia School of Tropical Medicine, Puerto Rico, 1926-1928.

He joined the Rockefeller Foundation as Associate Director of Medical Science on September 12, 1928, and held that position until his retirement in 1948. With the Rockefeller Foundation, he handled fellowship awards and the regular program of grants.

He was a pioneer in the use of tissue culture methods to study the behavior of malignant tumors. His third paper was, "On the Question of Immunization Against Transplantable Cancer by Injection of an Animal's Own Tissues." He was an active investi-

gator and during the next ten years his bibliography contained 57 entries.

Tulane University conferred the LL.D. degree on Dr. Lambert in 1949. He was honored by being elected to office in several societies. He received the following awards: Decoration of Chevalier de la Legion D'Honneur; Methodist Hall of Fame in Philanthropy; Appointed as Academico Honorario, University of Salvador.

Dr. Lambert died on November 20, 1960, at his sister's home in Fairhope, Alabama.

Daniel Drake—A Pioneer Teacher-Physician

Emmett B. Carmichael

University of Alabama Medical Center

Daniel Drake was born on a farm near Plainsfield, N.J., on October 20, 1785. When he was about two and a half years old, his father moved the family to the wilds of Kentucky and they settled near Maysville. Young Daniel became interested in medicine by reading his cousin John's medical books. Daniel's father, Isaac, made arrangements with Dr. William Goforth of Cincinnati for Daniel to be his apprentice as a medical student. After four years of study, Dr. Goforth certified on August 1, 1805, that Daniel Drake was qualified to practice Physic, Surgery and Midwifery. It was the first medical diploma issued west of the Alleghenies. Daniel took a course of lectures at the University of Pennsylvania and returned to Cincinnati in April 1806.

After a year of practice in Kentucky, Daniel returned to Cincinnati to take charge of Dr. Goforth's office while he was on a trip to New Orleans. Daniel stayed in Cincinnati and soon enjoyed a large practice.

In 1817, Dr. Dudley invited Dr. Drake to join the medical faculty of Transylvania University, the first medical faculty west of the Alleghenies. Due to dissension in the faculty, he resigned at the end of the first year.

In 1819, Drake appeared before the General Assembly of Ohio and obtained a charter to establish the Cincinnati College (now University of Cincinnati) and a charter to incorporate the Medical College of Ohio, the second medical school west of the Alleghenies. Dr. Drake was president of the Medical College for two years but resigned due to faculty jealousies. So in 1823, Dr. Drake was offered his former chair at Transylvania, which he accepted. In 1825

he was elected Dean of the Medical College. After four years, he resigned in 1827 and returned to Cincinnati and founded *The Western Journal of the Medical and Physical Sciences*.

Again Dr. Drake gave up his practice to accept a teaching position. This time it was the chair of the Theory and Practice of Medicine, Jefferson Medical College in 1831. He was the first western physician to be called to a professorship in an eastern school. However, after one year he returned to Cincinnati.

In 1835, Dr. Drake was responsible for adding the medical department in the Cincinnati College. Dr. Drake was elected Dean but in 1839, after two professors resigned and others indicated that they were going to resign, the Board of Trustees declared that all the chairs were vacant. Soon after this event, Dr. Drake was elected to the newly created chair of Clinical Medicine and Pathological Anatomy at the Louisville Medical Institute. Dr. Drake continued as professor for the next ten years but on learning that conditions at the Medical College of Ohio had become critical, he agreed to return to the college. The 1849 session had barely begun when faculty squabbles disillusioned him, and he resigned at the close of the session. Dr. Drake re-entered the faculty at Louisville and taught two sessions. In the meantime, many faculty changes had been made in the Medical College of Ohio and in 1852, Dr. Drake for the fourth time accepted a professorship in the college.

Dr. Drake attended the second annual meeting of the Kentucky State Medical Society in late October 1852 where he was elected the first honorary member. He contracted a cold on the trip and complications resulted in his death on November 5, 1852.

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The Near-Ultraviolet Absorption Spectra of Some Alpha-Monosubstituted Toluenes*

E. L. Greve, James L. Kassner, and Dean Calloway
University of Alabama

INTRODUCTION

This research was undertaken to obtain the near-ultraviolet absorption spectra of a series of alpha-substituted toluenes, to identify the position of the O - O bands, and to interpret these positions with respect to the calculated O - O band of benzene in terms of mass, resonance, inductive, and hyperconjugation effects on their electronic absorption spectra.

MATERIALS AND EQUIPMENT

The basic equipment and experimental procedure were essentially the same as described by Mountcastle (4). Tracings of the absorption spectra were made with a Leeds and Northrup microdensitometer, Model 6700P.** The spectra of the Pfund-type iron arc previously placed on the film were used as the wavelength standard.

The compounds were either National Bureau of Standards or Eastman white label grade. Those with unacceptable physical constants were distilled with a Podbielniak No. 3300 Microanalyzer equipped with a two-foot column. The values for the physical constants of the compounds are listed in Table I.

EXPERIMENTAL RESULTS AND DISCUSSION

Reproductions of the microdensitometer tracings for the compounds studied are shown in Figure I. The dotted line indicates the absorption "blank" are background. The assigned band positions and relative intensities are listed in Table II. The relative intensities were determined by visual comparison of the bands within each spectrum. No comparisons were made between the different spectra since different experimental conditions were used to obtain the optimum spectrum for each compound. All the spectra, except those of benzene and toluene, were diffuse.

*This research was supported by the Office of the Ordnance Research Contract No. DA-01-009-ORD-300 and the University Research Committee, University of Alabama.

**The films were scanned and recorded by Mr. Ellis Creitz of the United States Bureau of Mines.

TABLE 1. PHYSICAL CONSTANTS OF COMPOUNDS AND TEMPERATURES AT WHICH THE SPECTRA WERE OBTAINED

Compound	Physical Constants			Spectrum Temp. °C
	Temp. °C	ⁿ D	Density g./ml.	
Benzene	25.0	1.4982	0.8733	-80.0
Toluene	25.0	1.4940	0.8602	-23.0
Ethylbenzene	25.0	1.4933	0.8624	0.0
n-Propylbenzene	20.0	1.4922	0.8623	0.0
Benzyl chloride	20.0	1.5390	1.1004	15.0
Benzyl cyanide	20.0	1.5230	1.0163	50.0
Benzyl alcohol	20.0	1.5401	1.0456	55.0
Benzyl acetate	20.0	1.5022	1.0558	65.0
Benzylamine	25.0	1.5413		50.0
	b.p. 122.8°/115 mm.			
Benzyl methyl ether	25.0	1.4988	0.9594	20.0
Beta-Phenylethyl alcohol	20.0	1.5322	1.0203	75.0

The assigned band positions as determined in this work agreed well with the previous work for benzene (5), toluene (1), and benzyl chloride (2). Benzene was used primarily as a standard to evaluate the procedure and quality of measurement. The spectra of toluene were obtained since it was the parent compound of the series.

Benzene, due to its symmetry, has no O - O band in the near-ultraviolet vapor-phase absorption spectrum. This forbidden band has been calculated to be 38089 cm^{-1} (6). The symmetry of the benzene molecule is distorted by a substituent on the ring, thus an electron transfer occurs from the O-level of the ground state to the O-level of the excited state, hence the O - O band. This distortion, because of the interaction of mass, resonance, hyperconjugation, and inductive effects, causes a shift of the O - O band and other changes in the over-all spectrum of the compound. The O - O bands for the compounds studied were found to shift toward the red with respect to the forbidden O - O band of benzene. This shift, according to Matsen (3) and Hamner (2), is due to migration of electrons into or out of the ring and the degree of the migration determines the extent of the shift. The shifts are tabulated in Table III and have been interpreted qualitatively as in the following examples. The O - O band of each compound is indicated by "A" on its tracing in Figure I.

The greater mass and electron-releasing-inductive effect of the side chain in ethylbenzene and in n-propylbenzene compared to the mass and inductive effect of the methyl group of toluene would sug-

gest that the first two compounds should have O - O bands shifted further to the red than the O - O band of toluene. However, the mass shifts are small as compared to the other effects. The greater shift, Table III, found for toluene, 630 cm^{-1} , over that for ethylbenzene, 590 cm^{-1} , and n-propylbenzene, 590 cm^{-1} , is because of much greater hyperconjugation contribution of the three C-H bonds of the methyl group than of the two C-H bonds of the ethyl and propyl groups. The O - O band shift for beta-phenylethyl alcohol, 520 cm^{-1} , is somewhat less than that for ethylbenzene, although the mass and hyperconjugation effects should be similar in the two compounds. However, the electron-withdrawing inductive effect of the oxygen on the beta carbon weakens the electron-releasing inductive effect of the $-\text{CH}_2$ group and the net result is a O - O band shift less than that for benzyl alcohol or ethylbenzene.

The hyperconjugation effect of the C-H groups in benzyl chloride and benzyl cyanide will be less than that for the three C-H bonds for toluene. Because of this and the small mass effects, the red shift could be expected to be less than that of toluene. However, the chlorine atom in benzyl chloride, 980 cm^{-1} , and the nitrogen atom in benzyl cyanide, 970 cm^{-1} , are strongly electron-attracting. The strong electron-withdrawing-inductive effects of these ions are much greater than the hyperconjugation effect of the two C-H bonds and produced a strong migration of electrons away from the ring, and hence produced a large shift to the red. The additional resonance forms of benzyl cyanide stabilize this molecule at a lower energy level, so the O - O band shift is not as great as may be expected from the polar nature of the $-\text{CN}$ group. The O - O band shift for benzylamine, 690 cm^{-1} , is much less than that for benzyl cyanide, since the nitrogen atom of the $-\text{NH}_2$ group has much less electron-withdrawing-inductive power due to the two hydrogens than the nitrogen atom in the $-\text{CN}$ group.

The oxygen of the $-\text{OH}$ group in benzyl alcohol, O - O band shift of 800 cm^{-1} , has strong electron-withdrawing characteristics, although not as great as the chloride ion. Thus, the red shift is less than that for benzyl chloride. For benzyl acetate, 750 cm^{-1} , the strong electron-withdrawing-inductive effects of the oxygen attached to the alpha-carbon and the oxygen on the carbonyl carbon are opposed by the hyperconjugation effect and the electron-releasing-inductive effect of the $-\text{CH}_3$ group. Thus, the O - O band shift is less than that for benzyl alcohol. Likewise the electron-withdrawing-inductive effect of the ether-oxygen in benzyl methyl ether is less than that of the $-\text{OH}$ group in benzyl alcohol because of the

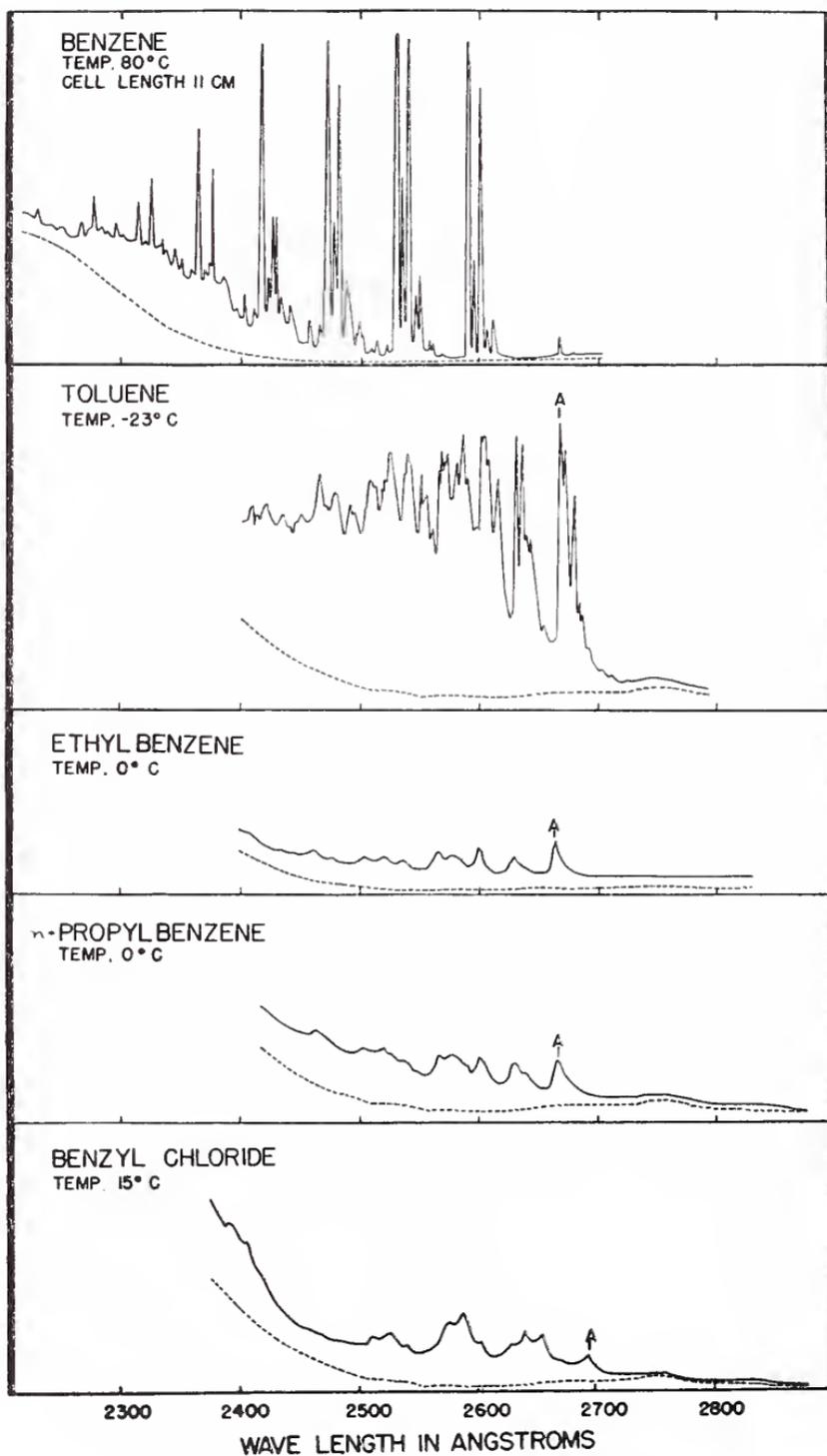


FIG. 1. The near ultraviolet absorption spectra.

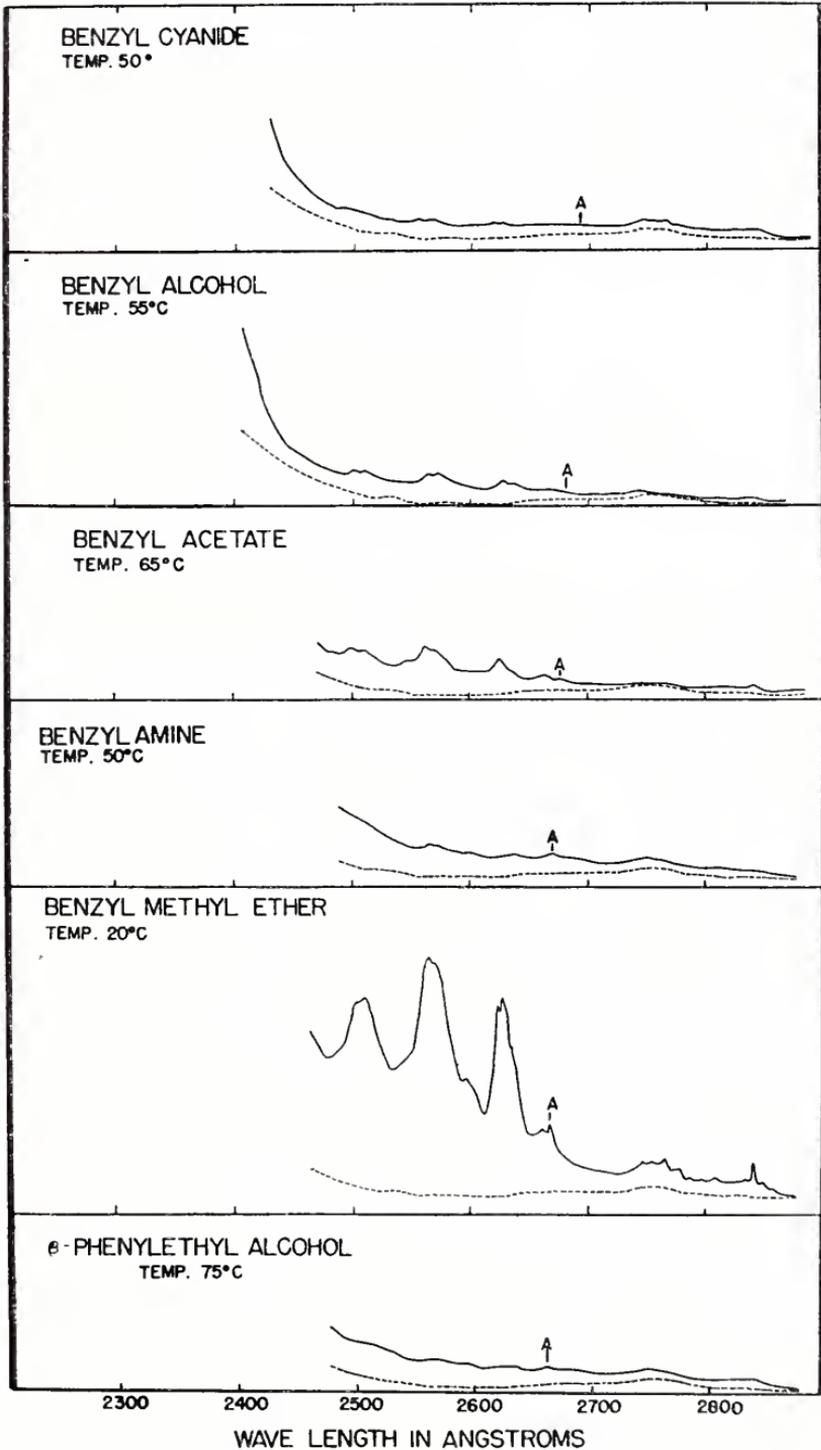


FIG. 1 (Continued). The near ultraviolet absorption spectra

effects of the $-\text{CH}_2$ group which supplies electrons to the ether-oxygen atom. This results in a O - O band shift, 630 cm^{-1} , less than that for benzyl acetate.

The bands at wavelengths longer than 2700 Å found in the spectra of benzyl chloride, benzyl cyanide, benzyl alcohol, benzyl acetate, benzyl methyl ether and beta-phenylethyl alcohol are assumed to be due to the benzyl carbonium ion, $\text{C}_6\text{H}_5\text{CH}_2^+$, which is stabilized by resonance. These bands above 2700 Å were always located at the same wavelengths regardless of the compound being used. No such consistently appearing bands were found in the spectra region from 2400 to 2700 Å.

SUMMARY

The near ultraviolet spectra in the vapor phase of a series of alpha-substituted toluenes were obtained and the band assignments were made for each.

The O - O band shifts for these compounds relative to the calculated O - O band position of benzene were studied with respect to mass, resonance, inductive, and hyperconjugation effects. The order of the red shifts from the greatest to smallest was found to be benzyl chloride, benzyl cyanide, benzyl alcohol, benzyl acetate, benzylamine, benzyl methyl ether and toluene, ether benzene and n-propylbenzene, and beta-phenylethyl alcohol.

REFERENCES

- (1) GINSBURG, NATHAN, ROBERTSON, W. W., AND MATSEN, F. A. J. Chem. Phys. 14:511. 1946.
- (2) HAMNER, W. F., AND MATSEN, F. A. J. Am. Chem. Soc. 70:2482. 1948.
- (3) MATSEN, F. A., ROBERTSON, W. W., AND CHOUKE, R. L. Chem. Revs. 41:273. 1947.
- (4) MOUNTCASTLE, W. R., SMITH, D. F., AND GROVE, E. L. J. Phy. Chem. 64:1342. 1960.
- (5) RADLE, W. F., AND BECK, C. A. J. Chem. Phys. 8:507. 1940.
- (6) SPONER, H., NORDHEIM, G., SKLAR, A. L., AND TELLER, E. J. Chem. Phys. 7:207. 1939.

TABLE 2. WAVELENGTH, WAVE NUMBER RELATIVE INTENSITIES AND ASSIGNMENTS OF SPECTRA

A	Cm. ⁻¹	Relative Intensity	Assignment
Ethylbenzene			
2666	37,500	vs	0—0
2630	38,010	s	0+510
2601	38,440	s	0+940
2579	38,760	ms	0+1260
2566	38,960	ms	0+510+940
2537	39,400	m	0+2x940
2521	39,650	ms	0+940+1260
2506	39,890	ms	0+510+2x940
2478	40,340	ms	0+510+940+1260
2462	40,610	m	0+2x940+1260
2446	40,870	w	
n-Propylbenzene			
2666	37,500	vs	0—0
2639	37,880	m	0+380
2630	38,010	ms	0+510
2600	38,450	s	0+950
2591	38,580	w	0+1060
2578	38,780	ms	0+2x380+510
2566	38,960	ms	0+510+950
2548	39,230	w	0+2x380+950
2536	39,420	w	0+2x950
2520	39,670	m	0+3x380+2x510
2503	39,940	w	
2463	40,590	w	
Benzyl Chloride			
2694	37,110	ms	0—0
2656	37,640	s	0+530
2641	37,850	s	0+740
2629	38,030	m	0+920
2605	38,380	w	0+530+740
2590	38,600	vs	0+530+920
2577	38,790	s	0+740+920
2540	39,360	w	
2527	39,560	w	
2512	39,800	w	

TABLE 2 (Continued)

A	Cm. ⁻¹	Relative Intensity	Assignment
Benzyl Cyanide			
2693	37,120	vw	0—0
2655	37,650	w	0+530
2626	38,070	m	0+950
2619	38,170	s	0+1050
2564	38,990	ms	0+2x950
2555	39,130	ms	0+2x530+950
Benzyl Alcohol			
2681	37,290	w	0—0
2636	37,920	s	0+630
2628	38,040	vs	0+750
2615	38,230	w	0+940
2608	38,330	w	0+1040
2573	38,850	s	0+630+940
2565	38,970	s	0+750+940
2511	39,810	m	0+4x630
2500	39,990	m	0+2 (630+750)
Benzyl Acetate			
2677	37,340	w	0—0
2664	37,530	m	0+190
2625	38,080	s	0+740
2612	38,270	w	0+930
2571	38,880	s	0+930+740+190
2562	39,020	vs	0+740+930
2549	39,220	m	0+2x930
2511	39,810	m	0+2x740+930
2501	39,970	w	
Benzylamine			
2673	37,400	s	0—0
2639	37,880	m	0+480
2604	38,390	w	0+990
2566	38,960	w	0+1560
Benzyl Methyl Ether			
2669	37,460	m	0—0
2662	37,550	w	0+90
2636	37,920	m	0+460
2628	38,040	s	0+580
2624	38,100	s	0+2x90+460
2596	38,510	w	0+1040
2566	38,960	vs	0+580+1040
2510	39,830	s	0+460+2x1040

TABLE 2 (Continued)

A	Cm. ⁻¹	Relative Intensity	Assignment
Beta-Phenylethyl Alcohol			
2661	37,570	m	0—0
2630	38,010	s	0+440
2593	38,550	m	0+980
2566	38,960	m	0+1390; 0+440+980

TABLE 3. RED SHIFT OF THE O - O BANDS

Compound	O - O Band	Band Shift
Benzene	38,090 cm ⁻¹ *	
Toluene	37,460	630 cm ⁻¹
Ethylbenzene	37,500	590
n-Propylbenzene	37,500	590
Benzyl chloride	37,110	980
Benzyl cyanide	37,120	970
Benzyl alcohol	37,290	800
Benzyl acetate	37,340	750
Benzylamine	37,400	690
Benzyl methyl ether	37,460	630
Beta-Phenylethyl alcohol	37,570	520

*Rounded off to nearest 10 cm⁻¹ which is equivalent to nearest angstrom unit, the accuracy of this work.

The Petrology of Some Lower Mississippian Carbonate Rocks of North Alabama

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The Tuscumbia Limestone and the Fort Payne Chert are of Mississippian age and crop out at many localities in the northern half of Alabama. In Alabama, the Tuscumbia Limestone has been divided into the Warsaw Limestone below and the St. Louis Limestone above. The Warsaw is underlain by the Fort Payne Chert. While the mapping of these units is well under way, little petrographic study of these units has been made. It is the purpose of this paper to summarize the results of a study of some of the carbonate rocks of the Tuscumbia Limestone and the upper part of the Fort Payne Chert. For details, the reader is referred to the complete work which is on file at the University of Alabama library in the form of a thesis. The study was conducted by selecting seven localities where the Fort Payne Chert and the Tuscumbia Limestone are exposed and obtaining data from field observation and the study of hand specimens, thin sections, and insoluble residues. In an attempt to detect areal changes, both in the nature of the rock and in insoluble residue, sampling localities were chosen at wide intervals.

METHOD OF STUDY

At each sampling locality or section, samples of fresh rock were taken, where possible, at one-foot intervals. For the study of the insoluble residues a part of each sample was crushed, screened, and filed. Samples representing five-foot intervals were then prepared by combining a small amount of material from five successive one-foot intervals. Each sample representing a five-foot interval was weighed on an analytical balance, placed in a labeled beaker, and dissolved with a solution of hydrochloric acid of about seven normal concentration. After the samples were completely dissolved, the residues were filtered, dried, and weighed. The percentage of total residue of each sample was then calculated.

To obtain residues suitable for study under the microscope, an additional sample from each five-foot interval was dissolved. The resulting residue was then washed and placed in a sedimentation cylinder where the material less than .015 mm. in diameter was removed. The remaining residue was then dried and placed in vials for future study. Determination of the percentages of the various

constituents making up the residue was accomplished by grain counting and the size frequency distribution of the detrital quartz grains was determined by a method which couples grain counting with screening.

As a further aid to the study, thin sections were made from samples at selected intervals and studied in detail. The selection of samples from which to make thin sections was done by choosing samples, which insofar as could be determined by hand specimen study, were representative of the several types of rock found at the outcrop. Most of the carbonate rock studied was formed by the accumulation of debris composed predominantly of calcium carbonate. Because these particles were subjected at times to the sorting or winnowing action of the sea, it was desirable to note among other things sorting, particle or grain size distribution, and grain orientation and wear. In working with the thin sections, it was found that the knowledge of the types of insoluble residue in the rock from which the thin section was made was invaluable.

PETROLOGY

FORT PAYNE CHERT

At three sampling localities near Sheffield, the Fort Payne appeared to contain more chert than the overlying Warsaw. However, since both the upper part of the Fort Payne and the Warsaw often contained limestone which is similar in appearance in hand specimens, and no sharp boundary exists between the more chertified rocks and those above, the contact is indistinct.

When the rocks of these sections are studied with the aid of insoluble residues and thin sections it is seen that the contact between the two units is gradational and the differences between the rocks of the Warsaw and those of the Fort Payne are seen more clearly. As usually seen in thin section, rock of the Fort Payne is composed principally of poorly sorted, relatively unbraided crinoid, bryozoan, ostracod, and foraminiferal test fragments cemented by clear calcite. Particles often show a preferred orientation.

Insoluble residue of the Fort Payne consists, in addition to the carbonaceous and clay size terrigenous material, of secondary quartz, detrital quartz, glauconite, mica, conodonts, fossil coral fragments, and pyrite. Secondary quartz occurs as doubly terminated, clear crystals, subhedral or partially developed crystals, and drusy quartz, which consists of clusters or aggregates of crystals.

Detrital quartz occurs as clear to frosted, subrounded- to suban-

gular-grains which often display inclusions and overgrowths of secondary quartz.

Glauconite occurs as replacements of parts of detrital carbonate material, as fillings of interstices between carbonate particles, and as fillings of foraminiferal tests. A few rounded grains occur which clearly were part of the debris which made up the original sediment.

In contrast to the overlying Warsaw, which contains a high percentage of secondary quartz, a low percentage of detrital quartz, and a high percentage of glauconite as its principal insoluble residue, the upper part of the Fort Payne contains a relatively high percentage of total residue, a high percentage of detrital quartz, and fossil coral and conodont fragments. Pyrite occurs occasionally and takes the form of pyritohedrons, cubes or subhedral masses.

In a section in Madison County, the Fort Payne is similar to that seen in the sections near Sheffield when studied in thin-section. Here, the insoluble residue of the Fort Payne consists of secondary and detrital quartz, pyrite and mica in addition to the carbonaceous and clay-size terrigenous material. Here, the percentage of carbonaceous and clay-size terrigenous material is apparently higher in the Fort Payne than in the overlying Warsaw.

As seen in a section near Trussville, the Fort Payne is noticeably darker in color than the overlying Warsaw and as seen in thin-section is a poorly sorted sediment composed of crinoid and bryozoan debris, and a few foraminiferal tests. The Fort Payne at this locality contains a higher percentage of total residue than the overlying Warsaw. This residue consists of an unusually high percentage of carbonaceous and clay-size material along with secondary quartz, detrital quartz, glauconite, and sphalerite (?).

In view of the petrographic information regarding the upper part of the Fort Payne, it is suggested that the depositional environment was either a rather deep part of the sedimentary basin or a sheltered area. Since a sheltered environment might be expected to be localized, and in view of the fact that almost the same type of sediment is found at every locality studied, it seems more probable that a relatively deep basin was the depositional environment.

TUSCUMBIA LIMESTONE

Warsaw Limestone

The lower Tuscumbia, or Warsaw Limestone, is composed principally of calcite cemented crinoid and bryozoan debris, and when compared with the upper part of the Fort Payne Chert, is relatively

well sorted and appears to have been deposited in a higher energy environment.

The percentage of total insoluble residue is comparatively low in the Warsaw and consists predominantly of secondary quartz, with smaller percentages of detrital quartz, glauconite, mica and sphalerite (?). At the sections near Sheffield, the residue of the lower Warsaw is characterized by a relatively high percentage of glauconite.

St. Louis Limestone

The upper Tuscumbia, or St. Louis Limestone, was studied at only one locality in Madison County. Here, the presence of the St. Louis is inferred by the occurrence of the characteristic fossil *Lithostrotion proliferum*; however, this fossil does not serve as an indicator for the Warsaw—St. Louis contact at this locality. The criterion for the differentiation of the Warsaw and the St. Louis, therefore, is petrographic rather than paleontologic. The rock of the St. Louis appears to have been deposited in a generally well-agitated sea where sediment transporting currents were active. Such conditions are inferred by the overall good sorting of the sediment and the paucity of the finer products of attrition. In addition, the worn appearance of most grains attests to the activity of currents or waves. Rock of the St. Louis is composed of crinoid, bryozoan, and foraminiferal debris, fragments of a penecontemporaneous consolidated carbonate sediment, and oolites and superficial oolites.

The percentage of total insoluble residue of the St. Louis is comparatively low, and consists primarily of secondary quartz, with smaller percentages of detrital quartz, glauconite, mica pyrite, and sphalerite (?). No significant differences between the residues of the St. Louis and those of the Warsaw were noted.

DIAGENESIS

The most important of the processes of diagenesis observed in the carbonate rock under consideration are: recrystallization of calcite, dolomitization, and silicification. Only the more important features of each will be mentioned here.

Various stages or types of recrystallization of the cement and the detrital carbonate particles may be seen. The state of recrystallization of the cement itself may be such that a microcrystalline development is present, or it may be such that a mosaic of anhedral calcite is seen. As is more often the case, the cement may be in optical continuity with detrital carbonate particles. Where this type of recrystallization has taken place, a particle and the surrounding

cement is a single crystal and crystal striations may be continuous from the particle through the cement. The size of the detrital particles and/or the amount of optically continuous cement governs the texture of the rock as seen in the hand specimen and determines its description as finely, medium, or coarsely crystalline.

Dolomitization was observed in all three units studied and has progressed farthest in the rock of the Fort Payne. Dolomite is seen as individual euhedra and as anhedral mosaics.

Post depositional silica occurs in the sediments under discussion as euhedral and subhedral quartz, chert, which occurs as microcrystalline silica, and chalcedony. A detailed investigation of the chert in these sediments was beyond the scope of this study, and information regarding the chert-carbonate relationship was obtained only through casual observation. It is probably worth noting, however, that most chert observed in thin-section is clearly secondary in nature. In many instances, the structure of the original rock has been preserved in the chert. In such cases the coating of argillaceous or carbonaceous material on the original carbonate particles is seen in the chert, preserving the outline of the particles.

CONCLUSIONS

GENERAL

The carbonate rock of the St. Louis Limestone, the Warsaw Limestone and the upper part of the Fort Payne Chert were formed chiefly by the accumulation of biochemically precipitated calcite particles, which in most cases have been subjected to abrasion and the winnowing action of ocean currents. Though unique in that their constituent material was derived from within the basin of deposition, they are, nevertheless, clastic sediments—the character of which reflects the environment of deposition.

Four types of rock-making particles are recognized. They are: (1) recognizable fragments such as crinoid parts, bryozoan fragments, mollusk shell particles, and foraminiferal and ostracod test; (2) carbonate skeletal fragments of unknown affinity; (3) oolites and superficial oolites; and (4) fragments which appear to be the results of erosion of a penecontemporaneous consolidated carbonate sediment. The first type is by far the most dominant constituent.

Probably a fifth type exists, this being calcareous ooze, or the product of direct precipitation from the sea water. The relative importance of the calcareous ooze as a rock-making material is not exactly defined, as the criteria for its differentiation from the

product of attrition of the other types of particles are in themselves subject to criticism. This material is thought to be rather insignificant in these sediments, however, and if present would be found in the poorer-sorted and finer-grained sediments.

The first four types of particles, which are found in different percentages in various horizons of each unit, are cemented by a calcite cement which is considered to have been deposited shortly after their deposition.

Since these limestones have been established as clastic in nature, it is logical to assume that they would be deposited either in zones relatively close to shore or in shallow areas. Since detrital quartz grains are common in these sediments, it is probable that orthoquartzite facies were in existence during their deposition. The sediments encountered in moving from land toward the deeper portion of the basin would, therefore, be (1) orthoquartzite, (2) limestone, and (3) shale. In view of the small amounts of fine silt and clay material in these limestones, the existence of a mappable unit of the last type of facies at any time during their deposition is doubted.

Based on the type and amount of terrigenous material in these units, the contemporaneous adjacent land areas were probably low in elevation. Of the three units studied, the Fort Payne appears to have had the highest relief between land and sea.

THE FORT PAYNE CHERT

With regard to the upper part of the Fort Payne Chert, as seen in the sections studied, the following is concluded:

1. It is composed almost completely of the first two types of the aforementioned types of carbonate particles.
2. It probably was deposited in a comparatively deep portion of the sedimentary basin.
3. A more elevated land area was in existence at the time of its deposition.
4. The insoluble residue of the Fort Payne, in addition to clay size terrigenous material, consists of secondary quartz, detrital quartz, glauconite, pyrite, mica, conodonts, and silica replacement of coral fragments. Of these, the replacement of coral fragments and conodonts are seen only in Colbert County.
5. Of the detrital quartz grains, the largest sizes are found in Colbert County in the northwest corner of Alabama.
6. On the basis of microscopic character and insoluble re-

sidue content, the Fort Payne may be distinguished from the other two units studied.

THE WARSAW LIMESTONE

With respect to the Warsaw Limestone, it may be concluded that:

1. It is also composed of the first two types of carbonate particles.
2. It probably was deposited in a shallow, somewhat-agitated-sea adjacent to which were only low-lying land areas.
3. The insoluble residue of this unit consists predominantly of secondary quartz, glauconite, detrital quartz, with mica, pyrite and sphalerite (?) being minor constituents.
4. With the aid of the insoluble residue it is possible to recognize, locally, zones or "horizons" in this unit. The areal extent of these zones, however, is not known.

THE ST. LOUIS LIMESTONE

With respect to the St. Louis Limestone, as seen in Madison County, it may be concluded that:

1. It is composed predominantly of the first two types of carbonate particles, with minor amounts of types three and four.
2. It probably was deposited in a shallow, intensely agitated sea in which reefs were common.
3. The oolite and superficial oolite particles are considered to have been formed in an agitated environment.
4. On the basis of microscopic character, the St. Louis may be differentiated from the underlying Warsaw.

The Organization of Behavior

A Further Discussion of "A Behavioral Model for Ontogeny"

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At the 38th and 39th Annual Meetings of the Alabama Academy of Science, papers were read before the Social Science Section describing a proposed behavioral model for ontogeny which might be useful in developing a more holistic concept in biology (1, 2).

The first paper projected a theoretical model, based on contemporary scientific knowledge, establishing a functional relationship between organic and inorganic matter. Inorganic matter is described as relatively stable "closed energy systems" in which energy "gradients" are manifested in nuclear synthesis or decay; organic matter is described as "open energy systems" in which the energy gradient is principally manifested in changing molecular chemical bonds (brought about by an activating system of enzymes) and is known as metabolism in living forms. Cosmic (including organic) evolution is the evidence of these various gravitating energy gradients, in which higher organization of resonant energy has provided greater randomness in energy distribution, and therefore satisfies the second law of thermodynamics or entropy. Organic systems allow for greater variability in organization (than inorganic systems) due to the "open end energy" arrangement, and thus provide the "mechanism" for living things to evolve. "Life" therefore is "experientially" the interaction of organism (as an open energy system) and the environment: this being a bi-polar relationship in which organism and environment are one continuum. Growth and development of organic forms, then, would follow principles expressed in the postulated cosmic ordering of energy. A study of contemporary notions about evolutionary mechanisms reveals that the above principles are essentially followed (3).

The second paper (2) described elementary thinking and perceptual learning, in light of contemporary knowledge and application of the proposed "behavioral model for ontogeny." The principles of communication and information theory are cited with reference to the proposed model, demonstrating that entropy provides the impetus for energy flow. "Energy flow" in organic forms finds expression in metabolism. However, metabolism subserves higher functions of organization which control the economy of organismic action. These higher functions are typified in adaptive be-

havior and learning. The paper further points out that intelligent behavior is commonly associated with efficiency and versatility *in information retrieval and learning*. Indeed, the organic sequence of stimulus-integration-response elaborates the entropy process through metabolism, and at the same time affords the development of a *control of probability* that arises as *information* within the metabolic complex of organismic activity. Experientially, these *controlled metabolic sequences* give rise to sensations, perceptions, emotions, and bodily changes that occur as the organism programs behavior in an effort to "problem solve." The second paper further diagrams the method whereby elementary thinking and perceptual learning is evolved by the organism.

In this paper we would like to explore the possibility of describing *the organization of behavior* in terms of our proposed model for ontogeny. Since we have followed evolutionary mechanics in developing our model thus far, we will apply the same modes of approach to the organization of behavior.

The manner in which organismic behavior is generated has held the attention of all disciplines dealing with the life sciences. Most approaches to the problem of mechanics, however, have been relatively segmented, and usually are described in the peculiar language of whatever discipline is making the study. An example of this is as follows: recently, much work has been done in the field of biochemistry and biophysics relative to biologic functioning (4). One of the important discoveries concerns biochemistry variability (5).

The formal approach in biochemistry has been to consider that the so-called primitive undifferentiate Zygote cell *a priori* possessed the molecular basis of any given specification. This approach has been challenged on the basis that this has led to stereotyping knowledge about cellular evolution and an oversimplification in the approach to theories dealing with cellular function. Cohen (6) has advanced the notion that "Cells contain many more compounds and biosynthetic mechanisms than we had suspected or list in our texts. Accordingly, either early chemical evolution was far more extensive than we have postulated or an evolution of biochemical synthesis and function took place which was more extensive than has been postulated; perhaps both have occurred. The chemical choices available from the environment have been considerable rather than limited and the cells have chosen adapted, improved upon a limited number of these, and in turn have themselves been selected. In the case of the naturally occurring antibiotic substances, biosyn-

thetic mechanisms for compounds which do not fit within the cells' own nucleic acids and proteins to advantage have nevertheless been preserved since they contribute to survival. On the other hand, some of these compounds . . . are fitted to other metabolic uses. The existence of the large number of uncommon relatives of the common components of the nucleic acids and proteins in turn implies an enormous untapped area of potential knowledge concerning their paths of biosyntheses and the genetic and physiological controls for these same paths. That these compounds exist perhaps also indicates an expanded material basis for a continuing biochemical evolution.

"Even common metabolic components may arise in and be degraded by different metabolic paths, a result which strengthens our feeling about the underestimation of the potentials for variations in chemical and biochemical evolution.

"Examples of biochemical diversity among organisms point to acquisition of biosynthetic function at numerous stages of evolution. Several novel mechanisms have arisen in response to the availability of the metabolite, molecular oxygen, itself produced by organisms. The exigencies of multicellular life resulting from advancing evolution have themselves culminated in acquisitions of a wide variety of new syntheses, biochemically specific substances, and activities which relate to some of the specialized functions of the higher forms."

Thus, even at the level of biochemistry we are seeing the evidence of growing concern for the evolutionary process in ontogeny. Yet, it contributes little, thus far, toward an overall understanding as how behavior is generated in the organism.

From a phenomenological approach to the organization of behavior we could consider the organism as a computer that is continually being programmed while also in the process of problem solving. In the developing organism, progressively differentiating sensory awareness gives rise to greater cognitive and conative activity in the perceptual field.

The elaboration of these characteristics into the symbolic and social level of behavior indicates the ramification of organized behavior. Cultural anthropologists today have applied ethnographic methods even to the point of developing a "calculus" for describing "cognitive process" (7). A study of these methods throws considerable light on the form and process of individual behavior.

Theorists ranging from theologians to physiologists have long pondered the causal relation between *perceived object*, *emotional*

experience, and associated body changes. In general four main solutions have been advocated: (8)

- (1) that perceptions arouse emotions, and then emotions cause bodily changes;
- (2) that perception induces bodily changes which are felt directly as emotions;
- (3) that perceptions arouse both emotions and bodily changes;
- (4) that emotions are aroused (experienced subjectively) not by perceptions directly but by an instantaneous appraisal of what we perceive; and that emotion is a tendency to some sort of action appropriate to this appraisal, accompanied by a pattern of physiological alteration in bodily state.

The fourth solution seems to more closely fit existing knowledge and our model. This solution seems to follow the sequence perception-appraisal-emotion-action. The central monitor for conservation of the organism seems to be located in the "limbic system" of the brain—the "old" or mid-brain. This system seems to provide the "instantaneous appraisal" necessary to evoke avoidance behavior in time of danger. This in turn evokes appropriate emotional behavior which backs up the action taken. The ascending reticular activating system in the brain stem seems to provide the arousal pattern necessary for cognitive functioning (16). Indeed, studies (9, 10, 11) have shown that the organism is mentally deprived more when constantly stimulated sensorily by meaningless sensations than in the absence of any sensory stimulation. The study further points out the fact that organismic activity must be meaningful and productive if intelligent behavior is acquired. It seems that the environment is playing a much more important role in development of personality and behavior than had formerly been suspected. This places tremendous responsibility on society to provide the proper atmosphere for human development. Work with slow learners and mentally retarded has demonstrated already the fruitfulness of providing the proper type of environment for development. Stimulating (meaningful) experiences can be programmed for developing children from conception on throughout early childhood. In fact many authorities in child development are placing these early years in the crucial position of determining the potential level of intelligence a child will attain in later years. Especially important is the pre-verbal and early verbal experience of the child (12). In this period the child "thematizes" experience, creates logical classifications "upward" and "downward" (universals), develops varieties of thinking and acting, and

experiments in verbal functioning (13).

The early verbal period provides the perceptual ground pattern for later symbolic language development without which modern intelligent behavior could not develop. Some authorities contend that the particular language one is brought up to speak conditions one's perception of objective reality and perhaps one's modes of thinking. Many who have learned to speak several languages contend that they are able to think more productively in one language than another, and many times this would be a language other than the native tongue. Auditory perception introduces the child to the world of verbal symbols that typify language development. From this the child develops verbal experience behavior. By school age the child is introduced to visual receptive behavior (reading) and soon after subjected to visual expressive behavior (productive writing). Language therefore contributes greatly to the organization of behavior in development. Much of modern society's impact on the developing human organism and his personality construction is found in the system of values characterized by the "language" environment.

Much of what we call personality represents the internalization of the culture into which one is born (14). No person participates in the whole of his culture, even in the simplest societies. The cultural content and interpersonal expectations which one internalizes depend upon one's position within the social structure—the network of relationships between individuals, families, and other groups making up the society. Moreover, socialization is always oriented toward preparing the child to live in the kind of world that the parents anticipate, which may not be the world as it now is.

If different positions in the social structure tend to produce different emphases in personality organization, one must inevitably be concerned with the fit between these personality constellations and the requirements of various adult roles and institutional arrangements. Another problem of fit occurs when people move from one social system to another or when the social system undergoes marked change in a relatively short period.

We are aware that this paper has only touched on the subject for which we intended to write. It is quite possible that some would say we didn't come within shouting distance. However, this is only one more in a series of papers we feel compelled to write, pointing up the crying need for interdisciplinary cooperation in dealing with problems of the life sciences. Specialization in scientific pursuits is a must, but we need to be brought back from

time to time to renew our common purposes so that the knowledge of modern science can be brought to bear on the most crucial problem of our time—Man (15).

Man's present precarious position results not only from misperceptions and wrong decisions, but also from the fact that our entire society has lost meaningful contact with our spiritual and humanistic values. Professions of morality and devotion to freedom have become empty and stylized rather than meaningful, psychological experiences.

In the past, man's basic problems were concerned with the complexities of his physical environment. To survive and flourish, it was necessary for him to learn to deal with the elements, to provide adequate food and water supplies, to master the challenges of distance and communication, and to acquire sources of energy beyond those available through the use of his own musculo-skeletal system. It is clear that in our time, the focus of the basic problem has changed from the external to the internal environment. Our primary need is no longer one of coping with the physical universe; it is now instead a question of learning, and of learning rapidly, how to cope with ourselves, with each other, and in particular with intergroup and international conflicts. This is the fundamentally new condition in response to which we must hope that we will be capable of rational anticipatory change. Our need is for a new Manhattan project devoted not to the development of a weapon but, instead, to the development of a new body of knowledge of intergroup relationships and conflict resolution, so that we can preserve freedom in peace.

LITERATURE CITED

- (1.) OVERTON, ELEAZER C., AND HERREN, GLEN W., A Behavioral Model for Ontogeny. Read before Section VIII, 38th Annual Meeting Alabama Academy of Science. 1961.
- (2.) OVERTON, ELEAZER C., AND HERREN, GLEN W., Elementary Thinking and Perceptual Learning. Read before Section VIII, 39th Annual Meeting Alabama Academy of Science. 1962.
- (3.) RENSCH, BERNHARD, Evolution Above the Species Level. Columbia University Press. New York. 1960.
- (4.) ASIMOV, ISAAC, The Wellsprings of Life. Abelard-Schuman. New York. 1961.
- (5.) KETTY, S., Science. Vol. 132. No. 1261. 1960.
- (6.) COHEN, SEYMOUR S., On Biochemical Variability and Innovation. Science. Vol. 139. No. 3559. 1963.
- (7.) WALLACE, ANTHONY F. C., Culture and Cognition. Science. Vol. 135. No. 3501. 1962.

- (8.) ARNOLD, MAGDA B., *Emotion and Personality*. Vols. 1 & 2. Columbia University Press. New York. 1960.
- (9.) ZUBEK, J. P., *et al.*, *Electroencephalographic Changes after Prolonged Sensory and Perceptual Deprivation*. *Science*. Vol. 139. No. 3560. 1963.
- (10.) *Ibid* (9), *Prolonged Immobilization of the Body; Changes in Performance and in the Electroencephalogram*. *Science*. Vol. 140. No. 3564. (1963).
- (11.) VERNON, JACK, *et al.*, *Sensory Deprivation and Hallucinations*. *Science*. Vol. 133. No. 3467. 1963.
- (12.) GESELL, A., AND THOMPSON, H., *Infant Behavior*. McGraw-Hill. New York. 1934; PIAGET, J., *The Origins of Intelligence in Children* (trans. by Margaret Cook). International Universities Press. New York. 1952; RHEINGOLD, H. L., *The Effect of Environmental Stimulation Upon Social and Exploratory Behavior in the Human Infant in Determinants of Infant Behavior*. Foss, B., Ed. Methuen. London. 1961. pp. 143-171.
- (13.) CHURCH, JOSEPH, *Language and the Discovery of Reality. A Developmental Psychology of Cognition*. Random House. New York. 1961.
- (14.) COHEN, YEHUDI A., *Structure and Personality, a casebook*. Holt, Rinehart and Winston. New York. 1961.
- (15.) POLLIN, WILLIAM, *Science*. Vol. 135. No. 3500. 1962; FROMM, ERICH, *Man for Himself*. Doubleday. Garden City, New York. 1961.
- (16.) WILENS, SIGMUND L., AND PLAIR, CASSIUS M., *Functional Organization of the Brain Stem Reticular Formation and Sensory Input*. *Science*. Vol. 138. No. 3544. 1962.

The Effects of Forest Tent Caterpillar Control Experiment on Fish and Wildlife

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Aerial applications of D. D. T., Sevin, Dibrom and Malathion in oil at various strengths were applied to eleven plots (40 to 320 acres) in Baldwin and Clarke Counties in March and April 1961. Studies were made to select a chemical for future application which would best control the forest tent caterpillar, *Malacosoma disstria*, with the least harmful effect on fish and wildlife. This paper deals only with studies and observations of the experiment as they affect fish and wildlife. D. D. T., when applied in oil at 1/2 pound per acre, was found to kill fish, fish food organisms and certain birds.

Laboratory analyses indicated sub-lethal doses of D. D. T. in fish in plots with applications as low as 1/8 pound per acre.

No harmful effects were observed from applications of Sevin, Dibrom and Malathion in oil at rates as high as 1 pound per acre except in certain fish food organisms in the Malathion plot.

The forest tent caterpillar, *Malacosoma disstria*, is found in the Delta area of Southwest Alabama. Periodic outbreaks of this forest pest occurred every few years in this area until about 1953. Since that time, annual infestations of some magnitude have occurred principally in the Tupelo, *Nyssa sp.*, and sweetgum, *liquidambar styraciflua*, stands in the river bottom lands of Baldwin, Mobile, Clarke and Washington Counties.

These infestations over an extended period are reported to cause loss of tree vigor, inadequate re-seeding, and in extreme instances, tree mortality.

Landowners of the infested areas became concerned over the problem and contacted both the U. S. Forest Service and the Alabama Department of Conservation, Division of Forestry, for aid in controlling this forest pest.

Mindful of the fact that fish and wildlife are an important source of recreation and income in the area and realizing that certain insecticides are detrimental to fish and wildlife, it was decided that experimental plots should be set up and sprayed with a variety of insecticides at various rates. The evaluation of the various insecticides used in these experiments was made in order to select those which would control the forest tent caterpillar with the least harmful effect to fish and wildlife.

PROCEDURE

Eleven experimental plots ranging in size from 40 to 320 acres were selected by the landowners and State and Federal forestry and fish and wildlife personnel. These plots were marked with balloons filled with helium at each corner. Chemicals selected were D. D. T. in oil at rates of 1/8, 1/4 and 1/2 pounds per acre, Sevin in oil at 1/2 and 1 pound per acre, Dibrom in oil at 1 pound per acre and Malathion in oil at 1 pound per acre (Table 1).

In an effort to determine the effects of the different insecticides on fish, a total of 24 live boxes were utilized. They were constructed of 1/4-inch mesh hardware cloth and were 2'x2'x2' in size. One box was submerged in water approximately 7 feet deep and 21 boxes were submerged approximately 3 feet. Two boxes were used to hold extra fish in case they were needed. When possible the live boxes were placed in the plots in such a manner that at least one box would receive some drainage from approximately 3/4 of the sprayed area.

Test fish were placed in these boxes from 3 to 10 days prior to treatment except in the one area where D. D. T. was applied at 1/8 pound per acre. This plot was stocked on the morning of treatment. Five control boxes, three in the Hal's Lake—South Carlton Area in Clarke County and two in the Stockton area of Baldwin County were used. Two boxes in the Hal's Lake—South Carlton Area and two boxes in the Stockton Area were placed a minimum of 1/4 miles above any nearby plot and in such a position that they would not receive drainage from a treated area. The third box in the Hal's Lake—South Carlton Area was used to determine the possible effect that sludge from nearby oil wells might have on the test fish.

Test fish used in these live boxes were obtained from the State Fish Hatchery at Spring Hill, Alabama. Twenty-five 2- to 3-inch bluegills were placed in each box. Insect boxes, made of plastic screen in a 6"x6"x6" size, were used in all except two plots. These boxes were placed within the plots and were submerged to a depth of approximately 2 feet. Control boxes were placed beside two of the fish control boxes. Test organisms used were primarily fresh water shrimp and dragon and damsel fly larvae.

Because of the flood water present (3 to 12 feet over all plots) no wildlife inventory was made prior to the spraying operations.

The actual operations began on March 30 with the insecticides being applied by a Stearman biplane at an altitude of approximately 100 feet. Weather and wind conditions except in early morning were

TABLE 1. MORTALITY OF TEST FISH USED IN EXPERIMENTAL PLOTS SPRAYED DURING TENT CATERPILLAR PROJECT IN 1961

Plot Number	Acres	Date of Application Chemical and Rate	Box No.	Location in Plot	No. fish per box	Percent Mortality After					
						30 Hours	48 Hours	72 Hours	96 Hours	144 Hours	
1	100	½ Lb. D.D.T./A. (oil) 3-30-61	A	Lower ¼ of area	25	—	—	44	—	—	—
3	320 ¹	½ Lb. D.D.T./A. (oil) 4-3-61 4-4-61	A	Upper ¼ of area	25	00	—	—	—	—	—
			B ²	Lower ¼ of area	25	00	—	—	—	—	—
			C	Lower ¼ of area	25	00	—	—	—	—	—
4	320	½ Lb. D.D.T./A. (oil) 4-4-61	A	Lower ¼ of area	(Box lost prior to stocking with test fish)	—	—	—	—	—	—
			B	Lower ¼ of area	25	04	—	—	—	—	—
6	320	½ Lb. D.D.T./A. (oil) 3-30-61	A	Upper ¼ of area	25	04	—	—	—	—	—
			B	Lower ¼ of area	25	76	—	—	—	—	—
			C ³	Lower ¼ of area	25	68	—	—	—	—	76
2	100	¼ Lb. D.D.T./A. (oil) 3-30-61	(Dry land on spray date)		—	—	—	—	—	—	—
			A	Lower ¼ of area	25	—	—	—	—	—	—
5	100	⅛ Lb. D.D.T./A. (oil) 4-4-61	A	Upper ¼ of area	25	00	—	—	—	—	—
			B	Lower ¼ of area	25	—	—	—	—	—	—
8	80	1 Lb. Sevin/Gal/A. (oil) 3-29-61	A	Lower ¼ of area	25	—	—	—	—	—	—
			B	Lower ¼ of area	25	00	—	—	—	—	—
9	40	½ Lb. Sevin/Gal/A. (oil) 3-30-61	A	Lower ½ of area	25	—	—	—	—	—	—
			B	Lower ½ of area	25	—	—	—	—	—	—
7	80	1 Lb. Dibrom/Gal/A. (oil) 3-29-61	A	Upper ¼ of area	25	00	—	—	—	—	—
			B	Lower ¼ of area	25	—	—	—	—	—	—
11	80	1 Lb. Malathion/ Gal/A. (oil)	A	Lower ¼ of area	25	—	—	—	—	—	—
			B	Lower ¼ of area	25	00	—	—	—	—	—

¹ Western ⅓ treated on 4-3-61. Eastern ⅓ on 4-4-61.

² 21 of the original 25 test fish present at the 48-hour check.

³ Box submerged in approximately 7 feet of water.

not ideal. Therefore, in most cases, the original spray schedule had to be modified.

RESULTS

D. D. T. applied at the rate of $\frac{1}{2}$ pound per acre in oil killed test fish in six of the live boxes used in these studies. Test fish showed distress 8 hours after the spray was applied and mortality in the boxes ranged from 4 to 76 percent in 30 hours. In a single live box submerged at approximately 7 feet there was an additional 8 percent mortality at the 144-hour check over that of 68 percent at the 30-hour check (Table 1).

The lack of mortality in Plot Number 3, which received D. D. T. at the $\frac{1}{2}$ pound per acre rate, was possibly due to additional floodwaters from the Alabama River. This rise in the water level caused a reverse of the currents through the plot and boxes B and C received less than $\frac{1}{4}$ the drainage from the area. In addition the western two-thirds of the area was treated on April 3 while the eastern one-third was treated the following day.

No mortality of test fish was found to occur in the live boxes where D. D. T. was applied at lower rates, or where other insecticides were sprayed. All control fish and extra test fish were observed to be alive after the last live box was checked on April 6 or 48 hours after the respective plot had been sprayed.

A laboratory analysis of surviving test fish from various live boxes revealed that they contained varying concentrations of D. D. T., D. D. E., and D. D. D. (Table 2).

TABLE 2. RESIDUAL CONCENTRATION FROM SURVIVING TEST FISH ANALYSIS

Plot No. and box location	Max. exposure possible	Live fish (p.p.m.) ¹			Total No. analyzed in aggregate
		D.D.T.	D.D.E.	D.D.D.	
1—Lower $\frac{1}{4}$	36 hours	12.5	2.54	2.33	9
3—Not given	24-48 hours	0.72	0.33	0.44	23
4—Lower $\frac{1}{4}$	30 hours	2.28	0.61	1.17	24
5—Upper $\frac{1}{4}$ ²	30 hours	trace	0.20	0.05	—

The dead fish taken from the boxes were analyzed in aggregate of 63 and an average concentration of D. D. T., D. D. E., and D. D. D. was found to be 0.22 (approx.), 0.15 (approx.) and 0.13, respectively.

The species and number of fish and wildlife found dead in various plots during the period of 1 to 7 days after D. D. T. had been applied at the rate of $\frac{1}{2}$ pound per acre were recorded. (Table 3).

TABLE 3. FISH AND WILDLIFE LOSSES AFTER DDT APPLICATION

Species	Number	Approximate size
Buffalo (<i>Ictiobus</i> sp.)	2	3.0 pounds
Longear sunfish (<i>Lepomis megalotis</i>)	1	4 inches
Bluegill (<i>Lepomis macrochirus</i>)	2	3 inches
Bluegill (<i>Lepomis macrochirus</i>)	24	6 to 8 inches
Cardinal (<i>Richmondena cardinalis</i>) ³	3	

¹ Data recorded as given from analyses report of U.S. Fish and Wildlife Pesticide Research Laboratory, Denver, Colorado.

² Received $\frac{1}{8}$ pound D.D.T. per acre, whereas other plots received 0.5 pound per acre.

³ Cardinals contained 22.49, 23.69 and 32.63 p.p.m. of D.D.T.

A hairy woodpecker, *Dendrocopus villosus*, was shot approximately 200 yards from one plot treated with D. D. T. at the $\frac{1}{2}$ pound per acre rate, and was found to contain a trace of D. D. T.

A prothonotary warbler, *Protonotaria citrea*, collected from the plot receiving malathion at 1 pound per acre did not contain any of this insecticide when analyzed.

No dead fish or wildlife were observed except in the plots treated with D. D. T., at the rate of $\frac{1}{2}$ pound per acre.

No wildlife other than birds were observed to be in any of the treated areas until after flood waters had receded in late April.

Fish food organisms were not seriously affected within 8 hours by most of the chemicals. Damsel fly larvae were killed completely in Plot Number 3 where D. D. T. was applied at the rate of $\frac{1}{2}$ pound per acre. An occasional fresh water shrimp was also observed to be dead in boxes placed where D. D. T. was applied at $\frac{1}{2}$ pound rate; however, others were alive when the boxes were checked from 24 to 48 hours after treatment. Malathion killed 30 percent of the dragon fly larvae in 8 hours in the insect box placed within the area sprayed. None of the other insecticides caused a significant loss of test organisms within the study period of 48 hours.

DISCUSSION

A check of the available literature indicates that the results in these experiments relating to fish, fish food organisms, and wild life closely parallel the findings of other studies involving the same insecticides. Numerous references are available indicating the harmful effects of D. D. T. and that such effects vary with the type of areas treated, the type fauna involved, and the method of application. Tarzwell (1958) summarizing the results of investigations of the U. S. Public Health Service reports laboratory bio-analyses tests indicate that 0.13 pounds of D. D. T. when placed in

one acre of water three feet deep will normally kill 50 percent of the fish within 96 hours. He further reports a residual action of the chlorinated hydrocarbons which include D. D. T. He found that a sand bottom pond treated with D. D. T. on two different occasions resulted in fish mortality following the second application. Clay bottoms and water containing considerable amounts of organic matter absorb or render non-toxic larger amounts of D. D. T. than do sand bottoms.

Tarzwel lists the comparative toxicity of D. D. T. and Malathion, both of which were used in these studies, to be 0.034 and 12.5 p.p.m. respectively. He states that in general the chlorinated hydrocarbons are more toxic to fish than are the organic phosphorus compounds.

Lawrence (1950) stated that bluegills in concrete pools were killed by D. D. T. in a fuel-oil formula at a concentration of 0.04 p.p.m. He further stated that largemouth bass, *Micropterus salmoides*, and golden shiners, *Notemigenus crysoleucas auratus*, withstood a concentration of 0.18 p.p.m. in these pools in cooler weather, whereas bluegills and black crappie, *Pomoxis nigromaculatus*, did not. Black bass fry and crappie fry were killed at somewhat lower concentrations than were the larger fish. Lawrence further reports some mortality among fingerling bluegills in earthen ponds receiving a 0.01 p.p.m. concentration of D. D. T. Yearling black bass (6 to 8 inches) were killed by a 0.05 p.p.m. concentration.

Before extensive spraying programs are initiated consideration should be given to the wildlife and fishery in the drainage area of the lower Alabama and Tombigbee Rivers and the Bay areas. Future spraying operations in the Delta Area of Southwest Alabama to control the tent caterpillar would involve spraying thousands of acres of timberland in a short period of this insect's life cycle. In addition, spraying may be needed annually or every few years. Aquatic forms valuable to the fishery, have been shown to be reduced well over 75 percent in the lower reaches of areas treated with small amounts of D. D. T. This type of damage would be almost immeasurable in the type of areas that were sprayed.

These studies suggest that the use of an insecticide other than D. D. T. would be most favorable from the standpoint of conserving fish and wildlife.

D. D. T. at $\frac{1}{2}$ pound per acre in oil will kill certain species of wildlife and fish when applied to flooded river bottom lands such as the ones in which the experimental plots were located.

It should be pointed out that the results of this study cannot

be conclusive for applications other than D. D. T. at $\frac{1}{2}$ pound per acre rate for the following reasons:

1. The plots were too small for accurate results.
2. Flooding conditions changed the composition of fish and wildlife on the area and made observations most difficult.
3. Rise and fall of floodwaters caused a continued changing condition and non-uniformity of the concentration of insecticides present.
4. Limited data obtained in the study.

More studies are needed to determine the effects of Malathion, Sevin, and Dibrom at various rates. Additional studies are also needed on D. D. T. at $\frac{1}{4}$ and $\frac{1}{8}$ pound per acre since large amounts of this insecticide were present in fish analyzed from plots treated at these rates.

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PRESIDENTIAL ADDRESS

THE AGE OF THE UNIVERSE

Louis J. Eisele, S.J.
Spring Hill College

In 1936, at a meeting of the American Association for the Advancement of Science in St. Louis, Missouri, while I was standing in line to register for the meeting, one of the members, after taking a long look at me, came up and said, 'You are in the wrong place, aren't you? This is a science convention.' (He was really serious!) Well, my presence here on this occasion, and in this capacity, certainly shows that things have come a long way from the days when it was generally thought that a clergyman should have nothing to do with the fields of science.

The thoughts I shall express tonight are for the most part, not original. There are here, I am sure, many who are better qualified to speak about the matters I propose to deal with than I am, for I do not consider myself to be an expert in the field of nuclear studies, or in astronomy, or geology for that matter. I teach undergraduate physics and also work in the field of seismology, and yet I propose to speak to you about the age of the universe as determined by studies in geology, in nuclear physics, and in astronomy. I shall attempt to be quite brief—and shall measure my time by the ordinary clock of the mean solar day—not by the clock of geologic ages, or in terms of the half-lives of the radioactive elements.

The beginnings of the scientific study of the age of the universe date back to the classic works of James Hutton and William Smith in the 18th century and the work of Sir Charles Lyell in the 19th century in which they did geologic studies of the various rock layers of the earth. Their time scale was a very relative one. They, first of all, classified the different sedimentary rock structures according to the fossil content of the strata. Of course, we live in the most recent period of the earth's history, the Quaternary Period. The sediments of this Period contain fossil remains of the most recent form of life, modern and primitive man. Underlying the rocks of the Quaternary Period are to be found those sediments of the Tertiary Period, classified according to their predominant fossil content, lower mammals and flowering plants.

Going back through the earlier Periods, to the sediments containing no fossils of living organisms, these geologists concluded that the earth had to be at least 1 billion, and perhaps 2 billion years old. Until the twentieth century gave to the 'cosmic historian' a new and very precise clock for measuring the age of igneous rocks containing no fossil records, the geologic age of the earth had to be given in very round numbers, and with the prefix always added—about 1 or 2 billion years. I might add here—there were quite a lot of people who wouldn't believe this at the time. They thought the numbers given were 'way too large.'

In 1907, suggestions were made to use the newly discovered natural radioactivity of certain rocks as a means of fixing the age of the earth with more certainty. The early attempts met with some success. By 1913, a measurement of the helium content of one sample showed a probable age of the rock of 500 million years, and another measurement on the amount of lead in a sample of uranium bearing rock showed an age of about 1.5 billion years. Not until quite recently has enough information been gained about the whole process of radioactive decay, and especially about the precise values of the rates at which the decay takes place, for precise measurements to be made.

Two important groups became engaged in the investigation of dating of rocks by radioactive means, one at the University of Durham, England in the late 1930s and another at the California Institute of Technology in the late 1940s. Both continue through the present time. The procedure used at the latter institution, and the results obtained, are those which I shall now outline. This method of dating by radioactivity—the process by which certain elements spontaneously break down into other nuclear species at a rate which can not be altered—is a most reliable means of arriving at a definite conclusion about the age of the sample of material being investigated.

Radioactive isotopes in nature fall into three main categories. Two of these consist of products which are continually being formed: (1) products of the breakdown of uranium and thorium; and (2) products of nuclear reactions in the earth's crust or in the atmosphere, e.g., carbon 14 formed by transformation of nitrogen in the atmosphere by cosmic rays. The third category, by far the most important from the point of view of dating, consists of the primary radioisotopes of uranium 238, uranium 235, thorium 232, potassium 40, and rubidium 87. Each of these isotopes was

apparently made at the time the elements originated and they are **not** being formed to any significant extent today. All have very long half-lives: the shortest, for uranium 235, is 710 million years, and the longest, for rubidium 87, is 50,000 million years. Shorter-lived isotopes can be made in the laboratory, for example uranium 236, with a half-life of 24 million years; but this isotope is not now found in nature. Were we to assume that it too, had been formed along with the other isotopes, because of its relatively short half-life, it would have completely disappeared in a period of 1 billion years. This fact, that uranium 236 is not now found in nature, is used as confirming evidence that the earth is at least 1 billion years old.

Uranium 238 breaks down into other radioactive elements until it eventually ends up as stable, non radioactive lead 206 and helium, while uranium 235 winds up its series as stable lead 207 and helium, and thorium 232 turns eventually into stable lead 208 and helium. The rate at which each isotopic species of lead is formed from its parent element differs, and hence, the ratios of the various forms of lead to be found in a given uranium bearing mineral sample allow one to compute with a high degree of probability the age of that sample. However, agreement must be reached between the various ratios possible for the results to give us this high probability.

Without going further into the details of the measurement process, and, I might add, these details are most intricate and scrupulously made, let me now give you the results which were obtained at the California Institute of Technology. The oldest ore sample that was analyzed, a uranium-bearing mineral from Southern Rhodesia, proved to have a history dating back 2.7 billion years as a very minimum. Making all possible allowances for factors which could influence the precision of the dating process, the age of the earth must be between 3.1 and 5.6 billions of years.

Higher precision is obtained from the analysis of meteorites. Their study has led the investigators both here and in England to conclude that the most probable age of our solar system is 4.6 billion years. This date is confirmed by a completely separate study based on the analysis of the ratios of isotopic forms of several of the noble gases such as helium, neon, krypton and xenon found entrapped in both terrestrial rock formations and, most importantly, in meteorites of both the metallic and stony variety. Here

again, most meticulous care and precision of measurement has led to the confirming evidence that our solar system is 4.6 billion years old.

Having established the age of our solar system, we now look into the fantastic world of astronomy to see the extent of our whole universe. Here, may I remark, we get in a very true sense, the big picture. From our earthbound vantage point, located in one of the spiral arms of the system of stars making up our galaxy—and we can see part of it as the Milky Way—let us look at the heavens which surround us. When viewed by means of optical and radio telescopes those tiny, twinkling points of light, the stars, which we can see on any clear night, multiply in number. And some, when further magnified, reveal themselves as other star clusters, as other nebulae, as other galaxies. And the vastness of the dimensions, both in number of stellar bodies, and in the distances involved, must make even the minds of the astronomers reel and falter, for they are beyond the comprehension of ordinary minds.

Those whose profession it is to analyze the data of stellar observations tell us that accurate means are available for determining both the distances to the various galaxies and the composition of the elements making up their masses. Also, and here is the chief reason for introducing this topic here, they tell us that the greater the distance to a given star or galaxy, the greater is the velocity with which that body is moving away from us. Strangely, this fact, based on the famous red-shift of the spectra of the stars, holds true regardless of the direction from us. We are, therefore, part of a very rapidly expanding universe whose dimensions are increasing even though there is a universal gravitational force acting to decelerate and reverse the expansion. Does it not seem possible, therefore, that at some remote time in the past our whole universe could have been concentrated at some single, central location, and that it should have, by a giant explosion, been hurled outward into space? Many cosmologists and scientists of note have held, and still do, hold this opinion. Some have even computed the time it should have taken for such an exploding universe to arrive at its present dimensions. Amazingly enough, the computations lead to a time of somewhere between 5 and 6 billion years.

Since I have set a time limit for this talk, I shall not continue with a discussion of the most probable nature of the primitive matter of the universe and how it changed by a fusion process into

all 92 elements of our naturally occurring substances, nor shall I discuss how this fusion process could have yielded the relative abundance of the elements constituting the universe which we find today. These several topics I shall leave for some venturesome successor of mine to discuss with you. And so I come to the conclusion of my address. Lest you imagine that this talk is taking too long, may I remind you that I have just compressed a 6 billion year history into less than 20 minutes!

You must, by now be asking yourselves why I have chosen to discuss a topic such as the foregoing. Well, here is the answer. Our universe had a beginning. It did not always exist. It came into existence at a time which can be fixed with a fairly high degree of accuracy by purely scientific means. Our faith in God recognizes Him as the Creator of our universe, and He has given us the intelligence to reason out the laws He has established for Nature. As scientists, we are deeply concerned primarily with discovering these laws of nature and as teachers, with helping our students to learn them, and, when the opportunity arises, to look beyond the bare, though exciting, facts of science and to see the inevitable implications behind them. As teachers of science we have many opportunities to add, not only to the scientific storehouse of knowledge in our students, but often to add enormously to their whole culture. And there are occasions even when we can help them to a deeper faith in God, whatever their religious creed. Let us, as teachers, never be false to our profession as educators. As students of science, could you not find some time occasionally to quietly think about the deeper meanings beyond the factual information of science? It is just possible that pursuits such as these could contribute in no small way to an improvement in both our scientific and cultural standing in the State of Alabama.

REFERENCES

- BAADE, WALTER, The Content of Galaxies. *Sci. Am.* Sept. 1956. Vol. 195, No. 3.
- GAMOW, GEORGE, The Evolutionary Universe. *Sci. Am.* Sept. 1956. Vol. 195, No. 3.
- OORT, JAN H. The Evolution of Galaxies. *Sci. Am.* Sept. 1956. Vol. 195, No. 3.
- ROBERTSON, HAROLD, The Universe. *Sci. Am.* Sept. 1956. Vol. 195, No. 3.
- SANDAGE, ALLAN R., The Red Shift. *Sci. Am.* Sept. 1956. Vol. 195, No. 3.
- BROWN, HARRISON, The Age of the Elements of the Solar System. *Sci. Am.* Nov. 1960. Vol. 203, No. 5.
- HOLMES, ARTHUR, Principles of Physical Geology. 1945. Ronald Press.

P R O G R A M

FORTIETH
ANNUAL MEETING

of the

A l a b a m a A c a d e m y

of

S c i e n c e

With The

GORGAS SCHOLARSHIP FOUNDATION

And The

ALABAMA JUNIOR ACADEMY OF SCIENCE

APRIL 26-27, 1963

UNIVERSITY OF ALABAMA

Tuscaloosa, Alabama

ALABAMA ACADEMY OF SCIENCE

THURSDAY, APRIL 25

- 6:30 P. M.—Executive Committee Dinner Philips' Restaurant
 8:00 P.M.—Executive Committee Meeting, open meeting
 Walter B. Jones Hall

FRIDAY, APRIL 26

- 8:00 A.M.—Registration Chemistry Building
 9:30 A.M.—General Session Chemistry Auditorium
 10:00 A.M.—
 12:00 Noon—Section Meetings
 I. Biological Sciences Chemistry Auditorium
 III. Geology and Anthropology Board Room
 Walter B. Jones Hall
 IV. Forestry, Geography and Conservation Room 124, Smith Hall
 V. Physics and Mathematics Room 201, Smith Hall
 VII. Science Education Room 224, Smith Hall
 VIII. Social Sciences Room 200, Smith Hall
 IX. Medical Sciences Room 214, Physics Building
 1:30 P. M.—Business Session Chemistry Auditorium
 2:00 P. M.—Section Meetings
 I. Biological Sciences Chemistry Auditorium
 II. Chemistry Room 230, Chemistry Building
 III. Geology and Anthropology
 —Geology Session Walter B. Jones Hall
 —Anthropology Session Room 225, Smith Hall
 IV. Forestry, Geography and Conservation Room 124, Smith Hall
 V. Physics and Mathematics Room 212, Physics Building
 VII. Science Education Room 224, Smith Hall
 VIII. Social Sciences Room 200, Smith Hall
 IX. Medical Sciences Room 214, Physics Building
 4:00—
 5:30 P. M.—Junior Academy of Science Exhibits open to Academy mem-
 bers and the public First Floor, Biology Building
 6:30 P. M.—Joint banquet of Junior and Senior Academies
 Union Ballroom

Host: E. H. SARGENT AND COMPANY

SATURDAY, APRIL 27

- 8:00—
 12:00 Noon—Exhibits of Alabama Junior Academy of Science open to
 Academy members First Floor, Biology Building
 3:00 A. M.—Section Meetings
 I. Biological Sciences Chemistry Auditorium
 IX. Medical Sciences Room 214, Physics Building
 10:30 A. M.—General Session with A.J.A.S. Chemistry Auditorium
 —Presentation of A.J.A.S. Officers and Counselors
 —Presentation of A.A.A.S. Awards
 —Presentation of Award to Outstanding A.J.A.S. Region

- Presentation of Undergraduate and Graduate Research Awards
- Introduction of A.A.S. Officers, 1963-64
- Address: Dr. F. C. Steward, Professor of Botany, Cornell University. Topic: "Carrots and Coconuts: Some Investigations on Growth."

EXHIBITS

- Alabama Junior Academy of Science First Floor, Biology Building
- Gorgas Science Exhibits Room 318, Lloyd Hall
- Commercial Exhibits Room 125, Chemistry Building

GORGAS SCHOLARSHIP FOUNDATION

THURSDAY, APRIL 25

- 4:00-5:00 P.M.—Registration Room 333, Lloyd Hall
 - 5:00 P. M.—Demonstration of exhibits to judges Room 318, Lloyd Hall
 - 6:30 P. M.—Banquet for Gorgas Finalists, Judges and Guests
..... Indian Hills Country Club
 - 8:00 P. M.—Personal interviews of finalists by judges Lloyd Hall
- (Awards will be presented at the Joint Banquet of the Senior and Junior Academies of Science, Friday, April 26 at 6:30 P.M.)

ALABAMA JUNIOR ACADEMY OF SCIENCE

FRIDAY, APRIL 26

- 8:00 A. M.—
 - 12:00 Noon—Registration Biology Building
 - 8:00 A. M.—
 - 12:00 Noon—Preparation of Exhibits Biology Building
 - 10:00 A. M.—Caucus of officers and official delegates
..... Room 102, Biology Building
 - Conference of sponsors and counselors
..... Room 201, Biology Building
 - 10:45 A. M.—Business Meeting Room 102, Biology Building
 - 12:00 Noon—Luncheon for AJAS Executive Committee
..... Philips' Restaurant
 - 12:30 P. M.—Meeting of AJAS Executive Committee Philips' Restaurant
 - 3:00 P. M.—Judging of Exhibits Biology Building
 - 6:30 P. M.—Joint Banquet Student Union Ballroom
- (The Junior Academy Party will be held in the Ballroom immediately following the banquet.)

SATURDAY, APRIL 27

- 8:00 A. M.—Noon—Exhibits on display First Floor, Biology Building
- finalists Room 102, Biology Building
- 8:00 A. M.—General Assembly: presentation of scientific papers by regional
- 9:00 A. M.—Business Meeting Room 102, Biology Building

10:30 A. M.—Joint meeting with Alabama Academy of Science _____
 _____ Chemistry Auditorium
 12:00 Noon—Luncheon for old and new Executive Committees _____
 _____ Philips' Restaurant

SECTION PROGRAMS

10:00 A. M., FRIDAY, APRIL 26

Section I, Biological Sciences

J. Richard Thomson, Vice President

1. **Effects of Magnesium on Growth and Cell Division of *Arthrobacter globiformis*.**
 Rebecca Wolfgang, Catherine Murphy, and Margaret Green, University of Alabama.
2. **Reproductive Isolation and Interspecific Gene Exchange Between Certain Southeastern Hylid Amphibians.**
 John S. Mecham, Auburn University.
3. **Studies of the Mechanism of Action of 6-Mercaptopurine.**
 Jane Golden, Linda Simpson, and L. L. Bennett, Jr., Southern Research Institute.
4. **A Chemically Induced Mammary Adenocarcinoma of the Rat as a Possible Tool in Drug Evaluation.**
 Daniel P. Griswold, Southern Research Institute.
5. **The Effect of 5-Hydroxytryptamine on Gastric Motility in Iproniazid Pretreated Rats.**
 Rebecca Ingle and Kenneth Ottis, Auburn University.
6. **Control of Fireblight and Scab of Apples in Alabama.**
 Urban L. Diener, Auburn University.
7. **Disease Development of *Cercospora* Leafspot on Peanut Plants.**
 James A. Lyle, Auburn University.
8. **Chemical Control of Seed-borne Diseases of Peanuts.**
 James A. Lyle, Auburn University.
8. **Effects of Adrenalectomy and Adrenergic Blockade upon the Cold-Stressed Rat. A preliminary note.**
 Margaret Frady and Kenneth Ottis, Auburn University.

SECTION III, GEOLOGY AND ANTHROPOLOGY

Douglas E. Jones, Vice-Chairman

1. **Nonpenetrative Methods of Prospecting for Coal.**
 Reynold Q. Shotts, University of Alabama.
2. **Notes on the Deposition of the Upper Part of the Warsaw Limestone (Mississippian), Colbert County, Alabama.**
 William Everett Smith, Alabama Geological Survey.
- †3. **Preliminary Study of the Paleocology of a Biofacies of the Lenoir Limestone in Cahaba Valley.**
 Marjorie A. Jackson, Birmingham-Southern College.
4. **Eufaula Bauxite District, Barbour and Henry Counties, Alabama.**
 Otis M. Clarke, Jr., Alabama Geological Survey.

5. **Some Anticipated Lunar Mining Problems.**
Reynold Q. Shotts, University of Alabama.
6. **Intra-Graban Oil Possibilities in Alabama.**
Thomas J. Joiner, Alabama Geological Survey.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

Earl J. Hodgkins, Vice President

1. **Conservation and Use of Alabama's Beauty Along Its Highways.**
Holly Mitchell, Alabama State Highway Department.
2. **Black Root Rot Found in Pine Plantations of the Florida Sandhills.**
Glendon W. Smalley, Southern Forest Experiment Station, U. S. Forest Service.
3. **Recreation Use of the Alabama National Forests.**
Spencer H. Palmer, U. S. Forest Service.
4. **Business Meeting.**

SECTION V, PHYSICS AND MATHEMATICS

Roscoe D. Kelley, Vice President

1. **Polarization Potentials for Electron Scattering.**
W. Ray Garrett and R. A. Mann, University of Alabama.
2. **The Percentage of Time that a Satellite Will Be in the Sunlight.**
R. E. Wheeler, Howard College.
3. **Integral-of-Motion Method For Solution of the Collisionless Boltzmann Equation.**
L. Wood, University of Alabama.
4. **Derivative Relative of a Vector and Some of its Many Applications.**
Rafael M. Fiterre, Athens College.
5. **A Presentation of the Binary System in Elementary Algebra.**
W. L. Furman, S. J., Spring Hill College.
6. **Scattering of Light by Free Electrons.**
R. Jacob, University of Alabama.

SECTION VII, SCIENCE EDUCATION

Room 224, Smith Hall

James M. Boyles, Vice President

1. **The High School Biology Curriculum.**
John Nuss, Cullman High School.
2. **Biological Curriculum Challenges Today.**
Barbara C. Butler, Julius T. Wright School for Girls, Mobile.
3. **An Experiment in Science Scheduling.**
Richard Jones, Indian Springs School, Helena.
4. **New Trends in the Biology Curriculum.**
David J. Cotter, Alabama College.
5. **Demonstrations in Electrostatics.**
G. O. Spencer, Troy State College.
6. **All Aboard for Outer Space and Aero Space.**
T. G. Thom, Boaz High School.

7. **A Recent Symposium on College Natural Areas.**

James M. Boyles, University of Alabama Mobile Center.

SECTION VIII, SOCIAL SCIENCES

Chester W. Hartwig, Vice President

1. **Sex Ratios in College Towns and Elsewhere.**

Roland M. Harper, Alabama Geological Survey.

2. **Further Comments on a Behavioral Model for Ontogeny.**

Eleazer C. Overton and Glen W. Herren, Birmingham.

3. **A Systematic Approach to the Field of Marketing.**

Charles T. Moore and Lyndon E. Dawson, Jr., University of Alabama.

4. **An Appraisal of Soviet Iron Ore Resources.**

Wayne C. Curtis, Auburn University.

5. **Agricultural Land Utilization Policies in the Soviet Union.**

Clifford C. Neilson Auburn University.

6. **Regulation of Trade Practices in the Dairy Industry in the South.**

Lowell E. Wilson, Auburn University.

SECTION IX, MEDICAL SCIENCES

Earl G. Hamel, Jr., Vice President

1. **Regulation of Nucleic Acids by Androgens in Guinea Pig Tissues.**

J. Hill and Charles D. Kochakian, University of Alabama Medical Center.

2. **Some Observations of the Effect of Pyrimethamine on the Oviduct of the Domestic Fowl.**

Norman Jackson, University of Alabama Medical Center.

3. **3 Alpha and 3 Beta Hydroxy-C₁₉-Steroid Dehydrogenases in Kidney and Liver.**

Yugo Aoshima and Charles D. Kochakian, University of Alabama Medical Center.

4. **Job Sobieski Weatherly.**

Emmett B. Carmichael, University of Alabama Medical Center.

5. **Urinary Excretion of 17-Ketosteroids and Individual Metabolic Patterns.**

Frieda L. Meyer, University of Alabama Medical Center.

6. **Charles Adolph Mohr.**

Emmett B. Carmichael, University of Alabama Medical Center.

2:00 P.M., FRIDAY, APRIL 26

SECTION I, BIOLOGICAL SCIENCES

J. Richard Thomson, Vice President

1. **Salamanders of the Genus *Gyrinophilus* in Alabama.**

Ronald A. Brandon, University of Alabama.

2. **The Separation of Fecal and Renal Products in Birds.**

J. R. Howes, Auburn University.

3. **Encircling Roots.**

Roland M. Harper, Geological Survey of Alabama.

4. **Cytological Studies in the Genus *Gardenia*.**

Rebecca Deramus, University of Alabama.

5. **Recessive Epistasis in Flower-Color Inheritance in *Vicia sativa*.**

Edward M. Clark, Auburn University.

6. **Inhibition of Resting Cells of *Escherichia coli* by Azaserine.**
Annie Jo Narkates and Robert F. Pittillo, Southern Research Institute.
7. **Methods for Evaluating Radiation—Modifying Compounds in Microbial Systems.**
Carolyn Moncrief and James Burns, Southern Research Institute.
8. **Evaluation of Some Radiation—Modifying Compounds in Microbial Systems.**
John Paul Garcia and Robert F. Pittillo, Southern Research Institute.
9. **New Records of *Anzia ornata* in North America.**
Herbert A. McCullough, Howard College.
- *10. **Method for Production of Inoculum of *Cercospora arachidicola*.**
K. E. Landers, Auburn University.

SECTION II, CHEMISTRY

Robert H. Garner, Vice President

1. **Determination of Resorcinol in the Presence of Phenol.**
Robert E. Daniel and James L. Kassner, University of Alabama.
2. **Polarography of Radioactive Thallium.**
Robert A. Culp, University of Alabama.
3. **Determination of Nickel with 2, 3-Quinoxaline Dithiol.**
Arthur F. Findeis, University of Alabama and R. W. Kiser, Kansas State University.
4. **Characterization of Some Silazanes by Proton Magnetic Resonance.**
Martha C. Thorpe, Southern Research Institute.
5. **Some Attempted Reactions of Diazo Compounds with 1-Ethoxyvinyl Acetate.**
Robert H. Garner and James C. Franklin, University of Alabama.
6. **Gas Analysis by Geiger Pulse Attenuation.**
Fred Williams, University of Alabama.
7. **Surface Tension Lowering of Aqueous Solutions of Organic Substances.**
Alan Hisey, University of Alabama.
8. **Differential Thermal Analysis of Oxalato-Niobic(V) Acid.**
Raymond W. Conrad and James E. Land, Auburn University.

SECTION III, GEOLOGY AND ANTHROPOLOGY (GEOLOGY SESSION)

Douglas E. Jones, Vice Chairman

1. **Business Meeting.**
- †2. **Paleocology of the Little Oak Facies of the Amended Lenoir Limestone.**
F. Kenneth McKinney, Birmingham-Southern College.
3. **Geology of the Pisgah Dome, Limestone County, Alabama.**
Thomas W. Daniel, Jr., Alabama Geological Survey and Earl L. Hastings, Eufaula.
- †4. **A New Method for the Correlation of Carbonate Rock Sequences.**
Paul Dowling, Birmingham-Southern College.
- †5. **Ecological Implications of Certain Rhizoconcretions.**
Dennis Burdick, Birmingham-Southern College.
6. **Geology of Wolf Ridge, Mobile County, Alabama.**

George F. Brockman, Mobile, Alabama.

7. **Clay Mineralogy of an Acid and an Alkaline Clayey Montmorillonitic Soil of the Black Belt Region of Alabama.**

B. F. Hajek and J. B. Dixon, Auburn University.

SECTION III, GEOLOGY AND ANTHROPOLOGY (ANTHROPOLOGY SESSION)

A. T. Hansen, Vice President

1. **Business Meeting.**
2. **Fluted Projectile Points from a Stratified Site in Marshall County, Alabama.**
David L. DeJarnette, University of Alabama.
3. **Some Relationships within Early Archaic Projectile Point Types.**
Oscar W. Brock, University of Alabama.
4. **A Western Intrusion of the Georgia Complicated Stamping Tradition.**
L. Ross Morrell, University of Alabama.
5. **An Archeological Survey of the Holt Lock and Dam Area.**
Joseph L. Benthall, University of Alabama.
6. **Anthropology and Counter Insurgency.**
Paul H. Nesbitt, Research Studies Institute, Air University.
7. **Alphabet and Speech: A Study of the Relations Between Graphic and Phonological Symbolism.**
James R. Jaquith, University of Alabama.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

Earl J. Hodgkins, Vice President

1. **How the Soil Conservation Service Classifies and Evaluates Forest Sites in Alabama.**
Meredith A. Peters, Soil Conservation Service.
2. **The Cattle and Cotton Production of Dallas County.**
Hazel Latendress Stickney, Livingston State College.
3. **The Atlantic Littoral as an Influence in Our National Development.**
Leon McCluer, Jacksonville State College.
4. **A Study of a Proposed Natural Area in Lee County.**
Philip E. Hodgkins, Auburn University.
5. **Challenge of the Branch Bottoms in Gulfcoast Longleaf Forests.**
Tom Croker, Southern Forest Experiment Station, U.S. Forest Service.
6. **Paleobotany in Alabama.**
H. O. Beals and B. C. Smoot, Jr., Auburn University.

SECTION V, PHYSICS AND MATHEMATICS

Roscoe D. Kelley, Vice President

1. **Special Transmission Properties of Spinach Chloroplasts.**
Dudley Bryant, Auburn University.
2. **Positronium Decay in Cholesteryl Acetate.**
G. D. Cole and William W. Walker, University of Alabama.
3. **Electrostatic Quadrupole Lens.**
Shih-yung Hsieh, Auburn University.

4. **Atomic Collisions With Crystal Surfaces.**
C. M. Chambers, University of Alabama.
5. **A New Technique For Solving the Linear Harmonic Oscillator Problem.**
Cecil Milton King, Auburn University.
6. **Fracture In Solids.**
Lynn Phillips, Cloverdale Junior High School, Montgomery.
7. **Ionic Waves In A Cylindrical System.**
Louis Patrick, Auburn University.
8. **Elastic Waves In An Infinite Continuum Due To An Arbitrary Point Force.**
E. T. Kinzer, University of Alabama.

SECTION VII, SCIENCE EDUCATION

James M. Boyles, Vice President

INTRODUCTORY COLLEGE BIOLOGY—A SYMPOSIUM

1. **Background of the Discussion—James M. Boyles, University of Alabama Mobile Center.**
2. **Presentation of Panel Members—Verda Horne, University of Alabama Mobile Center.**
Panel: Patrick Yancey, S. J., Spring Hill College
William T. Wilks, Troy State College
Joab L. Thomas, University of Alabama
Mary Jane Brannon, Huntingdon College
Paul Bailey, Alabama College

SECTION VIII, SOCIAL SCIENCES

Eleazer C. Overton, Vice Chairman

1. **Selection of Lee County, Alabama by the United States Rubber Company.**
H. Ellsworth Steele, Auburn University.
2. **Impact of the United States Rubber Company Plant on Lee County, Alabama.**
Homer S. Fisher, Jr., Auburn University.
3. **Socio-Economic Environmental Forces in Economic Development.**
E. D. Chastain, Jr., Auburn University.
4. **Karl Mannheim and the Sociology of Knowledge: A Scientific Investigation of Values.**
Richard M. Owsley, Auburn University.

SECTION IX, MEDICAL SCIENCES

Earl G. Hamel, Jr., Vice President

1. **Proliferation in the Adrenal Gland of the Male and Female Rats Studied with the Aid of Radioautographs.**
Thomas E. Hunt and Eleanor A. Hunt, University of Alabama Medical Center.
2. **Theoretical Basis for Presence of Competent Antigens in Autochthonous Neoplasms.**
J. D. Emerson and G. M. Emerson, University of Alabama Medical Center.
3. **A Comparison of Conditioned and Sensory Motor Learning of Identical Flexion Responses in Nearly Identical Learning Situations.**

J. D. Emerson, University of Alabama Medical Center.

4. **Determination of Acetyl Cholinesterase Activity in Small Amounts of Mammalian Nerve Tissue.**
M. Kline Hamlett and G. M. Emerson, University of Alabama Medical Center.
5. **Standardization of TSH Testing.**
O. David Taunton, V. A. Hospital and University of Alabama Medical Center.
6. **The TSH Activity of Thiols.**
William M. Shannon, Veterans Administration Hospital, Birmingham.
7. **Amino Acid Transport in Thyroid Glands.**
Albert F. Debons, Veterans Administration Hospital, Birmingham.

SECTION I, BIOLOGICAL SCIENCES

8:00 A.M. SATURDAY, APRIL 27

J. Richard Thomson, Vice President

1. **A Proposed Revision of the Monogenetic Trematode Family Microcotylidae Taschenberg.**
Emmett W. Price, Jacksonville State College.
2. **The Japanese Beetle.**
C. M. Farmer, Troy State College.
3. **The Effects of High Environmental Temperatures Upon Avian Nutrition.**
J. R. Howes, W. Grub and C. A. Rollo, Auburn University.
4. **Environmental Factors Affecting Ovaluation in Coturnix Quail.**
J. R. Howes, Auburn University.
5. **Storage of Experimental Neoplasms at -76°C.**
Jack H. Moore, Charles A. Kelley, and Gail Yerby, Southern Research Institute.
6. **Studies on the Variation of a Population of the Lancelet Branchiostoma Caribaeum From Tampa Bay, Florida.**
William M. Howell, University of Alabama.
7. **Fungitoxic Effects of High-and-Low-Organic Soils on Sclerotium rolfsii.**
E. A. Curl, Auburn University.
8. **Root and Crown Disease of Coastal Bermuda Grass in Alabama.**
Robert T. Gudauskas, Auburn University.
9. **Hydraulic Pressure and Nematodes.**
Eldon J. Cairns, Auburn University.
10. **Acid Production by a Fungus Growing on Peanut Meal.**
Norman D. Davis, Auburn University.

SECTION IX, MEDICAL SCIENCES

Earl G. Hamel, Jr., Vice President

1. **Olfactory Bulb, Accessory Olfactory Bulb and Hemisphere in Some Anurans.**
Henry H. Hoffman, University of Alabama Medical Center.
2. **The Olfactory Bulb and its Connection in the Opossum.**
Earl G. Hamel, Jr., University of Alabama Medical Center.
- *3. **The Histologic Structure of the Ligaments Supporting the Longitudinal Arch of the Human Foot.**

Jan Eagles, University of Alabama Medical Center.

- *4. **The Venous System of the Head and Neck of the Rhesus Monkey.**
George F. Martin, Jr., University of Alabama Medical Center.

*This paper is an entry for the graduate student research award.

†This paper is an entry for the undergraduate student research award.

FALL EXECUTIVE COMMITTEE MEETING

University of Alabama Medical Center

December 8, 1962

The meeting was called to order at 9:30 a.m. The following were present: Louis J. Eisele, S. J., presiding, William J. Barrett, John L. Baswell, Reuben Boozer, Herbert Boschung, James M. Boyles, Mrs. George Countryman, David J. Cotter, W. B. DeVall, Urban L. Diener, Robert H. Garner, C. C. Hall, Roscoe D. Kelley, Margaret S. Klapper, James E. Norman, Eleazer C. Overton, Edward L. Robertson, Carl Sensenig, G. O. Spencer, J. Richard Thomson, George O. Twellmeyer, S. J., Ruric E. Wheeler.

The minutes of the Spring Executive Committee Meeting held April 19, 1962, at Troy were read by the Secretary. After corrections were made, the minutes were approved as mailed to members of the committee.

REPORT OF PRESIDENT (EISELE). At the Annual Business Meeting of the Academy, April 20, 1962, at Troy State College, the place and date of the forthcoming annual meeting of the Academy was decided and unanimously approved. The place selected was the University of Alabama, and the date, April 4-6, 1963. During the summer Dr. Boschung informed me that the University had previously arranged to have Band Week at the University during this time. The great numbers of high school students who would be on campus at this time seemed then to warrant a possible change in the date of the Academy meeting. After consultation with the past president, Dr. Bailey, to find out if the President could make a decision on this matter without consulting entire membership of the Executive Committee, and because the matter was urgent, I agreed to change the date of the annual meeting. The most satisfactory date which could be found and the one agreed upon by the University is now set as the 25-27 of April, 1963. Our Secretary was notified of the change. On November 3 your President met with the members of the Local Arrangements Committee at the University of Alabama to set up plans for the annual meeting. The plans follow in general outline the same procedures worked out for the last annual meeting by our past president, Dr. Paul Bailey. We then met with the Executive Committee of the Junior Academy to coordinate the annual

meeting. At this meeting it was learned, and unfortunately so, that the late date of the annual meeting would make it impossible for the Finalists of the Science Fair competition to exhibit their projects during the meeting. We sincerely regret this, and hope that it may not happen again in the future. A vote was taken at the Junior Academy meeting to have their annual banquet with that of the Senior Academy. A rider, however, was attached to this vote; namely, that the affairs of the banquet, presentation of awards, speeches, and especially the address of the President be streamlined. An attempt will be made to abide by their sensible request.

Dr. Smith of Auburn University has secured the services of Dr. F. G. Steward of Cornell University for the purpose of addressing a joint meeting of the Junior and Senior Academies at a general session on Saturday morning to close the Annual Meeting in April. This lecture should be one of the high points of the annual meeting and is sponsored by the American Institute of Biological Sciences. It will be financed as an NSF-AIBS visiting lecturer contribution.

Your President attempted to appoint members to the many standing committees of the Academy and met with acceptance from most of those named. Chairmen of two committees are still lacking, one because the appointee is no longer in Alabama, and the other appointee no longer a member of the Academy. New appointees will be sought in the immediate future.

Lapses and errors in the carrying out of the many duties of the office of President could be ascribed to various causes; some personal, others not. Your President would like to place the blame on the government since he is now director of a government-sponsored seismic observatory. This job has added no little demand on his time and this, coupled with the normal occupations of a physics professor leave small opportunity to devote the necessary time and thought to Academy affairs.

The tentative schedule of activities planned for the 1963 annual meeting was distributed. It included activities of the Academy, the Junior Academy, and the Executive Committee, and was approved.

REPORT OF SECRETARY (DeVALL). The Academy is indebted to Dr. Ralph B. Draughon, President, Auburn University for the continued financial contribution for secretarial assistance that made it possible for your secretary to continue for another 3-year term. Mrs. Margaret Murphy has handled the clerical duties of the secretary's office working on a part-time basis.

Since the spring meeting of the Executive Committee, the secretary has handled applications for membership, 2) correspondence with members, officers, committee chairmen, AAAS, and others, 3) minutes of the spring meeting, and 4) revision of the By-laws. The minutes of the Spring Executive Meeting and the revised By-laws were distributed to the officers of the past year and those currently serving. A copy of the minutes of the Annual Business Meeting was mailed to the voting membership. All newly elected vice presidents received a letter congratulating them on their election. Each also received a summary of duties.

Vice presidents of the Biological Sciences and Medical Sciences sections were sent a copy of the resolution relative to legislation designed to control the use of experimental animals. Copies of letters received from all members of the Alabama Congressional delegation were routed to the chairmen of these two sections for information.

The secretary serves as a liaison officer of the Academy and handles correspondence with the AAAS and the Academy Conference. Information about the program of the Alabama Academy has been sent the AAAS for publication in *SCIENCE* and the *GENERAL PROGRAM*. All members of the Alabama Academy who are also Fellows in the AAAS are now so identified on the membership list kept by the secretary. A complete list of Alabama Academy members who are members of the AAAS was obtained. Your committee on Admission to Membership reviewed the list. It recommended 15 members for advancement to the grade of Fellow in the AAAS. Information on the Alabama Academies financial structure, program of activities, and NSF-grant program has been sent to the Academy Conference on response to written requests.

An advance planning meeting for the 1963 Annual Meeting was held in Tuscaloosa, November 3. The agenda for the meeting will be presented by the president at this meeting for your approval.

The following members of the Academy are now deceased, since April 1962, according to the records of the secretary: Dr. Paul Irvine and Dr. Gordon B. Mainland.

The secretary, on behalf of the Academy, wrote P. H. Yancey, S.J., congratulating him on his Golden Jubilee. Other Academy officers were asked to write similar letters.

Your secretary has served in a liaison capacity between the Academy and Auburn University's School of Agriculture and Agricultural Experiment Station. Special news items were submitted for the *NEWSLETTER*. Arrangements have been made for an internationally known scientist to speak at the joint session of the AAS and the AJAS in April 1963. Dr. E. V. Smith, Dean and Director, has been instrumental in making arrangements with Dr. F. C. Steward, Professor of Botany, Cornell University.

Letters of appreciation were sent to Dr. H. A. McCullough and Mr. C. D. Whitt for their services as Coordinators of Regional Science Fairs in the Central and North regions respectively.

The list of Exchange titles, as provided by the Archivist, was included in the *NEWSLETTER* for the fall quarter, 1962.

REPORT OF TREASURER (BARRETT.)

	AMOUNT RECEIVED	1962 BUDGET AMOUNT
RECEIPTS		
Membership Dues	\$2,309.00	\$2,715.00
Gifts and Contributions	60.00	50.00
Sale of <i>Journal</i>	7.50	10.00
Annual Meeting		
Registration Fees	330.00	

E. H. Sargent and Co.	208.46		
Banquet Tickets	<u>24.00</u>	562.56	300.00
Interest Earned		59.03	
Total Receipts		<u>\$2,997.99</u>	<u>\$3,075.00</u>
EXPENDITURES		AMOUNT EXPENDED	1962 BUDGET AMOUNT
Publication of <i>Journal</i>		\$ 454.50	\$ 900.00
Publication of History		—	500.00
Assistance to AJAS			
Cups	158.80		
Pins, frames, etc.	21.06		
Contributions to AJAS			
Budget	100.00		
AJAS Newsletter	<u>75.00</u>	354.86	400.00
Student Awards		150.00	100.00
Research Grants		150.00	400.00
Academy Conference Assessment		11.54	10.00
Annual Meeting			
Banquet	253.48		
Programs and other expense	<u>152.35</u>	405.83	300.00
Operating Expense			
Office of President	—		100.00
Office of Secretary	219.06		200.00
Office of Treasurer	37.97		
Office of Editor	90.64		150.00
Office of Coordinator of Science Fairs	50.00		50.00
Office of Permanent Counselor to AJAS	37.30		75.00
Newsletter	<u>66.18</u>	500.97	100.00
Total Expenditures		<u>\$2,027.70</u>	<u>\$3,285.00</u>

SUMMARY

BALANCE, January 1, 1962		\$1,193.04
Receipts		2,997.99
	Total	<u>\$4,191.03</u>
Expenditures		\$2,027.70
Balance, December 1, 1962		
Savings Account	1,131.46	
Checking Account	1,031.87	2,163.33
	Total	<u>\$4,191.03</u>
Excess of Receipts over Expenditures for period January 1, 1962 to December 1, 1962		\$ 970.29

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NATIONAL SCIENCE FOUNDATION GRANT NO. G-22268

Amount of Grant, received July 13, 1962		\$8,200.00
Expenditures		
Secretary's Salary	399.10	

Visiting Scientist Expense	385.28	
Supplies, Printing, Postage	248.31	
Conference Expense	295.83	
Total Expenditures		1,328.52
Balance, December 1, 1962		<u>\$6,871.48</u>

REPORT OF COUNCILOR OF AAAS (EISELE FOR YANCEY). Councilor Yancey plans to attend the AAAS Conference to be held in December at Philadelphia, Pennsylvania. A more complete report will be given at the Spring Meeting of the Executive Committee.

REPORT OF EDITOR OF THE *JOURNAL* (HALL). Materials to be included in the January and April issues of 1962 are prepared for the printer. It is hoped that the printer will be agreeable to doing the January and April issues of 1962 at the same time as a larger issue under one cover but indicated as numbers 1 and 2 with separate tables of contents. An insert will notify librarians of the two numbers under one cover. These two numbers contain only papers and the membership list. Handling two issues in this manner should save some time.

Authors of abstracts and articles included in the October 1961 issue have been notified to order reprints. Page proofs of articles have been mailed to authors and most have been returned to the editor. Page proofs of abstracts were not mailed to authors this time in order to conserve time in processing these materials. It usually takes several days to get sixty or more abstracts to and from the authors. In the future, however, page proofs of abstracts will be mailed to the authors if they wish to see them.

The October 1961 issue of the *Journal* will be mailed very soon. Completion of the index for volume 32 is essentially all that is lacking.

REPORT OF PERMANENT COUNSELOR OF THE JUNIOR ACADEMY (SPENCER). The Executive Committee of the Alabama Junior Academy of Science held its annual Fall meeting on November 3, 1962, with Dr. Gibbs Patton, local counselor of AJAS, on the University campus. The meeting was called to order by the president, Mr. Winston Long. All officers and sponsors, four regional counselors (Miss Clustie McTyeire, Mrs. Ibbie Bradford, Dr. Harold Strickland, and Mrs. Ruby Countryman), along with Permanent Counselor G. O. Spencer, and Associate Counselor Dr. Reuben Boozer were in attendance. Other members of the Senior Academy present were Louis J. Eisele, S.J., President of the Senior Academy; and Dr. Herbert T. Boschung, chairman of local arrangements for the Senior Academy. Other persons attending were members of the local chapter of the AJAS and their sponsors.

The following items of importance were discussed and the decisions are given herein:

(1) The Newsletter should continue. It was reported that one copy of the Newsletter had already gone to every high school in Alabama. The Junior Academy asked that the Senior Academy help bear the cost of the Newsletter as they did last year.

(2) The Junior Academy requests that a joint banquet be held with the Senior Academy during the state wide meeting. The Junior Academy, with the idea in mind that banquet tickets this year will cost more than

last year, asked that the Senior Academy help with the cost of the Junior Academy banquet tickets.

(3) It was recommended that a combined meeting for members of the AJAS and the AAS should be held on Saturday morning. It was recommended that awards for both the Junior Academy and the Senior Academy be presented at this meeting if possible. This kind of a procedure would tend to shorten the program at the banquet.

(4) It was recommended that seven categories as used by the National Science Fair be used in the Junior Academy exhibits. It was recommended that the first and second place winners in the categories from each of the Regional Science Fairs be invited to participate in the showing of exhibits. In addition, each school should be permitted to present a group exhibit in these categories or present group exhibits.

(5) The following budget to be underwritten by the Senior Academy is submitted for action of the Executive Committee:

I. Awards at the annual convention:

- (a) cups for exhibit and papers—nine first place cups and two second place cups, \$175.
 - (d) pens, guards, etc., \$35.
 - (c) AJAS Newsletter, \$75.
 - (d) pens, guards, etc., \$35.
 - (e) contributions to AJAS, \$100.
- TOTAL \$410.

ALABAMA JUNIOR ACADEMY OF SCIENCE BUDGET, 1962-63

RECEIPTS

1.	Expected dues and sale of membership cards	\$200.00
2.	Expected registration at convention	200.00
3.	Received from A.A.S.	<u> </u>
	TOTAL	\$400.00

EXPENSES

1.	Annual Convention	\$100.00
2.	Printing Program	50.00
3.	Supplies	40.00
4.	Engraving, lettering, and pins	20.00
5.	Postage and telephone	40.00
6.	Newsletter	75.00
7.	President	15.00
8.	Secretary	10.00
9.	Treasurer	15.00
10.	Miscellaneous	5.00
11.	Vice President	10.00
	TOTAL	<u>\$380.00</u>

A motion that died for lack of a second would have authorized the Academy to budget and allocate a fixed amount of money during 1963 to support the banquet of the Junior Academy. The Executive Committee agreed that the Academy would not make a financial contribution to the Junior Academy for its 1963 banquet.

It will support the awards for the Junior Academy in an amount not to exceed \$410.00.

REPORT OF COORDINATOR WITH SCIENCE CLUBS OF AMERICA (WHEELER). The Visiting Scientists Program made possible by a grant from the National Science Foundation has been publicized through a printed brochure. Members of the Academy willing to participate as visiting scientists should complete a data sheet. The National Science Foundation has approved payment of the expenses incurred by judges at Science Fairs and at the Junior Academy's annual convention. The Visiting Scientists Program has been used to advertise the work of the Junior Academy of Science, the program of the Regional Science Fairs, and the free information that can be obtained from Science Clubs of America. At this date, 49 visits have been made by the visiting scientists; 29 visits are scheduled; and 10 visits are in the process of being scheduled.

REPORT OF COORDINATOR OF REGIONAL SCIENCE FAIRS (TWELLMEYER).

NATIONAL SCIENCE FAIR-INTERNATIONAL—The 1963 National Science Fair-International will be held in Albuquerque, New Mexico, May 5-12, 1963. It will be recommended to the Regional Coordinators that hotel reservations for the Fair be made at an early date with a desirable hotel to avoid the difficulties encountered last year in Seattle. It will also be recommended that a definite number of rooms be reserved for the Alabama delegation in the headquarters hotel, if possible, even though a deposit must be made.

FINALIST'S EXHIBITS—In last year's report of the Coordinator of Science Fairs, it was recommended that the annual meeting of the Academy be held at a date not later than the second weekend in April in order that the Finalists of the Regional Fairs be able to exhibit their projects. The date of the meeting of the Academy which was set for April 4-6, 1963, having been twice deferred, it has again been made impossible for the Finalists to exhibit, since their projects must be shipped to the National Fair before the meeting of the Academy.

STATE SCIENCE FAIR POSTER—The Committee on Regional Science Fairs, at its meeting of April 19, 1962, determined to continue the use of a uniform poster for all Regional Fairs of the State. The printing and distribution of this poster has been delayed, however, by the last minute objection of the Northeastern and Southeastern Regions. It is hoped that agreement can be reached at the meeting of the Committee on Regional Science Fairs that is to meet immediately following this meeting. It is hoped that the practice of issuing a state poster for Regional Fairs can be continued.

COORDINATOR—NORTH REGIONAL SCIENCE FAIR—Mr. Phillip M. Mason, Director of the University of Alabama Huntsville Center, was appointed Coordinator, pro-tem, of the North Region. The coordinating committee of this Region, under his chairmanship, nominated Mr. James E. Norman, Sr., Research Projects Manager at Redstone Arsenal, as Coordinator for the Region. Mr. Norman has been appointed.

SOLICITATION OF FUNDS FROM STATEWIDE INDUSTRIES—Although the Committee on Regional Science Fairs determined to make one appeal to Statewide Industries for a contribution to all Regional Fairs,

first the objection of the Southeastern Region last year and the change in method of financing of the Mobile Region for this year may render this undesirable. It is hoped that a final solution will be found at the next meeting of the Committee.

REGIONAL REPORTS—Reports have been received for 1962 from the Mobile, Northeastern, and Southeastern Regional Science Fairs. Reports from the Central and North Regions have probably not been received because of a change in the Coordinators of these Regions. The three Regions reporting place a limitation on the number of exhibits that may be entered from any school in the Region. The Mobile Region reports 388 exhibits from 36 participating schools. The Northeastern Region 287 exhibits received from 54 schools and the Southeastern Region reports 376 exhibits from an undesignated number of schools. The Mobile and Southeastern Regions report a cash balance carried over after the operation of this year's fair. The cost of operation of the Northeastern Regional Fair has not been determined at the time the report was made. Copies of correspondence from Science Service with the Southeastern Region indicate that there is a possibility that this Region may not continue its contract with National Science Fair-International. No report has been received from the Region regarding this matter.

A suggested policy to govern the judging and awards for the Alabama Regional Science Fairs was proposed by Twellmeyer.

A SUGGESTED POLICY ON JUDGING AND AWARDS

FOR

ALABAMA REGIONAL SCIENCE FAIRS

1. There shall be a Director of Judging and Awards provided in the administration of each Regional Fair in Alabama who is responsible to the Alabama Academy of Science through the Regional Coordinator for the carrying out of the policies of the Academy and of the National Science Fair-International with regard to judging and awards for the Regional Fair.
2. The policies of the Academy are those outlined in Volume 31 of the Journal of the Alabama Academy in which the Sponsorship of Regional Fairs is outlined and defined and those established by the Committee on Regional Science Fairs of the Academy. The right of appeal to the Executive Committee of the Academy by any coordinating institution of the Region, as set forth in Volume 31, is to be preserved.
3. The Director of Judging and Awards (with a judging committee composed of the chairmen of the judging panels) shall provide judging panels of not less than three judges for each category of exhibits accepted by the Regional Fair. These judges shall be competent in the area of mathematics and/or science pertinent to the category of exhibits that they are to judge.
4. The Director of Judging and Awards shall provide for an Appeals Board of not less than five members who are not associated with the Regional Fair Administration. They are to be of recognized ability and integrity. It will be the duty of this board to decide all cases of doubt

regarding the qualification of an exhibit entered in the Regional Fair, to act upon an appeal from the judgment of a particular panel in disqualifying or qualifying an exhibit and to judge whether an exhibit merits the award in question, if the judging panel should be in doubt.

5. The Director of Judging and Awards, in the event that the Region has a contract with Science Service for the National Science Fair-International, shall provide that the chairman for the various judging panels in the senior division of the Regional Fair shall be constituted a Finalist Award Panel whose duty it shall be to select the Finalists to the National Science Fair-International, if in the opinion of those judges the exhibits should so merit.

6. Reserving the right of appeal by an exhibitor or teacher-sponsor regarding the qualification of an exhibit, the decision of the judging panels will be final. The Board of Appeals shall be the only judge of the right of appeal and their decision shall be final.

7. The Director of Judging and Awards shall certify to the Regional Fair Administration, with the approval of the Chairman of the Board of Appeals, the decisions of the judging panels regarding awards. This certification shall be binding.

8. The Norms of Judging for all Regional Science Fairs in Alabama shall be those established by Science Service for judging the National Science Fair-International.

160. Motion by Twellmeyer, seconded by Barrett that the Executive Committee of the Alabama Academy recommend the proposed statement of policy regarding the judging and awards for Regional Science Fairs to the Committee on Regional Science Fairs for its adoption at its next meeting. The maker of the motion and the second agreed to a revision of wording in section 3 shown in parenthesis in the preceding policy statement. Motion passed.

161. Motion by Twellmeyer, seconded by Wheeler that the Executive Committee of the Alabama Academy of Science commend H. R. 11711, a Bill to Incorporate Science Service, Inc. for the purposes indicated by Public Law 85-875. That it recommend that the Bill be reintroduced and passed by the House of Representatives and Senate of the Eighty-Eighth Congress. That a copy of this resolution be sent to Science Service, Inc., 1719 N. Street, N. W., Washington, D. C., to Mr. Gordon B. Fister, Chairman, National Science Fair-International Council, Call-Chronical News Papers, Inc., Allentown, Penna., and to the United States Senators and Representatives from Alabama with a request that they work with the Hon. Francis E. Walter, author of the Bill, for its passage by the Eighty-Eighth Congress. Motion passed.

The Secretary was instructed to transit copies of Motion 161 to the respective persons named therein.

162. Motion by Twellmeyer, seconded by Thomson that the

Executive Committee approve the revised Constitution of the Alabama Junior Academy of Science as published in the Newsletter of the AJAS and as amended in the *Journal* of the Academy, Vol.30, No. 1, page 62 (July 1958) and Vol. 31, No. 1, page 68 (July 1959), and cause same to be printed in the *Journal* of the Academy. Motion passed.

Reports of Section Vice-Presidents:

SECTION I, BIOLOGICAL SCIENCES (THOMSON). In an effort to promote increased membership in the Biological Sciences Section and to encourage attendance and participation in the Section meeting of the annual Academy meeting in April, we plan to mail a letter within a few weeks to all heads of departments of biology in the colleges and universities of the state. Some thought has been given to the organization of a botany or zoology field trip at the conclusion of the presentation of papers of the Section meeting. It is suggested that one of the members of the Department of Biology at the University of Alabama might be willing to take this responsibility, since they are familiar with their own locality.

SECTION II, CHEMISTRY (GARNER). Some thought has been given to the relative lack of interest in presenting papers in chemistry at the annual meeting of the Academy. One apparent reason for this situation is that investigations in chemistry are seldom concerned with problems of special local interest as is the case with some research in areas such as biology or geology. To offset this disadvantage several suggestions have been considered. Two of these are: (1) encouragement of members at academic institutions to present papers concerned with small research projects undertaken by undergraduate students in connection with the numerous undergraduate research participation programs that have been inaugurated; and (2) inviting some papers to be presented on results of special programs in chemical education such as undergraduate research programs, honors programs, television teaching, programmed instruction, etc. All members are urged to encourage their colleagues in chemistry to participate in next annual meeting.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION (DEVALL FOR HODGKINS). A proposed theme for the program is "The Forests of Alabama—Recent and Current Studies." Over 60 per cent of Alabama is covered by forests, forests that are made up of a great many ever-changing associations of trees, other plants, and animals. The development of the proposed theme will constitute no less than a state-wide survey of the formal studies of these forests that have been conducted very recently or that are being conducted currently. Emphasis will be placed on *what* is being studied and on what *needs* to be studied rather than on results, although results will not be ignored. It is proposed that the program be developed through a poll of agencies and individuals who might be conducting the appropriate studies. Those who are doing work on the forests will be asked to report on what they are doing. The Chairman or a moderator will report on the overall results of the survey. Emphasis will be placed on obtaining reports from non-forestry workers,

such as from geographers and botanists. The intent is to develop an interdisciplinary program.

SECTION V, PHYSICS AND MATHEMATICS (KELLEY). During early January, letters and application forms will be mailed to the Chairman of each Physics and Mathematics Department of all colleges and universities and to certain other businesses and groups located in Alabama inviting membership.

During the last part of January letters will be mailed to members of the Physics and Mathematics Section of the Alabama Academy of Science inviting those members who would like to submit papers or sponsor papers to be presented at the annual meeting to notify the Vice-President of the Physics and Mathematics Section with the title of the paper to be presented and the name of the persons who will make the presentation. At a later date the paper must be sent to the Vice President to be read and approved by a special committee. Follow-up letters will be mailed as necessary.

A tentative program of the Physics and Mathematics Section will be formulated, printed, and distributed to the membership of the Physics and Mathematics section of the Alabama Academy of Science by mail at least two weeks before the annual meeting date or as soon as it is ready for the Secretary.

SECTION VII, SCIENCE EDUCATION (BOYLES AND COUNTRYMAN). Following the general meeting at Troy State College the vice-chairman, Mrs. Ruby Countryman, and I met with several professors who expressed interest in science education. A number of suggestions were made which may prove to be helpful in obtaining speakers for this year's program. In August, 1962, I contacted approximately thirty science teachers attending a National Science Foundation biology course at the University of Alabama. A cordial invitation to participate in our program was extended, and two teachers indicated an interest. One of these, John Nuss, Cullman High School, has written confirming his proposed topic. Dr. Gibbes Patton, Department of Biology, University of Alabama, has contacted Miss Virginia Nancarrow, who teaches high school science in Birmingham, and who will report on the Biological Sciences Curriculum Study in Boulder, Colorado. Following this meeting Mrs. Countryman and I will again meet to agree on a specific plan of action.

The Science Education Section is making a special effort to encourage more active participation in its section of the complimentary members of the Alabama Academy of Science. As many of these complimentary memberships are held by virtue of the fact they are sponsors of Junior Academy Chapters, we feel their greatest interest should be in this section. Emphasis is being placed on these members registering at the annual meeting and paying the registration fee.

SECTION VIII, SOCIAL SCIENCES (OVERTON). As Vice-Chairman, I have acquainted myself with the duties of the office and the minutes of the last Executive Committee Meeting. I will cooperate with the Section Vice-President in developing an interesting program for the coming annual meeting in April, 1963. It is my desire that we enlarge the membership of our section this year and try to develop a greater participation of our members in the program of the Academy and its annual meeting.

It is indeed a privilege and inspiration to be asked to serve as an officer of the Alabama Academy of Science and I will do all I can to promote its program. I have enjoyed the fellowship and information received at the meetings I have attended and feel sure that there are many other men of science in our State who would benefit by becoming a member of the Academy.

Reports of Chairmen of Standing Committees:

RESEARCH COMMITTEE (DIENER). One research grant has been awarded and one request for a grant is pending.

ADMISSION TO MEMBERSHIP COMMITTEE (DEVALL).

Total Membership December 31, 1961	593
New applications Approved in 1962	61
Reinstated Individual Members	2
New Complimentary Members	45
Total	108

Section	Individual	Associate	Collegiate
Biological Sciences	14	1	6
Chemistry	10		2
Geology and Anthropology	4		11
Forestry, Geography, and Conservation	2		
Physics and Mathematics	5		
Industry and Economics	—		
Science Education	1		
Social Sciences	5		
Medical Sciences	—		
Engineering	—		
Total	41	1	19
	Total Increase		108

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Regular Membership (Loss)	
Resigned	7
Dropped	38
Deceased	2
Total Loss	47
Net Gain	61
Total Membership December 31, 1962	654

LOCAL ARRANGEMENTS COMMITTEE (BOSCHUNG). Reference was made to the schedule for the annual meeting previously approved by the Executive Committee at this meeting. He stated that details would be worked out with the Secretary. A cordial invitation was extended to all members of the Academy to attend the 1963 annual meeting at the University of Alabama.

EDITOR OF THE NEWSLETTER (COTTER). Three issues of the *Newsletter* were published during the year, 1962 in March, April, and November at the total expense of \$66.18. The major problem which will always confront the publication of the *Newsletter* is the lack of adequate

and complete coverage of the developments of science throughout the state. Several departments and even schools, as well as, some sections of the Academy are covered only superficially and in some cases not at all. For the *Newsletter* to be the publication it should be we need more and better information. Any success that it enjoys is due to the loyal correspondents that do an excellent job of sending information. We need more of them.

PUBLIC RELATIONS COMMITTEE (BASWELL). I am sure the Academy enjoys the very best public relations; however, the Public Relations Committee can claim no credit whatsoever for this. In an organized manner we have done absolutely nothing. At the proper time, I would like to discuss the responsibilities and lack of production of this committee.

COMMITTEE ON REGIONAL SCIENCE FAIRS (TWELLMEYER). The Secretary was asked to revise the list of committee members shown in the mimeographed list of Committees for 1962-63. Those listed as members, except the chairman, should be replaced by Carr (Auburn University), Boozer (Jacksonville State College), Norman (Redstone Arsenal), and Robinson (Howard College). No report in addition to that previously given by the Coordinator of Regional Science Fairs was submitted.

The President called for items of Old Business.

163. Motion by Twellmyer, seconded by Boozer that the By-laws of the Academy as revised by the Executive Committee April 19, 1962 and as assembled and mimeographed then later distributed to members of the Executive Committee by the Secretary be approved with the addition to Article IX of the phrase ". . . is ex-officio chairman of the Committee on Regional Science Fairs . . ." following the phrase ". . . is an officer of the Academy . . ." and that these By-laws be published in a forthcoming issue of the *Journal*. Motion passed.

Wheeler reported that as Director of the National Science Foundation grant he had acted as authorized by the Executive Committee (Motion 152) and had submitted to the National Science Foundation a request for an enlarged one-year program to include equipment and honorariums for visiting scientists, estimated to cost approximately \$18,000.

The President called for items of New Business.

164. Motion by Thomson, seconded by Twellmeyer that the deadline date of March 1, 1963 recommended by the Secretary for the Call for Papers be established. Motion passed.

165. Motion by Twellmeyer, seconded by Boozer that Certificates of Membership be offered to new members paying annual dues of \$5.00 or more and that the Secretary be authorized to purchase a Temple and accessories with which to letter the certificates in Old English. Motion passed.

The Secretary recommended that the Academy give special recognition to its Fellows, Honorary Members, and members of the Board of Trustees at each annual banquet. Most members favored recognizing Honorary Members only. It was felt that a final decision should be left up to the President.

The Admission to Membership Committee will consider nominees for Honorary Membership. Members of the Executive Committee were encouraged to call to the attention of the secretary names of persons who might be considered for this category of membership. It was pointed out that a maximum of two Honorary members may be elected in any one year.

166. Motion by Twellmeyer, seconded by Boschung that the President appoint a committee of three to make recommendations at the Spring Executive Committee meeting relative to the activation of Section X, Engineering. Motion defeated.

167. Motion by Overton, seconded by Boozer that the President be authorized to appoint a chairman pro-tem who would be instructed to organize and activate Section X, Engineering, in order that a program might be planned for the 1963 Annual Meeting and that at this meeting it might organize on a permanent basis and nominate officers. Motion passed.

A balanced budget in the amount of \$2860.00 for 1963 was submitted by the Treasurer.

PROPOSED BUDGET FOR 1963

Anticipated Income

Membership Dues		\$2,500.00
Registration fees, Annual Meeting		300.00
Gifts		50.00
Journal Sales		10.00
	Total	<u>\$2,860.00</u>

Anticipated Expense

Publication of <i>Journal</i>		900.00
Assistance to AJAS, Cups, etc.	175.00	
Contribution to AJAS Budget	100.00	
AJAS <i>Newsletter</i>	<u>75.00</u>	350.00
Student Awards		150.00
Research Grants		400.00
Academy Conference Assessment		10.00
Annual Meetings, Programs and Other Expense		300.00
Office of President		100.00
Office of Secretary		225.00
Office of Treasurer		50.00
Office of Editor		150.00

Office of Coordinator of Science Fairs	50.00
Office of Permanent Counselor to AJAS	75.00
Newsletter	100.00
Total	<u>\$2,860.00</u>

168. Motion by Diener, seconded by Barrett that the 1963 budget be adopted. Motion passed.

The meeting was adjourned at 12:35 p.m.

W. B. DeVall, Secretary

SPRING EXECUTIVE COMMITTEE MEETING

University of Alabama

April 25, 1963

The meeting was called to order at 8:20 p.m. The following were present: Louis J. Eisele, S. J., presiding. Paul C. Bailey, William J. Barrett, Reuben B. Boozer, Herbert Boschung, James M. Boyles, David J. Cotter, W. B. DeVall, Urban L. Diener, Robert H. Garner, C. C. Hall, Jr., A. T. Hansen, W. Hartwig, Earl J. Hodgkins, E. C. Overton, E. W. Price, E. Carl Sensenig, Reynold Q. Shotts, H. S. Strickland, J. Richard Thomson, George O. Twellmeyer, S. J., Carlton D. Whitt, William T. Wilks, P. H. Yancey, S. J.

President Eisele announced that the minutes of the Fall meeting of the Executive Committee had been mailed to all members of the Executive Committee.

169. Motion by Hansen, seconded by Thomson that the minutes of the 1962 Fall Executive Committee meeting be approved as mailed to members. Motion passed.

Reports of Section Vice-Presidents:

SECTION IV (HODGKINS). A total of ten papers will be given at the Annual Meeting. One paper is an entry for the undergraduate student research award. Subject matter coverage will be of maximum breadth within the area assigned to Section IV. A special effort was made to obtain papers from the geographers and the descriptive plant ecologists located at the various colleges and universities. Three papers resulted from this campaign. Five of the other papers were obtained through personal contact. Only two papers came as the result of the "general call."

The Section was asked by Professor Gibbes Patton to appoint two judges for the Junior Academy exhibit. Mr. William Black has accepted one appointment.

In an effort to promote attendance and membership, about 30 printed programs were mailed out to professional foresters who are not members of the Academy.

SCIENCE EDUCATION SECTION (BOYLES). Since the Executive Committee meeting last December, the vice-chairman, Mrs. Ruby Countryman, and I have completed our proposed program for the annual meeting.

Twenty four letters were exchanged with fourteen educators in the State. As a result we have thirteen participants in the program this year. There will be seven papers read in the Friday morning session. On Friday afternoon a symposium dealing with college biology curricula will involve seven participants. No Saturday morning session is scheduled.

Mrs. Countryman has obtained the consent of Mrs. Dorothy S. Ellison of Dora High School to submit her name as nominee for vice-chairman of our section in 1963-64. Mrs. Countryman will automatically succeed me as chairman.

MEDICAL SECTION (HAMEL). Seventeen papers are to be presented in the Medical Sciences section at this meeting. Participants are from the University of Alabama Medical Center and Birmingham Veterans Administration Hospital. In addition, members of the Medical Center staff will aid in judging exhibits and papers for the Junior Academy participants in this meeting.

During the current school year, members of the University Medical Center have been active in the Visiting Scientists Program; visiting high schools throughout the state.

Dr. Margaret Klapper of the University Medical Center will assume the role of vice-president for the next year.

REPORT OF SECRETARY (DEVALL). The Secretary's office has assisted the officers and committee chairmen of the Academy since December in matters pertaining to membership and programing of the annual meeting.

A copy of Motion No. 161 passed by the Executive Committee in December pertaining to incorporation of Science Service for the purposes set forth in H. R. 11711 was sent to Science Service, National Science Fair—International Council, Call Chronical News Papers, all members of the Alabama congressional delegation, and the Honorable Francis E. Walter, author of the bill.

Three publications received by the Academy were forwarded to the Archivist. The titles follow: "Materials Research Chronology", "Materials Research Abstracts", and "Charles J. Cleary Awards for Papers on Material Sciences".

A report on activities of the Alabama Academy of Science was submitted to the Academy Conference prior to its December 27 meeting in Philadelphia, Pa.

All new advisors to high school science clubs received letters notifying them that they hold complimentary memberships in the Academy. All advisors who no longer serve as counselors received a letter thanking them for their services. Each was invited to become an individual member of the Academy.

At the suggestion of the Chairman of the Research Committee, a preliminary investigation of bulk mailing privileges for the Academy was

initiated by the secretary. The Articles of Incorporation and By-Laws were submitted to the postmaster at Auburn, Alabama, February 20, 1963. The secretary has been advised that the Academy 'is entitled to the special bulk mailing rate for non-profit organizations'.

Minutes of each meeting of the Executive Committee are mailed to each member of the Committee. Minutes of the Annual Business meeting of the Academy are mailed to all members of the Academy.

Membership certificates are now being prepared by the secretary for those members requesting them. This is being done at no expense to the Academy except the cost of printing of the certificates.

REPORT OF TREASURER (BARRETT). Covering the Period January 1, 1962 to December 31, 1962.

RECEIPTS		Amount	1962 Budget
		Received	Amount
Membership Dues		\$2,334.00	\$2,715.00
Gifts and Contributions		60.00	50.00
Sale of Journal		7.50	10.00
Annual Meeting			
Registration Fees	330.00		
E. H. Sargent and Co.	208.46		
Banquet Tickets	<u>24.00</u>	562.46	300.00
Interest Earned		59.03	-
	Total Receipts	<u>\$3,022.99</u>	<u>\$3,075.00</u>
EXPENDITURES		Amount	1962 Budget
		Received	Amount
Publication of Journal		\$ 454.50	\$ 900.00
Publication of History		-	500.00
Assistance to AJAS			
cups	158.80		
Pins, frames, Etc.	21.06		
Contribution to AJAS Budget	100.00		
AJAS Newsletter	75.00	354.86	400.00
Student Awards		150.00	100.00
Research Grants		150.00	400.00
Academy Conference Assessment		11.54	10.00
Annual Meeting			
Banquet	253.48		
Programs and Other Expense	<u>152.35</u>	405.83	300.00
Operating Expense			
Office of President	-		100.00
Office of Secretary	219.06		200.00
Office of Treasurer	37.79		
Office of Editor	90.64		150.00
Office of Coordinator of			
Science Fairs	50.00		50.00
Office of Permanent Coun-			
selor to AJAS	37.30		75.00
Newsletter	<u>66.18</u>	500.97	100.00
	Total Expenditures	<u>\$2,027.70</u>	<u>\$3,285.00</u>

SUMMARY

BALANCE, January 1, 1962		\$1,193.04
Receipts		<u>3,022.03</u>
	Total	\$4,216.03
Expenditures		
Balance, December 1, 1962		2,027.70
Savings Account	1,131.46	
Checking Account	<u>1,056.87</u>	2,188.33
	Total	<u>\$4,216.03</u>
Excess of Receipts over Expenditures for period		
January 1, 1962 to December 31, 1962		\$ 995.29

NATIONAL SCIENCE FOUNDATION GRANT NO. G-22268

Amount of Grant, received July 13, 1962		\$8,200.00
Expenditures		
Secretary's Salary	584.73	
Visiting Scientists Expense	645.54	
Office Supplies	119.21	
Printing	146.10	
Postage and Telephone	42.00	
Conference	<u>295.83</u>	1,833.41
Balance, December 31, 1962		<u>\$6,366.59</u>

REPORT OF EDITOR (HALL). Volume 32, 1961 has been completed and mailed to the membership. Two numbers (1&2) of 1962 are in the printer's hands. Almost all full papers awaiting publication are in these two issues. Notices have been sent to all contributors who have papers in these two issues. The last two issues of 1962 (numbers 3 & 4) will be submitted to the printer as soon as numbers 1 and 2 are completed.

The report of the editor raised question of dating issues of the Journal. Points to be resolved by the Editorial Board included dating of issues to comply with postal regulations and priority dating of papers published to differentiate between the date received, date presented, and date printed.

REPORT OF THE EDITOR OF THE NEWSLETTER (COTTER). The list of correspondents will be drastically revised at the end of the academic year in the light of participation in news solicitation during the past year. Another issue of the Newsletter is planned for next month. One new innovation will be a request for a list of all publications by Academy members during the academic year.

REPORT OF THE COUNCILOR OF THE AAAS (YANCEY). I attended the two meetings of the Council on December 27 and 30 and the all day session of the Academy Conference on December 27. The latter honored Dr. Leland L. Taylor, a former president of the Conference, and myself with Distinguished Service Awards. The AAAS had its greatest year, adding 18,358 new members and eight new societies as affiliates. Section 9, Article 5 of the By-laws was changed to expend the Committee on the Public Understanding of Science from five to seven members. Dr. Ward Pigman, formerly of our Academy, raised the question about the effectiveness of

the committee on Council Affairs and the Council voted to have the committee study its own organization, especially as to the selection of its chairman, who is now the President-elect. Dr. Lawrence Gould, University of Arizona, was elected President. Dr. Philip H. Aleerson was appointed editor of **Science**.

At the Academy Conference a Survey of Junior Academies revealed the following: 1) The most successful junior academies meet separately from the senior academy; 2) Fifteen senior academies asked that one or two papers of the juniors be read at their sessions; 3) Several junior academies did not want their papers judged. 4) A lack of communication between junior and senior academies was noted; 5) There are only five collegiate academies in the country. They do better in smaller institutions; 6) The New Mexico Academy extended an invitation to all high school and college teachers and students to attend the program of seminars conducted by outstanding scientists (8 Nobel Prize Winners) during the National Science Fair in Albuquerque in May.

Dr. Gerald Akers becomes President of the Academy Conference, Dr. J. Teague Self was elected President-elect, and Dr. Harry Bennett, Secretary-Treasurer.

REPORT OF THE PERMANENT COUNSELOR OF THE JUNIOR ACADEMY AND THE COMMITTEE ON JUNIOR ACADEMY (SPENCER). On November 3 the Executive Committee of the AJAS held its annual Fall meeting with Dr. Gibbes Patton on the University campus and made plans for the annual convention to be held on April 26-27, 1963, concurrently with the Senior Academy on the University of Alabama campus. During the year work was done to encourage science research and study. Four AJAS Newsletters were mailed to each white high school in Alabama regardless of whether they were members of the Alabama Junior Academy of Science. It is believed that the Newsletter is serving a good purpose. It is felt that it is encouraging better exhibits and papers on the regional level as well as keeping the clubs informed. It is certainly the best media for getting general information to all clubs.

A copy of the devised Constitution and By-Laws of the Alabama Junior Academy of Science was mailed to all members.

ASSETS

July 1, 1961	413.30
July 1, 1962	686.22
July 1, 1963	680.00 - 690.00 Expected

The assets on July 1, 1962 shows an increase over the previous year in part because every Junior Academy member who attended the convention was required to pay a two dollar registration fee whereas in the past this was not true. Another contributing factor in this was the efficiency with which the former Permanent Counselor operated.

MEMBERSHIP: There are at present a total of 107 clubs. This membership broken down in regions are as follows: Mobile Region—20; North Alabama Region—12; Central Region—31; Northeast Region—24; Southeast Region—20.

EXHIBIT COMPETITION In order to show the members of the Alabama Academy of Science and the Alabama Junior Academy of Science

the best exhibits of the state, the first and second award winners in each of the seven categories in the regional science fair were invited to bring his exhibit for competition at the AJAS Convention. (Since the National Science Fair is so close to the convention some of the regional grand winners will not be able to show). Each club also has the right to bring a group exhibit for competition. A total of nineteen cups will be awarded for exhibits and paper competition.

CONVENTION: At least forty-six clubs have indicated that they will attend the convention. Last year there were thirty-five clubs that attended the convention.

VISITING SCIENTISTS PROGRAM: During the year the Visiting Scientists Program has been of great help to the Alabama Junior Academy of Science in giving lectures and paying expenses that would otherwise have come from other funds. The Permanent Counselor would like to express his appreciation to the Visiting Scientists Program and to the Senior Academy for their help during the year.

REPORT OF THE COORDINATOR OF SCIENCE FAIRS AND THE COMMITTEE ON REGIONAL SCIENCE FAIRS (TWELLMAYER).

NATIONAL SCIENCE FAIR-INTERNATIONAL: Finalists selected by the Judges from the five Regional Fairs of Alabama are as follows: Central Region—Annette Walker, Tuscaloosa High School, Ronald C. Merrell, Ensley High School; Mobile Region—Gaye Lindsey, Baldwin County High School, Donald Bliss, Murphy High School; North Region—Alice Hardin, Moulton, Alabama, Hank Caddell, Decatur, Alabama; Northeastern Region—Gayle Houston, Goodwater, Alabama, Alvin Atkinson, Sylacauga, Alabama; Southeastern Region—Kathy Van Wagoner, Montgomery, Alabama, Christopher Landrum, Auburn, Alabama.

Official finalists escorts are Mrs. Ibbie K. Bradford, the North Regional Counselor and Mr. James F. Davis, Mobile Regional Counselor. Two teacher-sponsors are also being sent by the Southeastern Region, Mrs. Mignon Andrews and Miss Susie Green.

COORDINATOR OF NORTH ALABAMA REGION: Because of transfer from the State, Mr. James E. Norman, Sr., Research Projects Manager at Redstone Arsenal, was forced to resign as Coordinator of the North Region. Dr. Walter H. Wharton, Chief Chemical Propulsion Branch, Redstone Arsenal has been appointed his successor.

UNIFORM POLICY ON JUDGING AND AWARDS: The proposed policy on Judging and Awards for the Alabama Regional Science Fairs which was recommended to the Committee on Regional Fairs at its December 1962 meeting was adopted by said Committee to be followed by all the Regions in the operation of their 1963 Fairs.

DATE SET FOR 1964 REGIONAL FAIRS: Following the policy of holding the Regional Science Fairs after March 1, before April 1, and not to conflict with Easter or the Alabama Educational Association meeting which in 1964 is being held March 19-20, it will be necessary to hold the Alabama Regional Science Fairs the week-end of March 12-14. Tentative dates have been set as follows: 1965—March 25-27; 1966—March 24-26; 1967—March 30-April 1.

SCIENCE SERVICE: The bill to incorporate Science Service for the purpose indicated by Public Law 85-875 which this Committee recommended at its last meeting to be re-introduced by its author, the Honorable Francis E. Walter has been passed by the House and sent to the Judiciary Committee of the Senate as HR 824. In connection with this I would like to propose the following: That the Executive Committee of the Alabama Academy of Science commend HR 824 and propose to the Senators from Alabama that they work for its approval by the Judiciary Committee and passage by the Senate.

REGIONAL REPORTS: Reports for 1962 fairs have not been received from the Southeastern and North Regions. The Central, Mobile and North-eastern Regions have reported on their 1963 fairs. The Central Region reports 575 exhibits entered from 36 schools. It is estimated that over 2000 viewed the fair. In the Mobile Region 349 exhibits were entered from 38 schools. In the Northeastern Region 53 schools entered 256 exhibits. An estimated 4000-5000 people viewed each of these fairs. Though a questionnaire sent to the participating schools, it was determined that 14,000 people attended the fairs preliminary to the Mobile Regional Fair. Over 5566 students worked on projects for the preliminary fairs in this Region. It has been recommended that such a survey be made in all the regions.

170. Motion by Twellmeyer, seconded by Bailey that the Executive Committee of the Alabama Academy of Science commend HR 824 and propose to the Senators from Alabama that they work for its approval by the Judiciary Committee and passage by the Senate. Motion passed.

Reports of Committee Chairmen:

LOCAL ARRANGEMENTS COMMITTEE FOR THE SENIOR ACADEMY (BOSCHUNG). Chairman Boschung called to the attention of the committee changes in rooms assigned for section meetings. He explained that changes had to be made because of room commitments for regular classes scheduled by the University.

RESEARCH COMMITTEE (DIENER). One grant of \$150.00 has been awarded to Dr Francis Bush of Howard College for a study of the blood typing of passerine birds. No additional applications are pending. It is urged that the availability of research support be brought to the attention of research faculty, graduate, and undergraduate students. Possibility of carrying an item in the Newsletter to publicize this fact to Academy members was suggested. The need of a project outline form has become apparent, and this committee will undertake to develop one to include with grant application forms.

This committee will serve as Student Research Awards Committee to judge the graduate and undergraduate papers presented at this meeting. There have been 3 papers submitted in graduate competition and 5 in undergraduate competition. There should be more papers presented for these competitions. The Research Committee is not constituted exactly along the lines recommended for the Awards Committee. Therefore, the

chairman and vice-chairman of each section are asked to assist in evaluating the presentation and quality of papers presented in their section.

ADMISSION TO MEMBERSHIP COMMITTEE (DEVALL). Total Membership			
December 31, 1961			593
New applications approved in 1962	61		
Reinstated members	2		
New complimentary members in 1962	45		
	Sub Total: 108		701
* * * * *			
Regular Membership (Loss)			48
Resigned	7		
Dropped	38		
Deceased	3		
	Sub Total: 48		
Total membership December 31, 1962			653
Net Gain			60

AUDITING COMMITTEE, SENIOR ACADEMY (THOMSON). The Auditing Committee has found the treasurer's books of the Alabama Academy of Science, including the National Science Foundation account, to be in order as of April 24, 1963. The balance of the A.A.S. account is \$3,222.39 (including savings account). The balance of the N.S.F. Grant administered by the Academy is \$5,925.10.

171. Motion by Twellmeyer, seconded by Boozer that the report of the Auditing Committee for the Senior Academy be accepted. Motion passed.

PLACE OF MEETING COMMITTEE (EISELE FOR CARR). The committee recommends that the invitation received from Auburn University to hold the 1964 Annual Meeting of the Academy on the campus at Auburn be accepted.

172. Motion by Shotts, seconded by Overton that the report of the Committee on Place of Meeting be accepted and that the Executive Committee recommend accordingly to the Academy during its business session on April 26. (Discussion of the motion brought out the desirability of scheduling annual meetings one or more years in advance both with regard to place and date.) Motion passed.

SCIENCE EDUCATION COMMITTEE (BOSCHUNG FOR WHEELER). During the 1962-63 school year, the Alabama Academy of Science has sponsored a Visiting Scientists Program to the high schools of Alabama. The program was made possible by a \$8,200 grant from the National Science Foundation. This program has included three phases of work of the Academy. First of all, the main objective of the program was to provide opportunities for experienced scientists, mathematicians, and engineers to work directly with the high schools of Alabama. In addition, the program provided opportunities for scientists to work with high school teachers through their in-service training programs. Finally, the program was set up to give assistance to two projects sponsored by the Alabama Academy of Science—the Alabama Junior Academy of Science and the Science Fair.

At this time, approximately 167 visits have been made under these three programs with 25 visits on schedule for the remainder of the school year. A detailed report of this program will be written in the summer of 1963, and copies of this report will be sent to the officers of the Alabama Academy of Science. The Alabama Academy of Science has recently received a \$11,500 grant for a similar program for the school year 1963-64. It is recommended that a steering committee consisting of the president, the immediate past president, the president-elect, and the treasurer of the Alabama Academy of Science along with a director be charged with the responsibility of administering this grant within the framework as set up by the National Science Foundation. It is also recommended that this committee be instructed to present a new proposal to the National Science Foundation for a grant for the 1964-65 school year.

A motion was made and seconded that the recommendations contained in the chairman's report on Science Education be approved. The secretary called to the attention of the audience an identical motion, Motion 150, passed by the Executive Committee on April 19, 1962 that authorized the action recommended by Wheeler. The motion was withdrawn.

The President called for items of Old Business.

The Academy brochure has been out of date for several years. The value of the brochure to those working on membership was brought to the attention of the committee.

173. Motion by Overton, seconded by Twellmeyer that the incoming president appoint a special committee to revise the Academy brochure and that the committee be instructed to recommend in the Fall a suitable format, its content, and estimated cost of printing so that the Executive Committee may take action. Motion passed.

A past recommendation that the Constitution and By-laws of the Junior Academy and the revised By-laws of the senior Academy be printed in the *Journal* was discussed. Some members would like to have these revised documents readily available in the *Journal*. Others felt that the pages of the *Journal* should be not be taken up with printing of such documents. Others suggested that these documents be printed but that minimum size type be used to reduce the number of pages. No formal action was taken on this matter.

The President reported that no progress has been made toward activating Section X, Engineering, as previously authorized in Motion 167.

174. Motion by Overton, seconded by Boozer that the President and the Steering Committee take the initiative to organize Section X, Engineering, during the next year. Motion passed.

The Secretary reported that new books are received periodi-

cally by him. After a discussion of how these books might best serve the Academy membership, it was suggested that titles be carried in the Newsletter, that the books be deposited with the Archivist, and that members be invited to request books on loan for review.

The President called for items of New Business.

175. Motion by Yancey, seconded by Thomson that the Secretary be authorized to determine the financial feasibility of obtaining a bulk mailing permit; that if feasible, application be made for it and that future mailings take advantage of the lower mailing rate if the feasibility study indicates it would be an advantage to the Academy. (During the discussion of the motion, the question was raised regarding use the Junior Academy might make of a bulk mailing permit obtained in the name of Senior Academy.) Motion passed.

176. Motion by Overton, seconded by Barrett that after April 26, 1963, individuals approved for membership in all categories receive membership certificates from the chairman of the Admissions to Membership Committee and that any person who became a member prior to April 26, 1963 might request a membership certificate and that no charge be made for the certificate. (During the discussion it was pointed out that the secretary's office could prepare these certificates without additional expense to the Academy. It was felt that the certificates would strengthen the relationship between the new member and the Academy.) Motion passed.

177. Motion by Overton, seconded by Yancey that the incoming president appoint a special committee to study and make recommendations at the Fall Executive Committee meeting that would improve and expand all aspects of publicity regarding Academy activities in coordination with the Committee on Public Relations and that the committee be authorized to activate their recommendations during the interim prior to the fall meeting in the best interests of the Academy. (Discussion brought out the apparent need for continuous publicity of Academy activities throughout the calendar year. It was felt that the work of this committee would not be in conflict with the activities of the Public Relations Committee.) Motion passed.

The chairman, Admissions to Membership Committee requested guidance relative to eligibility for membership of persons holding a B.S. degree who continue in or later return to graduate school. Several examples were cited to illustrate the recurring problem of shifting individuals from collegiate to individual memberships and from individual membership back to collegiate.

178. Motion by Hartwig, seconded by Shotts that the Admis-

sions to Membership Committee be instructed to work out a practical basis for deciding on eligibility for collegiate and individual memberships and that if necessary propose an amendment to the By-laws that would clarify the eligibility status of collegiate and individual members. Motion passed.

179. Motion by Hansen, seconded by Overton that the Committee on Place of Meetings be instructed to report at the Fall meeting of the Executive Committee the place and date for the 1965 annual meeting. (Discussion of the motion pointed out the need to establish dates in advance and to coordinate with other science groups, including those directly related to the Academy, plans for the annual meeting that would reduce conflicts of interest to a minimum.) Motion passed.

Several members expressed their views regarding ways and means of presenting Academy membership to prospective members. Some felt that a nominee should be considered by the Admissions to Membership Committee and if recommended for membership the nominee should receive an invitation to membership. It was felt that this would add dignity and honor to election of members. The Committee on Admissions to Membership was asked to consider this approach and to notify the membership regarding its recommendation through the Newsletter.

The meeting was adjourned at 11:10 p.m.

W. B. DeVall, Secretary.

ANNUAL BUSINESS MEETING

University of Alabama

April 26, 1963

The Annual Business Meeting of the Academy was called to order at 1:35 p.m. President Eisele announced that the minutes of the 1962 meeting held April 20 at Troy State College had been mailed to membership. Since there were no corrections requested by members, the president ruled that the minutes of the 1963 meeting would stand approved as mimeographed and mailed.

REPORT OF SECRETARY (DEVALL). Each member of the Academy was mailed a copy of the minutes of the 1962 business meeting. Changes in address should be reported to the secretary or treasurer to insure that minutes of this meeting, copies of the Newsletter, the *Journal*, and other mailings reach each member directly.

In the future, new members in all categories will receive membership certificates from the office of the secretary upon the election to membership. This action has been approved by the Executive Committee.

Representatives of nineteen agencies, institutions, and organizations have registered. Representatives from 5 other areas have also registered.

Registration prior to noon totaled 166. By sections the totals were:

I Biological Sciences	35
II Chemistry	19
III Geology and Anthropology	18
IV Forestry, Geography and Conservation	8
V Physics and Mathematics	11
VI Industry and Economics	1
VII Science Education	18
VIII Social Sciences	8
IX Medical Sciences	18
Misc. (No Section Indicated)	30
Total	166

180. Motion by Thomson, seconded by Fincher that the report of the secretary be accepted. Motion passed.

REPORT OF TREASURER (BARRETT). A summary of the detailed financial report submitted to the Executive Committee follows:

BALANCE, January 1, 1962	\$1,193.04
Receipts	3,022.99
	Total \$4,216.03
Expenditures	2,027.70
Balance, December 1, 1962	
Savings Account	1,131.46
Checking Account	1,056.87
	Total \$4,216.03
Excess of Receipts over Expenditures for period	
January 1, 1962 to December 31, 1962	\$ 995.29

* * * * *

NATIONAL SCIENCE FOUNDATION GRANT NO. G-22268

Amount of Grant, received July 13, 1962	\$3,200.00
Expenditures	1,833.41
Balance, December 31, 1962	\$6,366.59

Reports of Committee Chairmen:

ADMISSION TO MEMBERSHIP COMMITTEE (DeVALL).

Total membership, December 31, 1961	593
Increase in membership including reinstatements and new members	108
Loss in membership	48
Total membership, December 31, 1962	653
Net gain in membership for 1962	60

AUDITING COMMITTEE, SENIOR ACADEMY (THOMSON). The Auditing Committee has reported to the Executive Committee and now reports to the Academy that the Treasurer's books of the Alabama Academy of Science including the National Science Foundation account were in order as of April 24, 1963. The balance of the Academy account in-

cluding savings was \$3,222.39. The balance of the National Science Foundation Grant as of the same date was \$5,925.10.

AUDITING COMMITTEE, JUNIOR ACADEMY (McCULLOUGH). We have checked the books of the Alabama Junior Academy of Science and found them to be in order.

RESOLUTIONS COMMITTEE (McCULLOUGH FOR BOOZER). Your Resolutions Committee submits the following resolutions:

1. Whereas the Alabama Academy of Science is successfully engaged in Fortieth Annual Meetings on the campus of the University of Alabama, therefore, be it resolved:

a) That the Academy express appreciation to the officials of the University of Alabama and to its President, Dr. Frank E. Rose for their hospitality;

b) That special appreciation be expressed to Dr. Herbert T. Boschung, Jr., chairman of the Local Arrangements Committee for the Senior Academy, and to Dr. Ernest Gibbes Patton, chairman of the Local Arrangements Committee for the Junior Academy, and their co-workers whose untiring efforts contributed in no small way to the success of this meeting;

c) That the gratitude of the Academy be expressed to Mr. J. R. Skellinger and the Birmingham Division of the E. H. Sargent and Company for their hospitality in providing the annual dinner.

2. Whereas Dr. Roland M. Harper has faithfully attended the Academy meetings for the past 32 years, consecutively, and whereas he has served the Academy faithfully during this time; therefore, be it resolved that the Academy recognize and pay special tribute to Dr. Harper for his commendable record and inestimable value to the Academy.

3. Whereas during the past year, death has deprived the Academy of the valued services of six members; now, therefore, be it resolved that the Academy express its sympathy to the families of CAREY F. ELTON, GEORGE FERTIG, GORDON B. MAINLAND, ETHEL LUCILLE MARSHALL, FREDERICK L. MORRIS, AND PAUL IRVINE; and express its appreciation for the loyal and valuable services these members have given to the Academy.

181. Motion by McCullough, seconded by Fincher that the report of the Resolutions Committee be accepted and that the resolution be approved. Motion passed.

PLACE OF MEETING COMMITTEE (EISELE FOR CARR). The Committee on Place of Meeting recommended to the Executive Committee that the 1964 Annual Meeting be held on the campus of Auburn University. The Executive Committee recommends that this report be accepted by the Academy.

182. Motion by Jones, seconded by Yancey that the report of the Committee on Place of Meeting be accepted, that the recommendation of the Executive Committee be approved, and that the Forty-First Annual Meeting of the Academy be held at Auburn University in 1964. Motion passed.

It was suggested that the new committee on Place of Meeting be requested by the president to select the location for the 1965

Annual Meeting, establish open dates if possible, and that it report its recommendations at the Fall 1963 Executive Committee meeting.

NOMINATING COMMITTEE (YANCEY). The Nominating Committee consisting of Paul Bailey, Herbert McCullough, Ralph Chermock, William Wilks and P. H. Yancey, S.J., chairman, submits the following slate of officers to serve the Academy for the ensuing year:

President-elect—William J. Barrett

Treasurer—J. Richard Thomson

Editor of *Journal*—C. C. Hall, Jr.

Counselor of Junior Academy—A. Frederick Hemphill

Coordinator of Science Clubs—R. E. Wheeler

Trustee—Walter B. Jones (to succeed himself)

Trustee—J. F. Volker

Vice-Presidents and Vice-Chairmen of Sections:

I	Vice-President	Urban Diener
	Vice-Chairman	David Cotter
II	Vice-President	William Mountcastle
	Vice-Chairman	Frank J. Kearley
III	Vice-President	Douglas E. Jones
	Vice-Chairman	Paul H. Nesbitt
IV	Vice-President	Glendon W. Smalley
	Vice-Chairman	Hazel L. Stickney
V	Vice-President	Hoyt M. Kaylor
	Vice-Chairman	E. L. Robinson
VII	Vice-President	Ruby Countryman
	Vice-Chairman	Dorothy H. Ellison
VIII	Vice-President	Eleazer C. Overton
	Vice-Chairman	Arnold Barrett
IX	Vice-President	Margaret Klapper
	Vice-Chairman	H. N. Schnitzlein

183. Motion by Yancey, seconded by Goetz that the report of the Nominating Committee be accepted.

184. Motion by Yancey, seconded by Twellmeyer that the incoming president be empowered to accept the slate of nominees submitted by Sections VI and VIII not included in the report of the Nominating Committee. Motion passed.

185. Motion by Carmichael, seconded by Shotts that all nominees submitted by the nominating Committee, and nominees for sections not reported who are acceptable to the incoming president be elected to the office for which nominated. Motion passed.

REPORT OF THE EDITOR OF THE JOURNAL (HALL). All issues of Volume 32 for 1961 have been mailed to the membership. Numbers 1 and 2 of Volume 33 for 1962 are in the hands of the printer. This volume will be completed with numbers 3 and 4 as soon as possible. The Archivist has reported that the History of the Academy is in page proof form.

The President called for items of Old Business.

The Editor of the Newsletter asked for more active participa-

tion by the membership in submitting items for future issues of the Newsletter.

It was suggested that the Committee on Place of Meeting attempt to work out a schedule of meeting places and dates at least three years in advance.

A question was raised regarding the status of Section X, Engineering. The president reported that the authorization granted him in Motion 167 passed at the fall meeting of the Executive Committee has not been discharged. He stated that the Executive Committee has authorized the incoming president with the assistance of the Steering Committee to organize Section X.

It was suggested that the Academy through its Resolutions Committee take cognizance of those members whose demise during the year is known. It was stated that an attempt has been made during the last two years to forward the names of deceased members to the Chairman of the Resolutions Committee. Appropriate motions have been passed by the Academy within recent years.

The president called for items of New Business. There being no new business before the Academy, the president thanked all officers, committee chairmen, and University officials for a most successful meeting.

The meeting was adjourned at 2:08 p.m.

W. B. DeVall, Secretary

GORGAS SCHOLARSHIP FOUNDATION

Report of the Scholarship Committee 1962-63

Ninety-one seniors, representing twenty-one white high schools (public and private) in Alabama, completed the aptitude examination which was conducted by the Science Clubs of America and administered by Science Service, as the Westinghouse Science Scholarships. Thirteen of these were selected as Finalists.

Twenty-three seniors representing five Negro high schools completed the above qualifications and four were selected as Finalists.

The results of the white contest are:

	<i>Name</i>	<i>High School</i>
1st Award	R. W. Bagley	Tuscaloosa
2nd Award	H. H. Caddell	Decatur
3rd Award	W. R. Killingsworth	Banks

4th Award	J. E. Smith	Talladega
1st Alternate	Rona Beth Sayetta	Shades Valley
2nd Alternate	D. C. Brabston	Shades Valley
3rd Alternate	R. H. Worthy	Tuscaloosa
4th Alternate	E. P. Clement	Shades Valley
5th Alternate	R. C. Merrill	Ensley
6th Alternate	C. F. Bennett	Shades Valley
7th Alternate	C. K. Clarke	Tuscaloosa
8th Alternate	L. R. Hinken, II	Decatur
9th Alternate	D. G. Milton	John Carroll

The results of the Negro contest are:

	<i>Name</i>	<i>High School</i>
1st Award	Jennifer K. Lawson	Fairfield Industrial
1st Alternate	Rita Olivia Durr	Parker
2nd Alternate	Norma Ann Grayson	Fairfield Industrial
3rd Alternate	Ronald E. Damber	Parker

Judges were: Charles E. Feazel, L. L. Blackwell, R. W. Brockman, K. W. Coons, Shirley E. Gunter, Alan Hisey, Sidney Kent, Frederick W. Kraus, Herbert A. McCullough, F. Mitchell, W. R. Mountcastle, Richard A. Peacock, R. W. Pilcher, C. L. Seebeck, Jr., Wynelle D. Thompson, Jack Warner, William E. Webb, R. H. Wheeler and Robert N. Whitehurst.

—Emmett B. Carmichael, Chairman

THE JOURNAL

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OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

OFFICE OF THE EDITOR
AUBURN UNIVERSITY
AUBURN, ALABAMA

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A Western Intrusion of the Georgia Complicated Stamping Tradition

L. Ross Morrell

University of Alabama

This short study consisted principally of defining and describing a western intrusion into Alabama of the Etowah Complicated Stamping Tradition. This north Georgia Tradition had a rather limited distribution throughout northwestern Georgia with its center at Cartersville and extending along the Etowah River Valley in Cherokee, Bartow, and Floyd Counties, Georgia.

The first recognition of the Etowah series as a localized tradition or horizon was made by Robert Wauchope in 1948. The subsequent concern over its similarity with the late swift-Creek wares, and the possibility of being coeval with Savannah Stamped, brought about a new series of new studies in the Etowah drainage. The succeeding study by Wauchope (in 1950) very clearly demonstrated the outgrowth of Etowah Stamped from both Napier and Woodstock. The finest execution of Etowah Stamped is equal to the crudest of Napier. The first two Etowah Stamped motifs, line-filled blocks at right angles to each other and superimposed triangles or concentric diamonds, undoubtedly developed from almost identical, but still slightly different design elements in Woodstock Rectilinear Stamped and Napier Stamped respectively. The surface finish and technique of incising of Etowah Incised and Woodstock Incised were most similar, although the vessel forms and the motifs were distinct.

The extensive excavations at the Etowah Mound system and the Wilbanks site confirmed the association of the Etowah Stamped tradition with the elaborate cult paraphernalia of the area. The later breakdown of the Etowah series by Sears into four substages of mature Mississippian made it possible for this study to compare and correlate an Etowah Stamped sample from the Coosa River area in Alabama.

The sherd sample in question was collected from an unstratified Island site in the Coosa River and situated in St. Clair County. The cultural horizons represented at Woods Island (Sc^v40x1) were somewhat spotty and extensively eroded. The late Archaic com-

ponent was represented by a small number of chipped stone artifacts and a complete lack of aboriginal features. The early Mississippian was represented by an oval refuse pit containing Mulberry Creek Plain sherds. The middle Mississippian, or according to Sears "Mature Mississippian," appeared as a short occupation throughout the site, with one feature containing exclusively Etowah ceramics. The most abundant cultural material was from the last occupation and consisted principally of Historic McKee Island wares and an abundant amount of European trade items.

The sand tempered Etowah wares from Woods Island made up 13.75 per cent of the total sherd count and can be separated into three distinct types.

By far the most common Etowah type was Etowah Plain, with flared, carelessly rounded and occasionally flattened lips. One example exhibits a strap handle with protruding nodes. Etowah Burnished Plain was represented by only one sherd and exhibited the very high sheen characteristic of the Georgia type sherds. The paste is very similar to that of the plain ware but contains a temporing material of very fine sand. The striations made by the polishing pebble were evident in vertical lines.

The Etowah Complicated Stamped sherds from Woods Island exhibited only five of the recognized twelve design motifs characteristic of Etowah Stamped. The presence of the line block motif; Ladder Base Diamond; one bar diamond; one bar cross diamond, and the two bar diamond indicate the occupation to have been limited to the Etowah II Period.

The general breakdown of the design elements by Sears in 1958 into the four periods of the Etowah horizon, made it possible to correlate samples from other areas and suggest generalized period distributions.

At the present time, the Etowah samples from Woods Island represent the most westward extinction of the Etowah tradition and the largest sample collected outside of northwestern Georgia. The position of Woods Island in the Coosa River would suggest a diffusion of the Etowah traits down the Etowah River to its juncture with the Oostanaula where it forms the Coosa and flows east into Alabama and then turns south to join the Tallapoosa.

The future archaeological salvage work along the Coosa will greatly facilitate the eventual study of the complete Etowah dis-

tribution, possibly making new contributions to the growth of the stamping tradition in late Woodland and Early Mississippian periods throughout the southeast.

REFERENCES

SEARS, WILLIAM H., The Wilbanks Site, River Basin Surveys Papers No. 12. Smithsonian Institution, Bureau of American Ethnology. Bulletin 169. 1958.

WAUCHOPE, ROBERT, The Ceramic Sequence in the Etowah Drainage. Northwest Georgia. Amer. Antiq. Vol. 13. No. 3. 1948.

WAUCHOPE, ROBERT, The Evolution and Persistence of Ceramic Motifs in Northern Georgia. Amer. Antiq. Vol. 41. No. 1. 1950.

Mammals of the Howard College Natural Area

William H. Hill*
Howard College†

Introduction

This report deals with collections of mammals. The area studied was a 60-acre tract of land set aside as the Howard College Natural Area. The work represents only one part of the study of the biota of this area.

Preliminary collections of mammals were started in 1958-1959 by Dr. R. D. Weigel. Since then much time has been spent collecting and observing in the area. A general description of the Howard College Natural Area has been published (Holman, J. A. 1961. *J. Ala. Acad. Sci.* 32:77-87). This report shows a map of the general topography of the area (Fig. 1). Two sites in the area have been intensively studied; the Shades Mountain slope, which is a stand of mixed mesophytic plants and the Shades Valley flood plain, an old lake bed.

A total of 12 families, 22 genera, and 23 species was found. Three species occupied the Shades Mountain slope only: *Cryptotis*

*The author wishes to thank Dr. Herbert A. McCullough and Dr. Francis M. Bush of the Department of Biology at Howard College for their advice and encouragement during the course of this work, and Dr. Robert D. Weigel of Illinois State Normal University for his initial contributions to the collection.

†Presently at Illinois State University, Normal, Illinois.

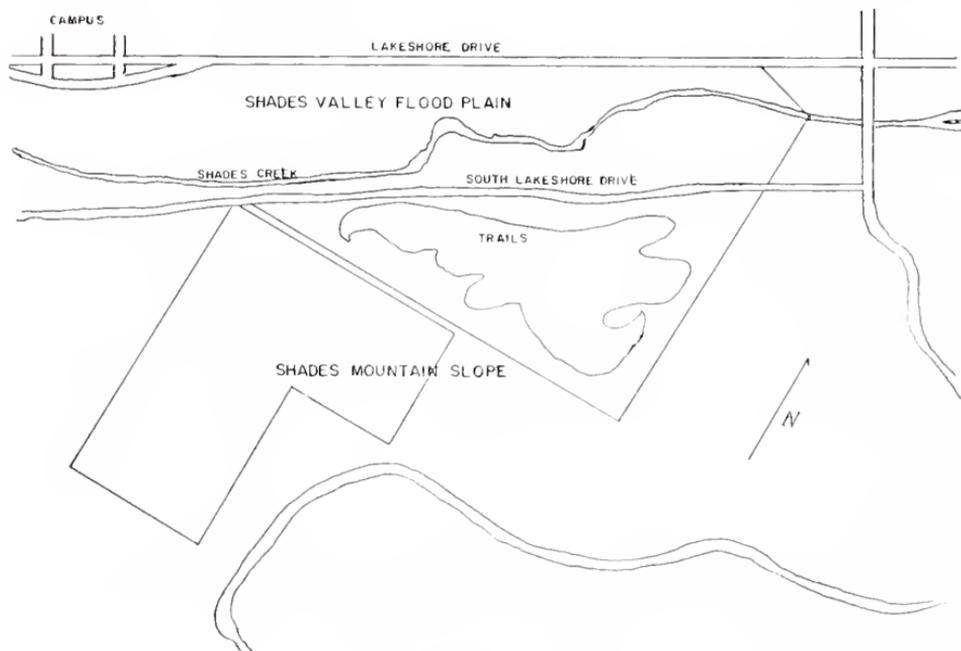


FIG. 1

p. parva, *Marmota m. monax*, and *Peromyscus g. gossypinus*. Four species occupied the Shades Valley flood plain only: *Castor c. carolinensis*, *Ochrotomys n. nuttalli*, *Sigmodon h. hispidus* and *Ondatra z. zibethicus*. All other species were common to both sites.

ANNOTATED LIST OF SPECIES

Systematic arrangement of species follows Blair, et al., 1957; Vertebrates of the U.S., McGraw-Hill Book Co., Inc., N.Y.; subspecies according to Miller, G.S. and Remington Kellogg, 1955, U.S. Nat. Mus. Bull. 205; and common names according to Collins, H. H., 1959, Field Guide to Amer. Wildlife, Harper and Brothers, N.Y. Specimens collected from the Howard College Natural Area are in the Howard College Collections in the Biology Building.

Didelphis marsupialis virginiana Kerr. ——— Material: HC M8. In a single specimen: Total Length 760 mm., Hind Foot 65 mm., Tail 317 mm.

The Opossum is often observed in the Natural Area and is the only representative of the order Marsupialia.

Cryptotis parva parva (Say). — Material: HC M99. In the single available specimen: T.L. 75 mm., H.F. 11 mm., T. 18 mm.

The Little Short Tailed Shrew is infrequently collected in the Area.

Scalopus aquaticus howelli Jackson. — Material: HC M57. The one available specimen measured: T.L. 154 mm., H.F. 18 mm., T. 25 mm.

This Eastern Mole comes from one-half mile north of the Area. No moles have been collected from the Natural Area but numerous runs indicate their presence.

Myotis sodalis Miller and Allen. — Material: HC M122. In one specimen: T.L. 50 mm., H.F. 8 mm., T. 25 mm.

This Indiana *Myotis* comes from the proximity of the Area.

Pipistrellus subflavus subflavus (F. Cuvier). — Material: Thirteen specimens measured: HC M132, T.L. 80 mm., H.F. 10 mm., T. 30 mm.; M133, 85 mm., 10 mm., 40 mm.; M134, 65 mm., 8 mm., 25 mm.; M135, 65 mm., 9 mm., 25 mm.; M136, 75 mm., 8 mm., 35 mm.; M137, 75 mm., 8 mm., 35 mm.; M138, 75 mm., 10 mm., 30 mm.; M139, 77 mm., 9 mm., 35 mm.; M140, 70 mm., 8 mm., 30 mm.; M145, 70 mm., 10 mm., 27 mm.; M146, 70 mm., 10 mm., 27 mm.; M129, 70 mm., 8 mm., 28 mm.; M110, 87 mm., 11 mm., 22 mm.

Lasiurus borealis borealis (Muller). — Material: HC M95. In the single available specimen: T.L. 90 mm., H.F. 35 mm., T. 35 mm.

Sylvilagus floridanus mallurus (Thomas). — Material: They are frequently observed in the Area. Many have been seen as D.O.R.'s.

Sylvilagus aquaticus aquaticus (Bachman). — Material: HC M113. In the one specimen: T.L. 420 mm., H.F. 85 mm., T. 65 mm.

Swamp Rabbits are found more commonly in the Shades Valley flood plain.

Sciurus carolinensis carolinensis Gmelin. — Material: Three specimens measured: HC M20, T.L. 536 mm., H.F. 70 mm., T. 250 mm.; M21, 402 mm., 59 mm., 194 mm.; M108, 480 mm., 55 mm., 260 mm.

The Gray Squirrel is ubiquitous in the Area.

Marmota monax monax (Linnaeus). — Material: HC M3 and M2. In the two adult individuals: T.L. 583-610 mm., H.F. 85-87 mm., T. 135-140 mm.

The above two specimens were collected about 150 yards from the south-east boundary of the Shades Mountain slope. Woodchucks have been observed in the Natural Area but none have been collected.

Tamas striatus striatus (Linnaeus). — Material: HC M33 and M34. In the two individuals: T.L. 220-275 mm., H.F. 28-30 mm., T. 80-83 mm.

Glaucomyys volans saturatus Howell. — Material: HC M31 and M32. In the two adults: T.L. 235-225 mm., H.F. 32-30 mm., T. 110-100 mm.

The above two Flying Squirrels came from one-half mile north of the Area. Flying Squirrels have been observed on the Natural Area on several occasions.

Castor canadensis carolinensis Rhoads. — Material: Beavers have been observed in Shades Creek, but irregularly.

Peromyscus gossypinus gossypinus (Le Conte). — Material: Fifteen specimens measured: HC M75, T.L. 160 mm., H.F. 20 mm., T. & 0 mm.; M76, 180 mm., 25 mm., 75 mm.; M77, 174 mm., 22 mm., 79 mm.; M78, 171 mm., 22 mm., 64 mm.; M79, 170 mm., 22 mm., 70 mm.; M80, 180 mm., 22 mm., 75 mm.; M82, 160 mm., 21 mm., 73 mm.; M83, 165 mm., 23 mm., 80 mm.; M84, 145 mm., 20 mm., 67 mm.; M87, 157 mm., 22 mm., 74 mm.; M100, 150 mm., 21 mm., 65 mm.; M101, 180 mm., 21 mm., 74 mm.; M109, 170 mm., 22 mm., 75 mm.; M131, 140 mm., 18 mm., 59 mm.; M142, 150 mm., 20 mm., 70 mm.

Ochrotomys nuttalli nuttalli (Harlan). — Material: Four specimens measured: HC M90, T.L. 168 mm., H.F. 19 mm., T. 70 mm.; M91, 140 mm., 20 mm., 65 mm.; M93, 147 mm., 18 mm., 61 mm.; M94, 165 mm., 18 mm., 62 mm.

Golden Mice are common in the Shades Valley flood plain during fall and winter months. Spring floods tend to temporarily disrupt the population.

Sigmodon hispidus hispidus Say and Ord. ——— Material: Eight individuals measured: HC M52, T.L. 240 mm., H.F. 30 mm., T. 95 mm.; M53, 210 mm., 30 mm., 85 mm.; M102, 213 mm., 22 mm., 88 mm.; M103, 220 mm., 30 mm., 90 mm.; M104, 210 mm., 27 mm., 80 mm.; M105, 250 mm., 25 mm., 100 mm.; M141, 250 mm., 30 mm., 100 mm.; M143, 215 mm., 28 mm., 85 mm.

The Hispid Cotton Rat is found primarily in the flat grassy area and in the grass along road-side ditches.

Pitymys pinetorum pinetorum (Le Conte). ——— Material: HC M60. A single available specimen measured: Body Length 85 mm., Hind Foot 16 mm. This specimen was preserved inadvertently. No other measurements were made.

Pine Voles are rarely collected on the Natural Area.

Ondatra zibethicus zibethicus (Linnaeus). ——— Material: HC M49. One adult measured: T.L. 630 mm., H.F. 90 mm., T. 265 mm.

Muskrats are quite common along Shades Creek.

Mus musculus brevirostris Waterhouse. ——— Material: Three specimens measured: HC M63, T.L. 190 mm., H.F. 15 mm., T. 80 mm.; M106, 150 mm., 9 mm., 70 mm.; M107, 150 mm., 10 mm., 75 mm.

House Mice can be found throughout the Natural Area, but they do not occur in great abundance.

Urocyon cinereoargenteus cinereoargenteus (Schreber). ——— Material: Gray Fox are very infrequent on the Natural Area but have been occasionally observed.

Procyon lotor varius (Nelson and Goldman) . ——— Material: Sight observation in the proximity of the area. Tracks have also been found along Shades Creek where it runs through the Natural Area.

Mustela vison Schreber. ——— Material: One adult specimen was found dead on the road that separates the flood plain and slope areas in August, 1963. The measurements are: body length 440 mm., hind foot 56 mm., tail length 140 mm. This is the only record of minks on the Natural Area.

Mephitis mephitis (Schreber). ——— Material: Part of a carcass was found on the Shades Mountain slope; it was not collected.

ABSTRACTS**Physics And Mathematics****Ionic Waves in a Cylindrical Column**

Lewis W. Patrick
Auburn University

The theory of ionic oscillations in an ionized gas has been applied to a cylindrical cavity with metallic walls. The development offers no explanation of the origin of the oscillations but does yield a dispersion relation that may prove useful in measuring electron temperatures. The solution is that of a standing electric field wave subject to boundary conditions which assume the cavity walls perfectly conducting. The application remains to be verified experimentally.

**Positron Annihilation in Cholesteryl Acetate
as a Function of Temperature**

George D. Cole and William W. Walker
University of Alabama

Positron lifetimes have been measured in three phases of the organic substance cholesteryl acetate. This compound has a cholesteric liquid crystal phase intermediate between solid and ordinary liquid phases. Measurements were made using a transistorized time to amplitude converter of Simms¹ design. In the solid phase the mean life (τ_2) was constant at 1.5 ± 0.1 nsec as the sample was heated from 25°C to 63°C. At the latter temperature an irreversible discontinuity was observed with an increase in τ_2 to 2.4 ± 0.1 nsec. Qualitative x-ray diffraction studies indicate that this discontinuity is the result of a solid-solid transition. τ_2 was observed to be 3.2 ± 0.1 nsec in both the liquid crystal and the ordinary liquid phases.

¹ Simms, P. C., The Review of Scientific Instruments. 32, 894, 1961.

A Presentation of the Binary Number System in Elementary Algebra

W. L. Furman, S.J.
Spring Hill College

Presentation of new number systems can be made to students of elementary algebra by starting with a simple analysis of the base ten system. A whole number in this system may be considered as the coefficients of a polynomial if the coefficients used are less than ten and ten is substituted for the variable. The same polynomial expression has different value when another number is substituted for the variable. Two principles used are: (1) that the number of digits in any system equals the base number, and (2) that in any system the base number is always represented by the same two digits. Successive presentation of number systems of base ten, nine, eight and so on to base two has been found to be a very effective way to introduce the student to the binary and other number systems.

Atomic Collisions with Crystal Surfaces

Charles M. Chambers
University of Alabama

The transfer of kinetic energy of an incident particle into vibrational energy of the solid has been studied using a basically one-dimensional discrete particle model which has restorative and dissipative correction terms added to the equations of motion to include the effect of the bulk of the crystal. As the collisions involve many phonon creations, classical mechanics has been used throughout, following the previous work by Zwanzig(1) and Cabrera and Kinzer(2). This work has been extended to include the modifications introduced by the restorative effect of the crystal bulk and the dissipation of energy into the bulk in the form of transverse wave motion. The efficiency of energy conversion is generally less than for the simpler models previously considered. An analysis will be presented of the trapping properties of this model and comparison made to the previous results.

(1) ZWANZIG, R. W., J. Chem. Phys. 32. 1173. 1960.

(2) CABRERA, N. AND KINZER, E., Bull. Am. Phys. Soc. Ser. II. 6. 337. 1961.

Spectral Transmission Properties of Spinach Chloroplasts

F. Dudley Bryant
Auburn University

The spectral light scattering and transmission properties of strongly absorbing dielectric particles has not been widely studied, nor are they well understood. In a combined experimental and theoretical approach, information about one such system was studied.

Physical optical theory was used to account for the observed spectral properties of partial layers of spinach chloroplasts. Extinction and scattering curves of partial layers of spherical particles were predicted by equations derived from "large particle" theory. Parameters in these equations include values for the refractive index and absorption coefficient of the individual particle, particle size and particle concentration. (This research was supported by U.S. Public Health Service grant.)

Electrostatic Quadrupole Lens

Shih-yung Hsieh
Auburn University

An electrostatic quadrupole lens has been constructed using results of Lu and Carr(1). The lens and an appropriate 10-stage accelerator has been installed in a 60-degree Nier type mass spectrometer. Results on the ion throughput and the resolution of the spectrometer will be given.

(1) LU AND CARR, The Review of Scientific Instruments, 33:823. 1962.

A New Technique for Solving the Linear Harmonic Oscillator Problem

C. Milton King
Auburn University

The energy eigenfunctions for the linear harmonic oscillator were obtained by using operator similarity transformations to reduce the energy eigenvalue equation to a first order differential

equation. The eigenfunctions were easily obtained by solving the first order equation and reversing the transformation. The method yielded a representation of the eigenfunctions which was especially adapted to several problems. Most significant among these was a derivation of the Green's function for the linear oscillator.

Elastic Waves in an Infinite Continuum Due to an Arbitrary Point Force

Earl T. Kinzer
University of Alabama

The vector elastic wave equation has been solved for an arbitrary force acting at a point in an infinite isotropic elastic medium. The solution was obtained using the Fourier Transform method for the solution of partial differential equations. An outline of the solution of the problem and some of the difficulties involved were indicated. The final result was checked by comparing the special case of a constant force to the well-known solution to the corresponding problem in static elasticity.

Chemistry

Characterization of Some Silazanes by Proton Magnetic Resonance

Martha C. Thorpe
Southern Research Institute

A method was needed to confirm the structure of newly-prepared silazanes. An infrared method was investigated, but was found unsatisfactory because of the complexity of the spectra and the presence of the same functional groups in several compounds.

A method was tried based on proton magnetic resonance spectra. Identification of the functional groups was simple, and their chemical shifts were sufficiently different that the bands were well separated.

This separation of absorptions made possible effective use of electronic integration to determine the proportions of the various functional groups present. In conjunction with elemental analyses and molecular weight determinations, structures of the group of compounds were satisfactorily confirmed.

Some Attempted Reactions of Diazo Compounds With 1-Ethoxyvinyl Acetate

Robert H. Garner and James C. Franklin
University of Alabama

The preparation of some cyclopropane derivatives by the cycloaddition of diazo compounds to 1-ethoxyvinyl acetate was of interest since the hydrolysis of these compounds could yield products arising from cyclopropanone intermediates.

Cycloaddition reactions were attempted with diazomethane, diphenyldiazomethane, and ethyl diazoacetate. Only the reaction with ethyl diazoacetate has produced any cycloaddition products. The evidence for the preparation of a small amount of ethyl 2-ethoxy-2-acetoxycyclopropanecarboxylate will be discussed.

Determination of Nickel With 2,3-Quinoxaline Dithiol

Arthur F. Findeis, University of Alabama,
and
R. W. Kiser, Kansas State University

2,3-Quinoxaline dithiol forms a red complex with nickel ions in solution. The use of a mixed solvent of dimethylformamide-water minimizes correction factors that are required in aqueous media.

Gas Analysis by Geiger Pulse Attenuation

Fred Williams
University of Alabama

A method of quantitative analysis of gas mixtures is based on the alteration of the electronic characteristics of Geiger gases by the admixture of additional components. This alteration due to a change in composition of the Geiger gas results in a shift in starting potential and a change in gas amplification.

In this method the gas mixtures are passed through a counter in a stream of commercial Geiger gas, Q gas. The counter is operated in the Geiger region of gas amplification with a low intensity source of radiation for an oscilloscopic display of the pulse. The sensitivity of detection is less than 2.5×10^{-6} moles for halogenated hydrocarbons. Linear calibration curves were obtained for many binary mixtures. In those cases where one of the components had a high electron attachment probability a nonlinear, but reproducible calibration curve was established. Ternary mixtures containing argon may also be analyzed by this approach. The precision by observation of the pulse attenuation on an oscilloscope screen is one per cent. Gases studied by this technique were nitrogen, oxygen, argon, helium, carbon dioxide, methane, low molecular weight alcohols, ketones, aldehydes, halogenated hydrocarbons, and binary or ternary mixtures of the above.

The Surface Tension Lowering of Aqueous Solutions of Organic Substances

Alan Hisey
University of Alabama

In spite of the general acceptance of the validity of Gibbs' Surface Tension Equation, there has never been established a quantitative relationship between the molecular weight of the solute and the degree of lowering of the surface tension. With the help of a grant-in-aid from the University Research Council and the use of a Friden Calculator it has been possible to determine accurately, from a large number of data in the literature, the values in Gibbs' equation for the fatty acids and a few other compounds. By the method of least squares the best straight line was found in each case and also the value of its slope and intercept. This permitted calculation of the ratio of the integration constant to the slope, which is the surface tension constant related to the molecular weight. As a result of this investigation the general surface tension equation for the fatty acids can be stated as follows:

$$F/aRT = \ln w_1 - \ln w_2 + 0.644M + 0.560 \pm 0.13 \text{ SD}$$

where F is the lowering of the surface tension in dynes per centimeter, a is the surface concentration in mols per square centimeter, R is the gas constant, T is the temperature, w_1 is the weight of solute in grams per kilogram of water, w_2 is the weight in grams of one kilogram of water, M is the molecular weight of the fatty acid.

Differential Thermal Analysis of Oxalato-Niobic(V) Acid

Raymond W. Conrad and James E. Land
Auburn University

Samples of oxalato-niobic(V) acid prepared by the method of Fairbrother were subjected to differential thermal analysis over the temperature range of 25 to 500 degrees C. At 225° C. a large endothermic change indicated the decomposition of the oxalato ligands. Other less pronounced endotherms in the 303-340° range indicated the probable loss of waters of constitution and the for-

mation of amorphous Nb_2O_5 . A comparison of the D.T.A. curve of the above mentioned sample to one which had undergone sublimation was presented.

Polarography of Radioactive Thallium

Robert A. Culp
University of Alabama

Polarography at infinite dilution is possible with exempt quantity radioisotopes. A description of the experimental approach was given in this paper.

Social Sciences

Regulation of Trade Practices in the Dairy Industry in the South

Lowell E. Wilson
Auburn University

The problem of fair competition is common to many businesses. However, there are differences in the way this problem appears among industries. Certain "unfair" or disruptive practices may be unique to some industries. State milk control laws and dairy fair trade laws authorize regulation of dairy trade practices in most Southern states.

Unfair competition by milk dealers or other distributors can eliminate milk dealers from a market. In the belief that producers, consumers, and dealers are adversely affected by unfair competition, a number of state legislatures first passed emergency dairy laws in the 1930s dealing in part with business practices in this industry. Since that time, dairy practices have been the subject of additional legislation in many states.

Practices considered unfair or disruptive to the orderly marketing of milk include: sales of milk and milk products below cost; price discrimination; granting of discounts and rebates, gifts, advertising allowances, loans, credit; and similar practices that may affect the sales price of regulated dairy products.

Regulation of trade practices varies among states. A practice illegal in Alabama may be considered a fair practice in the dairy industry in another state. Likewise, some trade practices considered fair in Alabama may be illegal in other states. This variation in the concept of fairness among states is brought about in part by the variation in development and structure of the dairy industry from one state or region to another.

Business dealings regulated or forbidden in state laws include the more prevalent unfair practices found in this industry. In essence, these laws provide that persons engaged in the sale of milk are forbidden to sell milk at prices other than the established market price.

Systematic Approach to the Field of Marketing

Chas. Thomas Moore and Lyndon E. Dawson, Jr.
University of Alabama

The purpose of this paper was twofold: (1) to explain a systematic approach to marketing, and (2) to approximate the ways in which the social sciences may contribute to this systematic approach.

The systematic approach to a firm's activities implies that an understanding of the behavior of the actors in the marketing process must be obtained to enable the inherent function to maximize the difference between costs and revenues. The behavior system envisioned includes the individuals and groups within the framework of the firm who are responsible for marketing activity and the individuals and groups outside the firm whose system of behavior applies contra-pressure on the firm's efficiency. Thus the systemic approach provides a framework for interrelating and coordinating the firm's market activities.

The systematic approach as applied to marketing implicitly includes men, material, and capital girded by a marketing program which includes the function of advertising and sales promotion, pricing, physical distribution, personal selling, product, and channel analysis. These functions are performed within the boundaries established by the firm.

The activities involved in the marketing program are controllable within the firm's system and determine the firm's internal working position. The external or contra-pressure which also shapes the boundaries of the firm's total system include sellers and non-controllable variables such as competitors and the government. These contra-pressures determine the extent of the market and control by the firm over its market.

Understanding of the push-pull forces of the total system is limited by knowledge of the actors in the marketing process. The total system is incomplete and blockages to knowledge are created by the failure to utilize knowledge in the social sciences. If a systemic analysis of the impact of marketing is to be developed, tools of the social sciences must be used to provide a basis for organization and decision theory.

An Appraisal of Soviet Iron Ore Resources

Wayne C. Curtis
Auburn University

Today the strength of a nation is largely dependent upon industrial power. This, in turn, requires minerals. With the development of modern industry, there has occurred a considerable worldwide increase in mineral requirements. One very prominent mineral—the importance of which cannot be overemphasized because of its use in steel production—is iron ore. It is almost a certainty that no country can expect to become a world power without possessing sufficient supplies of this ore.

Available information indicates that the position of the Soviet Union in regard to this significant natural resource is fairly secure. Although the U.S.S.R. has but limited quantities of top-grade ore, its resources are abundant. Conservative estimates based on examination of the most important and best-studied deposits reveal resources in excess of foreseeable Soviet needs. Distribution of the resources, however, is less favorable and may present a transportation and coordination problem in the future.

Agricultural Land Utilization Policies in the Soviet Union

Clifford C. Neilson
Auburn University

The utilization of agricultural land in the USSR under present policies results in three distinct types of farms. The most commonly found are the *kolkhozy* or the collective farms; these are theoretically democratically-organized farms on which the resident families decide by vote on what is to be raised and how the proceeds are to be distributed. Although the land itself belongs to the state, it is leased in perpetuity to the *kolkhozy*.

The second form is the *sovkhozy* or the state farms; these may be compared to a factory-in-the-field in which all management decisions are made by an appointed farm manager. Workers are paid a standard hourly wage with bonuses for exceeding quotas. The land is owned and managed by the state.

The third type is the private homestead; each farm family on a collective or state farm is rented a small plot of land on which he

may build a home and raise produce, livestock, and poultry as he sees fit with all profits accruing to the family.

Recent pronouncements by the Soviet hierarchy coupled with actual observed structural changes lead to the conclusion that the collective farm as a type has been declared out-moded and it to be phased out over a period of years. The state farms by absorbing former collective farms are becoming individually larger while their total number grows greater. The private acreage, although an obvious exception to communistic doctrine, is slated to remain relatively stable since it continues to furnish a proportionately great amount of the total Soviet agricultural production.

Karl Mannheim and the Sociology of Knowledge: A Scientific Investigation of Values

Richard M. Owsley
Auburn University

Science and philosophy, as modes of experience, have confronted each other in a variety of ways. Scientists have thought of themselves as dependent upon philosophy, and some philosophers have considered their task to be one more example of the scientific procedure. Most examples of conquest have resulted, however, in a delicate but durable mutual respect. This compromise has left to the sciences the investigation of the facts and to philosophy the recommendation of values.

In his particular concept of the sociology of knowledge (there are, of course, others) Karl Mannheim has threatened the compromise between social science and social philosophy. The sociologists, to Mannheim, records social facts, establishes relations among them, and attempts to predict new facts on the basis of the laws thus established. But—the sociologists must go further. He must interpret value configurations such as ideologies and utopias and recommend some value complexes over others in a given social situation. In this latter capacity he has become a philosopher.

This paper explored: (1) Mannheim's definition of the sociology of knowledge, (2) the specific method which he believes such a concept entails, (3) the explicit and implicit philosophical presuppositions of the definition and the method, and (4) the criteria for the "good" society which has resulted. These explorations will serve as a basis for critically evaluating Mannheim's concept of knowledge and the sociology of it.

**Selection of Lee County, Alabama, by the
United States Rubber Company**

H. Ellsworth Steele
Auburn University

Hungry for new industry because of what it means for its people, the South rejoices whenever plans for a new plant are announced. This was the case when the United States Rubber Company revealed in July 1962 that it would build a \$20 million plant in Lee County, Alabama.

The present paper examines the criteria used by large industrial firms in selecting new sites and explores the advantages which Lee County has to offer such firms, particularly those in the rubber industry. Attention is focused upon five factors which influence location: market; climate; labor; fuel, power, and water; and access to raw materials.

The financial inducements which Lee County offered U.S. Rubber appear to have been crucial in the final decision to locate in Alabama. For this reason the various methods available for financing such a large plant are studied. Special emphasis is placed upon the industrial revenue bond which was the method selected.

The paper developed from research undertaken by graduate students in business at Auburn University. Information for it was obtained through correspondence with the major rubber companies, interviews with public and private officials in Opelika, and a study of the literature on plant location.

Socio-Economic Environmental Forces in Economic Development

E. D. Chastain, Jr.
Auburn University

Socio-economic environment forces as they influence economic development were analyzed. The approach was one of drawing attention to development opportunities in the contemporary environment. These opportunities were explored with respect to not necessarily changing the attitudes, customs, traditions, beliefs, and values of the people. The changing of these attributes is generally considered to be a slow process. Also, these attributes are not necessarily bad or require change when viewed in a development perspective.

Geology and Anthropology

Fluted Projectile Points From a Stratified Site in Marshall County

David L. DeJarnette
University of Alabama

For a number of years, fluted projectile points have been found scattered over the surface in counties bordering the Tennessee River in North Alabama. Because of the profusion of these points, the presence of an early hunting complex called Paleo Indian is assumed. However, no previous excavation had demonstrated a stratigraphic placement of these fluted points.

During the 1962 University of Alabama field season, such a site was partially excavated. This site, a rock house located in Marshall County near Asbury Community approximately six miles north of Albertville, was discovered by members of the Marshall County Chapter of the Alabama Archaeological Society and brought to the attention of the University of Alabama archaeologist. The last two weeks of the summer session were devoted to an extensive test of the site.

In the 10th and 11th levels (40 to 44 inches below surface) the site yielded four sections of Cumberland points. The Cumberland is an eastern variety of early hunting projectile point which exhibits well developed fluting. The stratigraphic position of the Cumberland places it at the same time period or slightly earlier than the Dalton Complex, which had been dated in the Stanfield-Worley excavation of 1961 by radiocarbon at $9,640 \pm 450$ years ago.

An Archaeological Survey of the Holt Lock and Dam Area

Joseph L. Benthall
University of Alabama

For a number of years, there has been considerable interest in that area of the Black Warrior River which will be subject to flooding by the fall of 1966 because of the construction of a large dam. This area is of particular interest to many archaeologists because of the rather large number of aboriginal occupation or habitation sites which will be inundated.

At the present, a preliminary survey of the area is being conducted, under the supervision of Professor David L. DeJarnette of the University of Alabama, with the hope that the more productive sites may be excavated before flooding takes place.

Even though very little is known about the nature of the cultural materials of the area, recent surface collections seem to suggest a predominance of Woodland and Archaic traits with, perhaps, a slight amount of influence from Mississippian times. One site revealed evidence of the Traditional Period between Paleo and Archaic times.

Alphabet and Speech: A Study of the Relations Between Graphic and Phonological Symbolism

James R. Jaquith
University of Alabama

The background of the problem which motivated the present research is, briefly, this: Ideally an alphabet, by contrast to other major types of writing systems (e.g., logographic, syllabic) maintains a one-to-one correspondence between a set or sets of graphic symbols and selected phonological subsystems of any given language, including most prominently what are known as segmental phonemes. Alphabetic writing is enormously easier to learn than either of the other types, especially logographic, which in principle demands the memorization of a graphic symbol for each word read or written.

It is reasonably common knowledge that contemporary spelling orthographies vary impressively in terms of the correspondences alluded to above. Finnish, Polish, and Spanish are examples of relatively efficient spelling orthographies. Knowledge of, or feeling for, the relative inefficiency of the English alphabet has prompted educators and intellectuals of various backgrounds (among them George Bernard Shaw) to urge spelling reforms on English.

The relative efficiency of spelling systems can be measured by means of an empirical, quantified comparison of the fit between graphic and phonological systems of selected languages. The study from which the present abstract was drawn has employed randomly-selected 10,000-word samples of graphic material from each of four languages. Each graph from the samples was counted and recorded

with a view to determining actual frequencies and functional load differentials as opposed to dictionary-derived assertions.

Analysis based on this count reveals that in descending order of efficiency the alphabets of the languages selected for this study must be ranked as follows: Spanish, German, French, English.

Some Relationships Within Early Archaic Projectile Point Types

Oscar W. Brock, Jr.
University of Alabama

In the Tennessee Valley, the Early Archaic cultural period, ranging from approximately six-thousand to nine-thousand years ago, manifests a bewildering variety of projectile point sizes, styles, and materials. Nonetheless, the current typological system used in the Tennessee Valley area has recognized more than thirty distinguishable types. These types consistently appear in stratigraphic context well below the earliest ceramic horizons and show common features such as fine pressure flaking and basal grinding. The subsistence basis and settlement patterns ascribed to these lowest levels are highly problematical and hypothetical. Tentatively, however, the transition from the Paleo Indian into the Early Archaic can be characterized by a gradual shift from the specialized hunting of post-Pleistocene mammals to a generalized hunting-gathering economy.

A successful projectile point typology must provide a continuum of evolving projectile point forms and must attempt to genetically relate various "types." Despite a serious lack of information, certain evolutionary lines and family relationships are tentatively being traced from the Paleo Indian through the Early Archaic.

Forestry, Geography and Conservation**Black Root Rot Found in Florida Sandhills**

Glendon W. Smalley
Southern Forest Experiment Station

Black root rot, caused by a fungus complex of *Sclerotium bataticola* and *Fusarium* species, is primarily a nursery disease but has recently been found on a wide variety of sites in the sandhills of the west Florida panhandle. Thus far, mortality is restricted to young slash pine in plantations established on cleared, deep sand sites.

During the spring of 1962 over 20,000 acres of 2- to 7-year-old slash pine plantings in five counties were surveyed. Evidence of black root rot was found on nearly 95 per cent of the 644 plots. On the average, 15 per cent of the trees were dead, 13 per cent apparently dying, and 72 per cent alive. Ninety-six per cent of the apparently dying slash pines had root rot suggesting that most dead pines probably were heavily infected also. On the average, 69 per cent of the live trees exhibited both root and foliar symptoms of root rot. There was no clear relation between the presence of root rot and either topographic position or aspect.

The results of incidental observations made on other planted species and four small direct-seeded areas, and cultures from 17 root samples are also reported. The root and attendant foliar symptoms are described and illustrated.

**Challenge of the Branch Bottoms in the
Longleaf Forests of South Alabama**

Thomas C. Croker, Jr.
U. S. Forest Service

South Alabama's longleaf forests are interlaced with narrow branch bottoms. These bottoms occupy one-fifth of the gross longleaf forest area, and probably account for a third of its total potential productive capacity. These "fire islands" in longleaf forests subject to frequent burning provide a haven for wildlife, assist in the control and use of fire, and tend to reduce the fire hazard. They are a source of food and cover for wildlife. Because of their jungle-like vegetation and boggy terrain, these areas are usually bypassed in

logging and silvicultural operations. In many such bottoms heavy brush has prevented trees from reproducing. Recent developments favor better management. Among these are the advent of a market for hardwood pulp, development of equipment suitable for use in branch bottoms, and promising results from exploratory research. Concerted action is needed to meet the challenge of the branch bottoms. We should begin to apply those practices that our present knowledge indicates are desirable, such as brush control. Knowledge of branch bottom management should be increased through research. As this knowledge increases and is translated into practice, better management of an estimated million acres of branch bottoms in south Alabama will add several million dollars annually to the economy of the area.

Recreation Use of the Alabama National Forests

Spencer H. Palmer

Forest Service, United States Department of Agriculture

Recreation use of the Alabama National Forests contributes to the health and welfare of the people of the State and Nation. Inspiration, enjoyment of the out-doors and relaxation can hardly be evaluated in material terms, but their importance to the well-being of our citizens is recognized and accepted. Each year sees larger numbers of people seeking outdoor recreational opportunities throughout the country. More and more people are investing in camping, fishing and hunting equipment. It will take the combined resources of Federal, State and private lands to meet the expected recreation demands of the future.

The Forest Service management goals for the Alabama National Forests are to serve present and future public outdoor recreation needs; to prevent unsanitary conditions, pollution, and forest fires resulting from recreation use; to take all measures necessary within reason to assure the safety of users; to coordinate recreation and other types of resource and land use in a manner which will enhance and protect existing and future public recreation values.

Estimates shows that by the year 2000 our population will double and the demand for recreation should triple. The task of meeting this demand will call for concerted effort of all public and private interests. Alabama National Forest recreation developments will be of simple, forest-type and in general will supplement those of other agencies to provide recreation facilities for the public use.

How the Soil Conservation Service Classifies and Evaluates Forest Sites in Alabama

Meredith A. Peters
Soil Conservation Service

When the soils in a county are surveyed the soil scientists classify the soil by series and type.

Most soils are made up of several distinct layers that are called horizons. The layers of a soil make up what is called a soil profile. From soil borings the scientists note and record the thickness of the layers and their arrangement in the profile. They also note characteristics of the soil layers that affect plant growth, or that are related to the formation of the soil. Some of the important characteristics are color, texture, structure, consistency, and acidity or alkalinity.

To assist in planning the use of soils for growing trees, the soils in a county are placed in woodland suitability groups. A woodland suitability group consists of soils that have about the same limitations to growth of trees and that need about the same management.

For determining the productivity of soils for timber growth, dominant trees are located on typical soils. A site index rating is given for each important tree species. In the Southern pine region productivity of forest soils are measured by the height of a tree at 50 years. The heights of dominant trees are obtained with an Abney level and a 100-foot chain. The age of a tree is determined by taking a core from the tree with an increment borer. The number of rings on the core indicates the age of the tree.

Woodland suitability groups are given ratings for degree of limitations to seedling mortality, plant competition, logging equipment limitations, erosion hazard, windthrow hazard, growth rate, and production.

Cattle and Cotton Production in Dallas County, Alabama

Hazel Stickney
Livingston State College

Dallas County is still a major cotton producing county, but changes in certain portions of the county are no less conspicuous on that account. The prairie portions of the county have turned to cattle almost exclusively. This new cattle economy is found in the north-

western part of the county. The southwestern portion is a combination of the old and the new with farms combining cotton and cattle. In the western part of the county, in general, dairying is quite important, and some farmers are involved in sheep production. The northeastern section of the county raises cotton, devotes certain areas to cattle, and the remainder is left in forest. The southeastern section is chiefly in forest with lumber and paper companies owning considerable acreage and purchasing additional supplies from privately owned tracts of land. In total, about half of the acreage of the county is estimated to be in forest.

During the past thirty years the standard of living has improved tremendously and requirements for the capital invested in farming operations have skyrocketed. Many small-scale farmers have been enabled to seek off-the-farm employment because of mechanization of their operations. This same mechanization has hastened the migration of the Negro population to cities outside the Black Belt largely. Selma has grown, and with an expanded consumer market the town is enjoying a period of prosperity even greater than during its hey-day as a river port for the old cotton trade. In spite of its spectacular change in aspect and outlook, however, cotton production still remains a major phase of Dallas County's agricultural economy and will continue to be a major source of farm income for many years to come.

BOOK REVIEW SECTION

TRANSITION IN ALABAMA, A Study by the Alabama Business Research Council, 1962, University of Alabama Press, Tuscaloosa, Alabama, 114 pp., \$3.00.

The purpose of this publication appears in the foreword, "to summarize and evaluate the changes which have characterized the Alabama economy over the last two decades and to take note of the general direction of these changes."

Readers "will be impelled to conclude that Alabama is no longer a sharecropper, poverty stricken, predominantly agricultural state."

The authors go about "impelling" readers in a brief data-laden, but enthusiastic and readable treatise on changes.

Dollar income facts of Table 1 present the heart of the changes. These facts are not modified to reflect constant purchasing power. The relative Bureau of Labor Statistics wholesale price index was 42.2 in 1939 and 100.6 in 1959. These years are the anchor points usually used to measure changes. To measure changes from 1939 to 1959 in terms of a constant-purchasing-power dollar, items must be deflated, in general, by well over 50 per cent. It may be noted also that personal income items were subject to much greater tax attrition in 1959 than in 1939 simply because they were much larger in terms of dollars and were, in effect, generally "inflated" into higher brackets for taxing purposes in the later year.

Nevertheless, changes have been demonstrated to be great and, in many respects, dramatic. Changes in relation to agriculture were highlighted. Certainly, a decrease in number of farms from 232,000 to 116,000 and in farm population from 1,343,000 to 403,000 in the two decades after many decades of either increase or relative stability may be considered dramatic. Likewise, a decrease in horses and mules on the farms by 70 per cent and an associated increase of tractors by 790 per cent are impressive.

The reported increase in personal income of farm proprietors by 153 per cent is not impressive, especially when compared with the State average increase of 554 per cent in all personal income. However, a 497 per cent increase in cash receipts from farming was reported (pages 53 and 55). This figure is 90 per cent of the average increase in personal income and it rather than personal

income from wages and farmers' proprietors personal income measures the potential market generated by farming.

The great population shift off farms and decrease in number of tenants is dramatic but really shares in national changes of the same type.

Relatively great increases in the form of wages and salaries occurred in contract construction, finance and related fields, highway freight transportation, communications, business and repair services, military, and in miscellaneous items.

Total wage personal income in mining, on the other hand, showed very little total change, thus falling far behind personal income in most other fields.

Description of these and many other changes together with comments on their implications make an interesting story of change and progress in our State.

Some inconsistencies appear in the story. Cotton accounts for a "trifling" 1.5 per cent of Alabama's personal income: all farm production for but 5.8 per cent of it; and farm production plus mineral production for but 10 per cent of the total. However, in the chapter on agricultural transformation, the "potential market" generated by farming is gross cash farm income which is about 2.5 times the net farm income. The latter presumably more closely approximates personal income from farm wages and farm proprietorship discussed in the treatise.

Similarly, the point is made (page 7) that "Transportation, to be sure, has lost ground heavily (as a payroll maker) due to fading . . . railroads." Later (page 73), we read, "In summary it may be said that transportation as a whole, commercial, private business, and personal has been a front runner in terms of growth of volume of service rendered and payrolls, directly and indirectly, created in the past 20 years."

This reviewer notes with approval that the authors skirt the monetary inflation handicap in a number of instances by comparing Alabama's changes with national changes.

Nevertheless, this interesting and provocative book would surely have gained more in stature than it would have lost in reader appeal by more positive emphasis on measures of changes that are less biased than undeflated personal income.

Perhaps, also, agriculture would fit more soundly and certainly differently in the picture if, like transportation, changes were viewed from the standpoint of personal income created "directly and indirectly" by it. In such a case, much of the whole field of "agribusiness" would enter the picture. This would include the business fields supplying the farmers and their farms and those processing and handling farm products.

—Ben F. Alvord, Auburn University

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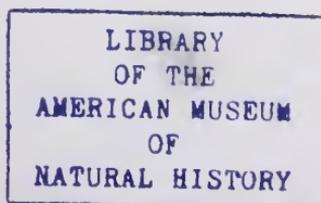
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The Percentage of Time That A Satellite Will Be In The Sunlight

Ruric E. Wheeler

Howard College

A knowledge of the per cent of time that a satellite will be in the sunlight for a planned orbit is important in the design of certain components of the satellite such as solar batteries. A numerical method for obtaining the per cent of time that a satellite will be in the sunlight was presented. Computations can be made on any one of the many electronic digital computers in use today.

The equation of the cylindrical surface formed by the light rays (extending parallel) from the sun to the outline of the earth is $Z''^2 + Y''^2 = R^2$ where the origin of our coordinate system is at the center of the earth with the X'' axis in the direction of the sun, and where R is the radius of the earth.

If Angle A is the declination of the sun, then the equation becomes $[-X' \sin(A) + Z' \cos(A)]^2 + Y'^2 = R^2$ when the Z'' and X'' axes are rotated through an angle $-A$ until the X' axis coincides with the plane of the equator of the earth.

Now, rotate the X' , Y' axes through an angle $-B$ until the X axis extends in the direction of the vernal equinox. Substituting $X=r \cos(C) \cos(D)$, $Y=r \cos(C) \sin(D)$, and $Z=r \sin(C)$, the equation of our cylinder in geocentric equatorial polar coordinates becomes:

$$S \cos^2(C) \cos^2(D) + T \cos^2(C) \sin^2(D) + V \sin^2(C) \\ + V \cos^2(C) \sin^2(D) + W \cos(C) \cos(D) \sin(C) \\ + X \sin(D) \cos(C) \sin(C) = R^2/r^2$$

Where $S = \cos^2(B) \sin^2(A) + \sin^2(B)$

$$T = \sin^2(B) \sin^2(A) + \cos^2(B)$$

$$U = \cos^2(A)$$

$$V = -2 \sin(B) \cos(B) \cos^2(A)$$

$$W = -2 \cos(B) \sin(A) \cos(A)$$

$$X = -2 \sin(B) \sin(A) \cos(A)$$

The plane of any orbit is defined by two angles P and i (P being the geocentric equatorial latitude measured to the intersection of the equatorial plane and the orbital plane, and i the angle between the two planes). The equation of an elliptic orbit of a satellite can be written as $r=a(1-e^2)/(1+e \cos(n))$ where \tan

$C = \tan(i) \sin(D-P)$, and $\sin C = \sin(i) \sin(\theta + n)$. (e is the eccentricity, a is semi-major axis of the orbit, θ is the orbital longitude of the perigee measured from the intersection and n is the true anomaly).

A search scheme may be devised enabling an automatic computer to find angles n_1 and n_2 at the intersection of the elliptical orbit and the cylinder. The right ascension of a position (D) in the orbit is assumed. For a given P and i , one can obtain the declination (C) of this position. Substituting this C and D in the equation of the cylinder, one obtains the length of the radius vector to the cylinder (R_c).

At the same time, with the given elements (P , i , θ , C , and D) the true anomaly of the assumed position can be found which gives the radius vector of the position in orbit (R_o). If R_o is greater than R_c the assumed position is the sunlight; when $R_o = R_c$ the elliptic orbit intersects the sun cylinder. Thus D is varied until there occurs a change in sign of $R_o - R_c$. The two angles n_1 and n_2 are computed at the points of intersection. If no intersection exists, then the complete orbit is in the sunlight.

Since the rate at which the radius vector sweeps out area is constant, a calculation of the time spent in the dark portion of the orbit can be found by calculating the area swept out by the radius vector between n_1 and n_2 . Thus the fraction of time spent in the dark is given by $1/2ab$ times the integral of $r^2 dn$ from n_1 to n_2 , where $r = a(1 - e^2) / (1 + e \cos n)$. The fraction of time spent in the sunlight is found by subtracting this quantity from 1.

Paleobotany in Alabama

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Auburn University

Plant fossils in Alabama can be found in the exposures of the Eocene of the Cenozoic era, the Upper Cretaceous of the Mesozoic era, and in the Pennsylvanian and Mississippian systems of the Paleozoic eras. This study deals with plant fossils from the Upper Cretaceous.

The paleobotanical work in Alabama has been limited to persons employed by the United States Geological Survey and by the Alabama Geological Survey. Much of this work was done between 1875 and 1925. E. W. Berry probably has done more work in the field than any other one person, and he published his results in the *Bulletin of The Torrey Botanical Club*, the *American Journal of Science*, *Journal of Paleontology*, *American Naturalist* and *Washington Acad of Science Journal*, and others. He was employed by the United States Geological Survey and some of his reports were published as USGS Professional Papers. The most informative of these is USGS Professional Paper 112, published in 1919. Other workers in the field of paleobotany were E. A. Smith, D. W. Langton, and L. C. Johnson, who were with the Alabama Geological Survey, and their reports were published in the Alabama Geological Survey Special Reports. Leo Lesquereux worked with some of the coal plants of Alabama and published a list of those coal plants found in Alabama in the Geological Survey of Alabama, Report of Progress for 1875-78. Since the early 1920s, little additional work has been done.

Excluding those plants from the coal deposits, most of the determinable plant remains found in Alabama occur in the lower part of the Upper Cretaceous named the Tuscaloosa formation. Most of the fossils found in other formations of the Upper Cretaceous are marine fossils such as Crinoids, *Ostrea*, shark teeth and others. Much of the plant fossil material found in the upper layers is poorly preserved and does not have as much value as those of the Tuscaloosa.

The Upper Cretaceous belt from which the best fossils have been collected extends from Benton County in west-central Tennessee southward and eastward to west-central Georgia through Franklin, Marion, Lamar, Fayette, Pickens, Tuscaloosa, Green, Hale, Sum-

ter, Perry, Bibb, Chilton, Autauga, Dallas, Lowdes, Elmore, Montgomery, Macon, Bullock, Russell, and part of Lee Counties in Alabama.

The Tuscaloosa formation was named by E. A. Smith and L. C. Johnson in 1887 after the city of Tuscaloosa. The Tuscaloosa is characterized by light colored sands and gravel together with pebble beds made up of quartz and chert.

Fossil plants are abundant in Alabama but only a few collecting localities have been recorded. Some of these localities are in Fayette County near Shirleys Mill, and Glen Allen in Tuscaloosa County near Tuscaloosa, Cottondale, Snow Plantation, Sanders Ferry Bluff and in Green County near Whites Bluff. More fossils have been found in Fayette County at Shirleys Mill than at any other exposure. Approximately 100 species have been recorded from this location. It should be noted that many of these locations are along the Warrior River. Much of the field work was done along the rivers of Alabama which were traveled during the summer on a house boat.

A particularly good exposure has been noted in Macon County near Tuskegee along the Uphapee Creek. At this location pertified hardwood logs of yet unidentified species have been found. These logs range up to three feet and more in diameter. Also, a matted layer of leaf material has been noted in this same area and several plants such as willow, sweetgum, and several oak species have been identified.

Some of the plant fossils found in the Tuscaloosa include such species as Ficus, Magnolia, Myrsine, Salix, Sassafras, and Sequoia. More than 150 species in more than 80 Genera have been identified from the Upper Cretaceous.

In addition to the Tuscaloosa formation, the Eutaw and the Ripley formations of the Upper Cretaceous have produced plant fossils.

ABSTRACTS

Biological Sciences

Soil Fungitoxicity in Relation to Survival of *Sclerotium rolfsii*

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Sclerotium rolfsii Sacc. is a soil-inhabiting facultative plant parasite with a wide host range and capacity for long survival in soil. Its persistence is attributed primarily to resistant sclerotia, while little is known of the fate of mycelium in natural soil. With more information on the relation of natural biotic phenomena of soil to survival of *S. rolfsii*, biological means of suppressing the fungus may become feasible. The following work was an exploratory examination of the microflora and toxic nature of a Chesterfield sandy loam soil in relation to survival of *S. rolfsii*.

The samples chosen for study were of contrasting organic matter content and were designated as HO (high organic) and LO (low organic). Relative populations of soil microorganisms were determined. Mycelium of the pathogen, grown on nylon-gauze squares (18 x 18 mm), was buried in natural and sterilized potted soil from each sample for 7-16 days. The squares were recovered, washed and stained, and the number of mycelial filaments per mesh determined microscopically. Laboratory-grown sclerotia of the pathogen were buried, recovered, and their viability and microbial infestation determined.

There was little difference in total numbers of fungi or bacteria in the two soils, but Streptomycetes were more abundant in the LO soil. *Trichoderma viride* was usually the predominant fungus in the HO soil and *Aspergillus sp.* predominated in the LO soil. Destruction of mycelium of *S. rolfsii* in the HO soil was complete in less than 13 days, while mycelium persisted in the LO soil throughout the experimental period of 16 days. Mycelium in sterilized soil of either sample was not destroyed but eventually lost viability. All sclerotia recovered from sterilized soil after 16 days germinated, whereas 21 per cent of those from natural HO soil and 33 per cent of those from natural LO soil germinated. Little difference was found in the degree of microbial infestation of sclerotia in the two soil samples.

The Effect of 5-Hydroxytryptamine on Gastric Motility in Iproniazid Pretreated Rats

Rebecca Ingle and Kenneth Ottis
Auburn University

Eighty-four white rats in the 220-230 gram range were used in a series of experiments to test the effects of Reserpine-Marslid upon the histochemistry and gastric motility of this warm-blooded species. Standard recording and perfusing procedures were used as in the 1961 study. The diazo-safranin method (Lillie, *et al.*, 1953) was the most suitable technique for the histochemical analysis of the gut sections. The motility records were measured with a planimeter and the results expressed in square centimeters.

The overall mean increase in contractility of the duodenal sections of the treated animals over the control was nearly fourfold or 383 per cent. The monoamine oxidase inhibitor maintained the 5-hydroxytryptamine concentration in the duodenal sections at significantly high levels for periods up to four hours.

Effects of Magnesium on Growth and Cell Division of *Arthrobacter Globiformis*

Rebecca Wolfgang, Catherine Murphy, and Margaret Green
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Arthrobacter globiformis ATCC 8010 produced elongated and involuted cells and failed to complete its normal life cycle when grown in the following peptone broths: biosate, gelysate, lactalsate, milk protein hydrolysate, polypeptone, tryptose and trypticase. The addition of Mg ions (3.2×10^{-3} mg/ml) to these media resulted in completion of the life cycle. Optimum growth was obtained only when the organism completed its cycle of morphogenesis, i.e., reached the coccoid stage. Soytone, phytone, and trypticase soy broth contained adequate nutrients for completion of the life cycle without Mg supplementation. The effect of Mg was not replaceable by Ca, Co, Cu, or Fe.

ABSTRACTS

Development of *Cercospora* Leafspot of Peanut

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Cercospora leafspot, the most important disease of peanuts in Alabama, can reduce yields as much as 20-30 per cent when control measures are not practiced. However, little fundamental information is available concerning the etiology and pathogenesis of the causal fungi, *Cercospora arachidicola* and *C. personata*.

Glass microscope slides, with a vaseline film on one surface, were exposed for half-week periods in weather-vane type spore traps at six predetermined locations in peanut fields for determination of rate and density of spread of *Cercospora* spores. All slides were examined bi-weekly and number of trapped spores recorded. Infectivity was estimated by exposing potted plants, grown under *Cercospora*-free conditions in the greenhouse, simultaneously with the slides. Following field exposure, the potted plants were incubated for 72 hours in a moist chamber and moved to a greenhouse bench, where they were observed for initial expression of *Cercospora* leafspot symptoms. Leaf samples were collected bi-monthly from plants growing under field conditions to determine the average number of lesions per leaf as an estimate of relative infection. Maximum and minimum air temperatures and precipitations were recorded and correlated with disease data.

Greatest numbers of conidia were detected during July 15-31, a period of abundant moisture and high minimal (72°F.) and maximal (93.7°F) temperatures. During this period the potted plants developed leafspot symptoms within nine days after placement. Infection was correlated with high inoculum production when environmental conditions favored infection, since 38-day-old plants showed leafspot symptoms as soon as did 42-, 52-, and 60-day old plants. Random samples of field-grown peanut plants showed essentially the same per cent expression of leafspot symptoms. The data indicate a fairly light infestation of *Cercospora*, with maximum infection occurring from July 10 to August 10.

Studies on the Mechanism of Action of 6-Mercaptopurine (MP)

Jane Golden, Linda Simpson, and L. L. Bennett, Jr.
Southern Research Institute

By using tracer methods in two tumor systems *in vivo*, an attempt was made to determine the relative sensitivities of the var-

ious sites of action that have been indicated for MP. Formate- C^{14} incorporation into purines of the soluble fraction, ribonucleic acid (RNA), and deoxyribonucleic acid (DNA) was inhibited by various levels of MP, ranging from 5 to 40 mg/kg doses administered to mice bearing Ehrlich ascites and from 1 to 25 mg/kg doses administered to mice bearing sensitive L-1210 leukemic cells. At the lower levels of MP the effect on guanine was greater than that on adenine, suggesting that the conversion of inosinic acid (IMP) to guanylic acid (GMP) was more sensitive to inhibition than the conversion of IMP to adenylic acid (AMP). Studies were made of the effects of MP on the utilization of various other C^{14} -labeled precursors, each of which entered the biosynthetic pathway at a different point. From these experiments evidence was obtained for two sites of action of MP in ascites cells *in vivo*; one, a major block on the *de novo* pathway prior to the formation of aminoimidazolecarboxamide (AIC) ribonucleotide and second, a lesser block of the conversion of IMP to GMP.

Reproductive Isolation and Interspecific Gene Exchange Between Certain Southeastern Hylid Amphibians

John S. Mecham
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The potentialities for interspecific gene exchange between certain species of the genera *Acris*, *Pseudacris*, and *Hyla* in the southeastern United States is discussed, and evidence for natural hybridization is reviewed. It is concluded that introgression of genetic material is probably a widespread phenomenon in this series of species, and may be an important source of hereditary variability.

A Chemically Induced Mammary Adenocarcinoma of the Rat as a Possible Tool in Drug Evaluation

Daniel P. Griswold
Southern Research Institute

The need for experimental animal tumor systems which mimic, at least in their response to chemotherapy, various human cancers is recognized by many workers involved in the search for effective carcinostatic drugs. Since almost 22 per cent of all cancer in women is breast cancer, and since nearly 50 per cent of premenopausal

breast cancer is hormone dependent, it would seem logical to add a hormone dependent breast carcinoma to the growing list of primary drug evaluation systems.

The 7, 12—Dimethylbenzanthracene (DMBA) induced mammary adenocarcinoma in the female rat is currently being studied as a possible addition to the primary drug evaluation systems already available. The hormone dependence of this tumor has been demonstrated by the observed regression of large, well established malignant tumors following either (1) hypophysectomy, (2) ovariectomy, or (3) treatment with testosterone propionate.

Optimal results, regarding tumor incidence and mortality, resulted from the oral administration (by stomach tube) of 100 mg/kg DMBA to groups of the Holtzman line of Sprague-Dawley female rats averaging about 150 grams each. Growth rates, uniformity of growth and spontaneous regression of the tumor are discussed.

Control of Fireblight and Scab of Apples in Alabama

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Fireblight and scab diseases of apple have long been major problems and limiting factors in apple production in the Southeast. Spread and infection by fireblight bacteria are favored by warm (75-85°F), rainy periods during bloom, which result in severe blighting of blossoms, twigs and girdling of large branches. Experiments to control this disease with the antibiotic streptomycin, were conducted for three years at the North Alabama Horticultural Substation near Cullman. Three blossom sprays containing 50-100 ppm of the antibiotic were applied to Red and Yellow Delicious apples every 4-5 days beginning at 25 per cent bloom. These applications gave 95-98 per cent control of the disease in comparison to unsprayed trees. Fireblight was severe in 2 of the 3 years.

Scab, a fungus-incited disease, is most severe during cool, rainy years when leaf and petiole infection by the fungus may defoliate apple trees. Even when scab is partially controlled, all fruit may be damaged. Fungicidal sprays were applied, from the delayed dormant and pre-pink bud development stages to 3-4 weeks after bloom, to Red and Yellow Delicious apple trees with an air-blast sprayer. In the 3-year period (1960-62), diseased fruit was reduced from 59.4 per cent on unsprayed trees to 16 per cent on captan-

sprayed trees and to 8.5 per cent on dodine (Cyprex)-sprayed trees. Cyprex gave outstanding control of scab at $\frac{3}{4}$ -1 lb. rate per 100 gal. of spray. Only fair to good control was obtained in 1962 with a $\frac{1}{2}$ -lb. rate. Captan at a 2-lb. rate gave fair to good control. Apple scab was quite severe in 1961 and 1962.

Control of fireblight, scab, and other apple diseases are essential to profitable apple production, and adequate pesticide applications should be a basic part of the apple production program.

Effects of Adrenalectomy and Adrenergic Blockade upon the Cold-Stressed Rat: A Preliminary Note.

Margaret Frady and Kenneth Ottis
Auburn University

Eighty-eight 30- to 45-day-old male rats of the Holtzman strain were used in this investigation. The animals were divided into three primary groupings; control, shamadrenalectomized and adrenalectomized animals. The experimental design called for one adrenalectomized control, one sham, and five adrenalectomized treated rats. These seven animals comprised the experimental group.

Twelve experiments have been run, so far, in an attempt to clarify the degree of protection against cold-stress provided by the cortical steroids on one hand and the sympathetic division of the autonomic nervous system on the other. The results tend to indicate that the sympathetic, as well as corticosteroids, are necessary for the animal's survival under cold-stress of 0° - 10° C.

Chemical Control of Seed-Borne Diseases of Peanuts

James A. Lyle
Auburn University

Planted seeds and very young plants are subject to two types of diseases before emergence. The entire seed may be decayed, or the developing embryo may be attacked by saprophytic or damping-off fungi. Losses from these pre-emergence diseases of peanuts may be reduced effectively by fungicidal seed treatments.

All materials used have usually improved the stands, but some have given better results than others. The response to seed treatment is about the same for different peanut varieties. Since 1956,

37 different fungicidal chemicals have been applied to Dixie and Early Runner peanut seed at varying dosage rates in experiments at the Wiregrass Substation, Headland. The materials used were both experimental and commercially available compounds in either dust or liquid form.

Arasan, 2 per cent Ceresan, and Spergon have proved effective as chemical seed treatments for peanuts. Newer seed-treating fungicides, such as Metasan E and Panogen 15, also have been effective. In limited testing, other promising seed-treating fungicides that warrant future investigation are: Emmi, Hercules 3944, Memmi, Omadine 1563, Orthocide 75, and Ortho LM applied at the rate of $\frac{1}{2}$ or 1, 2, $\frac{1}{2}$, and 2 ounces, respectively, per 100 pounds of shelled peanut seed.

Cytological Studies in the Genus *Gardenia*

Rebecca Deramus
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Gardenia, a genus in the family Rubiaceae, is mainly tropical in distribution and consists of from 60 to 100 species.

A survey of the literature reveals that little cytological investigation on species of *Gardenia* has been undertaken. Chromosome counts have been reported in six species and two varieties of *Gardenia*. All of these were found to have a chromosome number of $2N=22$.

In the present study, chromosome counts were made on *Gardenia globosa* Hochst., *G. spatulifolia* Stapf. and Hutchinson, *G. Thumbergia* L.f. and the following cultivars of *G. jasminoides* Ellis: 'August Beauty', 'Fortunei', 'Grandiflora,' 'Meadow Martin,' 'Radicans' and 'Veitchii.' With one exception all these counts also revealed a chromosome number of $2N=22$. This exception was *Gardenia jasminoides*, 'Meadow Martin,' which proved to be a tetraploid with a chromosome number of $2N=44$. This is apparently the first tetraploid to be reported in *Gardenia*.

Attempts were also made to induce polyploidy through treatment of young seedlings with colchicine. *Gardenia* proved to be exceptionally resistant to the effects of this alkaloid. Plants submerged in intervals up to 90 hours failed to show a change in the chromosome number.

The Separation of Fecal and Renal Products in Birds

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Auburn University

The analysis of fecal and urinary products from mammals was among the earliest achievements of organic chemists over a century ago. Since that time nutritionists and physiologists have conducted extensive studies with mammalian waste materials, but this area has received little attention in birds. The need for data concerning avian digestive and renal physiology is great, and it is possible that the information gained may assist in medical and veterinary problems.

Probably the greatest reason for the lack of information concerning avian digestive and renal physiology is the difficulty in separation of the fecal and renal materials that collect in the cloaca. Several attempts have been made by earlier workers to surgically separate renal materials by exteriorizing the ureters. This has not proved satisfactory and questions concerning the reabsorption of water in the cloaca also have arisen. It appears more satisfactory to exteriorize the colon, but most workers have found that birds do not survive the operation for more than two to three weeks. Digestive and renal data collected from such birds not in homeostasis are of doubtful value.

An illustrated description of the simple surgery needed to colostomize males and females was presented. The problems encountered in collecting uncontaminated fecal and renal materials and the processing of these heterogenic materials were also described. The value of the method in providing data for avian digestive, body fluid and renal physiology were emphasized.

Inhibition of Resting Cells of *Escherichia coli* by Azaserine

Annie Jo Narkates and Robert F. Pittillo
Southern Research Institute

The effect of azaserine on washed cells of different strains of *Escherichia coli* suspended in physiological saline has been studied. Relatively low concentrations of azaserine (0.1 $\mu\text{g/ml}$) repeatedly killed *Escherichia coli* under these conditions. As judged by the ability of the cells to form colonies when plated on nutrient medium, greater than 99 per cent of the cells of most strains of *Escheri-*

chia coli were killed after 10 minutes exposure to 0.1 μg azaserine/ml. Temperature of exposure exerts a marked effect: the lower the temperature, the slower the kill rate. The effect of compounds structurally related to azaserine, and generally thought to be glutamine antagonist, has also been investigated. Diazo-oxo-norleucine at concentrations of 100 $\mu\text{g}/\text{ml}$ failed to inhibit *Escherichia coli* under these conditions. Glutamyl- γ -hydrazide, another glutamine antagonist, also failed to kill *Escherichia coli* under these conditions.

Methods for Evaluating Radiation-Modifying Compounds in Microbial Systems

Carolyn Moncrief and James Burns
Southern Research Institute

The purpose of this report is to describe microbial systems used in preliminary screening for agents that modify the effects of radiations on living cells. The essentials of the technique used are as follows:

Overnight broth cultures of the test organism were washed and re-suspended in phosphate buffer. Test compounds were added at 0.01 M concentration. The organisms were irradiated with cobalt-60 or X-rays at dosages found by previous experience to kill approximately 99 per cent of the cells. Numbers of surviving cells were determined by plate counts on the irradiated suspensions. Appropriate controls were included to determine toxicity of the test compounds on nonirradiated suspensions.

Using this technique, we have determined survival curves for a number of representative bacteria and yeasts irradiated in the absence of modifying agents. Departures from these curves in the presence of chemical modifiers can be expressed by a number of arbitrarily defined factors. Of these we have used dose modifying factor (DMF) and S50. These are described graphically. Some statistical evaluations of the accuracy and reliability of the method also are presented.

Evaluation of Some Radiation-Modifying Compounds in Microbial Systems

John Paul Garcia and Robert F. Pittillo
Southern Research Institute

The evaluation of compounds for their potential as radio-protectors or radio-pontentiators on the basis of the Dose Modifying Fac-

tor (DMF) and S50 is discussed. Structural relationships seem to exist among the radio-protecting compounds and among the radio-potentiating compounds. We have found that potentiation may be demonstrated with numerous chlorinated and iodinated compounds. Most active in this respect appear to be short chain aliphatic compounds-e. g. chloroform, chloral hydrate, dichloroacetamide, iodoacetic acid. Compounds must be present during irradiation if they are to show an effect. It is known that chlorinated aliphatic hydrocarbons produce hydrochloric acid upon irradiation; however, HCl does not show any effect when tested. Dose response curves of radio-protectors (e. g. mercaptoethylamine-MEA) and radio-potentiators (e.g. iodoacetamide) are shown. MEA is able to reverse the action of the potentiator, chloral hydrate.

Pink Flower Color Due to Recessive Epistasis in *Vicia sativa*

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A spontaneous mutation from purple to pale-pink flower color in the Warrior variety of *Vicia sativa* was found to be a result of the interaction of two genes. These were called *C* and *P*, with *p* epistatic to *C* and *c*. The F_1 of the cross *CCpp* (white flower) X *ccPP* (pink flower) had purple flowers, and segregation in the F_2 gave a ratio of 9 purple: 3 pink: 4 white.

New Records for *Anzia oranta* (Zahlb.) Asah

Herbert A. McCullough
Howard College

Prior to 1961 *Anzia colpodes* (Ach.) Stizenb. was the only member of that genus reported from the United States. In 1961 Culberston reported a collection of *Anzia ornata* in Dublin County, North Carolina. Previously, this species had been collected only in Sinano Province, Japan. During recent months, *Anzia ornata* has been collected in Tallapoosa, Shelby, and Winston Counties of Alabama. The material is present in reasonable quantity and in excellent condition, although no fruiting bodies have been found.

Method for Production of Inoculum of *Cercospora arachidicola*

Kenneth E. Landers
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A method for obtaining rapid growth and sporulation of *Cercospora arachidicola* Hori was developed since previous investigators reported that *C. arachidicola* and other species of *Cercospora* grew slowly and sporulated sparsely on potato-dextrose agar and other laboratory media. The medium developed for large-scale production of inoculum was composed of 5 per cent wheat starch, 0.5 per cent yeast extract, and 0.5 per cent KH_2PO_4 . The pH was adjusted to 4.5 with HCl. Fifty ml of this medium were placed in 250-ml Erlenmeyer flasks and inoculated with the fungus while the medium was still warm (40°C) after autoclaving. Immediately after inoculation, the flasks were placed in an incubator-shaker at 30°C for two weeks. One culture was added to 500 ml of sterile water and shaken by hand to obtain a uniform suspension of spores and mycelium for pathogenicity studies in the greenhouse. Thirty-day-old peanut plants were sprayed with the inoculum of spores and mycelium and placed in a moist chamber for 72 hours. Typical symptoms of the early leafspot disease of peanuts were observed in 10 to 14 days.

The Japanese Beetle

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Troy State College

A native of Japan, the Japanese Beetle (*Popillia japonica*), was discovered in New Jersey in 1916 and has spread over large areas in several states since.

While visiting in Virginia the last two summers, I had the opportunity to study the insect; it was abundant on shrubs, cherry trees, and on garden vegetables.

The adult beetle is about one-half inch long and half as wide, more rounded than the June Beetle (sometimes called May Beetle), and about half as large. It is more active than the May Beetle, which is clumsy and a poor flier. The Japanese Beetle is greenish-brown in color, with some whitish spots on sides and posterior.

They are very active in daytime and fly well. In early morning they seem sluggish, and some were caught by hand in rose flowers. Sometimes there were as many as five or six in a single flower.

In late August they can be seen freely conjugating. The males are slightly smaller than the females. After conjugating, the females go into the ground about three inches and lay an abundance of eggs, sometimes as many as 1,500 in a square yard of sod. After laying eggs, the female returns to the plant for further feeding. Grubs hatch in a short time. These larvae look much like the June Bug larvae but are somewhat smaller. They could be easily mistaken for the common grub of the June Bug. They pupate in the spring and come out in early June as adults and stay till September.

These beetles are very destructive to many kinds of vegetation. I saw their destructive effects on crape myrtle, roses and other ornamental shrubs, as well as cherry trees and grape leaves.

They eat the tissue between the veins and leave a gauze-like effect, very much as the Mexican bean beetle does on bean leaves. In Appomattox County I saw them on garden vegetables, and was told that they infest corn fields, eating the silks and preventing pollination, resulting in no grain. It is said that ripe or ripening fruits of various kinds are susceptible.

The larvae are also very destructive, eating the roots of grasses or other vegetation. Their presence may not be suspected until the vegetation on the infested area dies.

There are certain sprays that may be used to advantage in the control of these pests. One trouble in some cases is that an owner may spray on his place while his neighbors may not, and reinfestation soon takes place.

A parasite has been used to destroy them, with what success I do not know. These parasitic bacteria are used to give what is called "milky disease" to the grubs. Of course, there is the possibility that a parasite used to destroy a pest may itself in time become a pest as bad or worse than its host.

The beetle has spread over sections of Virginia, North and South Carolina. A prediction of the experiment station at Virginia Polytechnic Institute is that the insect may in time spread to other parts of the country.

Control measures, such as the quarantine, should be found to check the advance of this destructive pest.

The Effects of Environmental Temperatures Upon Avian Nutrition

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Auburn University

Previous studies at Auburn University, using 12 environmental chambers and associated facilities, have shown that hyperthermia adversely affects domestic poultry. The domestic fowl appears able to adapt to constant environmental temperatures up to 90°F., since the elevated body temperatures quickly decline to normal. However, appetite, growth, and ovulation rate are reduced. At temperature regimes of 80°F. the economic traits of domestic poultry are not seriously affected, and the slightly reduced appetite results in greater economic efficiency. Studies were undertaken to determine if production efficiency could be maintained at high temperatures by improving the quality of the diet, thus eliminating the detrimental effects of hyperthermia upon appetite.

One hundred and seventy-six S. C. White Leghorn pullets were maintained for a five-month period in four environmental regimes (60°, 75°, 90°, $\pm 2^\circ\text{F.}$ and variable). The 44 individually caged birds in each environment were divided at random into four treatment groups. Eleven birds in each environment received diets containing calorie-protein (C-P) ratios of 36, 48, 72, and 96, respectively. All diets were equivalent from the standpoint of vitamins and minerals. As was expected, in all environments the best feed efficiency was obtained at the lowest C-P ratio. However, the birds in the variable, 60° and 75°F. environments with the C-P ratio of 48 produced the most eggs in the 5-month period. Birds kept at 90°F. required a C-P ratio of 36 for equivalent efficiency. The detrimental effects of hyperthermia upon appetite in the domestic fowl may thus be reduced by improving dietary quality.

It is well known that egg shell quality deteriorates with elevated environmental temperatures. An experiment to determine the effects of environmental temperature upon calcium metabolism was carried out for a five-month period using 126 S. C. White Leghorn pullets, 42 in each of three environments (60°, 75°, 90°, $\pm 2^\circ\text{F.}$). Three levels of dietary calcium (2.25, 3.75, and 5.50%) were evaluated. The efficiency of calcium utilization was measured by determining specific gravity (egg shell thickness) and by crushing (egg shell strength). The two methods for measuring egg shell quality were found to be closely correlated. In all environments, the shell quality was significantly inferior of eggs from birds receiving the 2.25% level of dietary calcium. Egg shell quality could be satisfactorily

maintained in the 60° and 75°F. environments with a dietary calcium level of 3.75%, whereas 5.50% was necessary to maintain a satisfactory egg shell quality at 90°F. Thus, it appears possible to reduce calcium deficiencies caused by hyperthermia by increasing the calcium content of the diet.

Environmental Factors Affecting Ovulation in Coturnix Quail

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Coturnix quail have been proposed as an experimental avian species. They have already been used in several studies by other workers to measure the effects of different light regimes upon ovulation. It appears, however, that critical knowledge concerning the response of this species to natural day lengths is lacking. Data relating to ovulation as affected by other environmental parameters in Corturnix quail also is obscure.

Six hatches, each consisting of 24 six-week-old Auburn Strain female Coturnix quail, at two monthly intervals were placed in individual cages in a quiet uninsulated room with windows but devoid of artificial light and heat. All 144 birds received the same management at all times, and eggs were collected and recorded daily.

Birds hatched in mid-May and July came into partial egg production for a very brief period before ovulation ceased in early September. Those hatched after July did not come into production until the following spring. September birds were the first to lay the following spring, laying a few eggs in February and March. Birds hatched in mid-May, July, November, and January also began to ovulate in March. The sixth hatch, which came out of the incubator in mid-March, began laying in June. All birds stopped ovulating during the early part of September as in the previous year. Furthermore, all hatches failed to exhibit the very early and intense egg production characteristic of Coturnix given supplemental light in other experiments.

It appears that Coturnix require a rapid increase in the day length to induce ovulation, and will quickly stop ovulating with the onset of a rapid decrease in day length. They will, however, continue to lay if the day length is not greatly changed. These data compared with those from several other experiments also indicate that Coturnix quail maintained at approximately 32.5° of latitude, re-

quire extra artificial light for rapid maturity and intense egg production.

Results from other studies showed that *Coturnix* will ovulate at sub-zero temperatures provided they receive sufficient light stimulus. An examination of 300 eggs laid throughout the year indicates that the egg of the *Coturnix* quail consists of 60% albumin, 30.8% yolk, and 9.2% shell by weight. The albumin height of broken-out eggs ranged from 4 to 43 mm., with a median of 25 mm. The egg shell strength as measured by specific gravity units ranged from 1.045 to 1.085 with a median of 1.060 to 1.065. The egg weight of a similar large sample of *Coturnix* eggs ranged from 5 to 12 g., with a medial value of 9 to 9.5 g.

It is evident that *Coturnix* quail are more sensitive to light than to temperature as measured by ovulation. These data should prove of value in efforts to determine the response of ovulation in *Coturnix* to various light regimes, and also help establish standard values for egg weight and composition.

Storage of Experimental Neoplasms at -76° C

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In order to compare recent results to those obtained months or years earlier, it is desirable to maintain the biological systems used in an experimental rodent tumor screening program in a static or near-static state. Genetic stability of the tumor cells is particularly desirable. A frozen-tumor bank which, in effect, "stops time" for these cells can be used to considerable advantage in this type of research. We use such a storage bank and have successfully recovered a large number of rodent tumors from storage at -76°C.

Crown and Root Disorders of Coastal Bermudagrass

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Localized rotting of stems, roots, stolons, or crowns was frequently associated with die-back of Coastal Bermudagrass (*Cynodon dactylon* (L.) Pers.) at six locations in southern Alabama in 1962.

The majority of necrotic areas occurred around, or could be traced to, wounds that appeared to be insect-inflicted. Fungi and bacteria associated with these necrotic tissues were isolated from plants collected at the various locations, and the predominate isolates were tested for pathogenicity.

Species of the fungal genus *Helminthosporium* comprised over 50% of all isolates from all locations. Of these, *H. rostratum*, *H. spiciferum*, and an unidentified *Helminthosporium* sp. predominated. Numerous isolates of the three fungi were tested for pathogenicity on Coastal Bermuda plants in the greenhouse. The fungi were increased on an oat-seed medium and inoculation was accomplished by adding the infested oat seed to sterile soil in which plants were growing. Stems, roots, and crowns of some test plants were wounded with a needle, while others were left unwounded.

Isolates of *H. rostratum* and the unidentified *Helminthosporium* sp. were pathogenic on both wounded and non-wounded plants, whereas noticeable infection by *H. spiciferum* occurred only in wounded plants. Typical symptoms of infection were: rotting in stem, crown, root and stolon tissue; yellowing and browning of leaves; and general weakening of plants. The extent and severity of the rots varied among isolates, but invasion was usually more pronounced in wounded plants. Data obtained during 1962 pointed out the significance of insect or other wounds in roots and crowns of Coastal Bermudagrass. Such wounds appeared to serve as additional portals of entry for fungi which brought about decay of invaded tissues.

Acid Production by *Aspergillus niger* Growing on Peanut Meal

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Aspergillus niger produced sizable quantities of an unidentified carboxylic acid when grown in a medium consisting of oil-free peanut meal homogenized with water. Maximum acid accumulation occurred in four days after which the acid disappeared from the medium, presumably being further metabolized by the fungus. Greatest acid accumulation occurred in standing cultures with a total acidity of 7.0 meq of acid per 100 ml of medium. In shake cultures, 2.1 meq of acid was produced per 100 ml of medium.

The purified acid belonged to solubility class S₂, decomposed without melting above 200°C, and had R_f values of: 0.64 in a

butanol solvent system, 0.10 in a benzyl alcohol system, and 0.05 in an amyl alcohol system. Infrared spectrum analysis, paper chromatography techniques, and melting point determinations showed that the acid was similar, but not identical, to galacturonic acid. The quality of acid produced and the length of time required for maximum accumulation compared favorably with most industrial fermentations involving filamentous fungi.

Medical Sciences

Regulation of Nucleic Acids by Androgens in Guinea Pig Tissues

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Male guinea pigs were castrated at 3-4 months of age. After 7 months, a portion of these castrates was treated with testosterone for varying lengths of time. Nucleic acids were extracted from the seminal vesicle, prostate, and temporal muscle of the castrate, androgen-stimulated and normal of the same age and weight. RNA and DNA were determined by the orcinol and diphenylamine reactions respectively. Castration produced decreases of 43 per cent in mg RNA/gm of tissue and 85 per cent in total RNA of the seminal vesicles. Androgen stimulation produced a rapid two fold increase in both concentration and total RNA. The mg DNA/gm of the seminal vesicles was increased 54 per cent after castration but the total DNA showed a decrease of 42 per cent. Androgen stimulation after 12 days produced little or no change in the mg DNA/gm seminal vesicle but increased with the increase in organ weight. The RNA content of the prostate showed only a small decrease in mg RNA/gm of tissue in the castrate. With androgen stimulation the increase in RNA was again rapid, as with the seminal vesicle, but to a lesser degree. The mg DNA/gm prostate increased 30 per cent with castration and gradually returned toward normal with androgen stimulation. The temporal muscle showed a slight increase in mg RNA/gm tissue with castration. Androgen stimulation produced a 40 per cent increase over the castrate. The mg DNA/gm of temporal muscle increased two fold with castration and androgen stimulation produced only small changes from the castrate.

The Olfactory Bulb, Accessory Olfactory Bulb, and Hemisphere of Some Anurans

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The olfactory bulb, accessory olfactory bulb, and cerebral hemisphere of some anurans were examined. Thionin, Weil, pyridine silver, and Golgi techniques were utilized in this study.

The cellular configurations studied differ considerably in size and development. The olfactory formation varied from a completely ventral pattern in *Bufo marinus* to one which completely encircled the olfactory bulb in *Rana catesbiana*. An accessory olfactory bulb was present in the telencephalons of all the anurans studied. In the precommissural septal area, prominent medial and lateral septal nuclei extended throughout almost the entire medial hemisphere wall. The primordial hippocampal, piriform, and general pallial areas were identified. A well differentiated amygdala may be divided into two parts which have essentially the relationships which characterized the corticomедial and basolateral groups found in most of the higher vertebrates. The striatum had recognizable dorsal and ventral segments.

Many of the fiber systems of the anuran telencephalon were markedly developed. The olfactory systems had a widespread discharge to the hemisphere centers. The basic fiber components of the stria medullaris were readily recognizable in both toads and frogs. The forebrain bundles were well developed and had marked commissural components. The stria terminals carried the essential amygdalopreoptic and amygdalohypothalamic connections. The hippocampal and anterior commissures characterized the midfield of the telencephalon just rostral to its transition into the diencephalon.

The Olfactory Bulb and its Connections in the Opossum

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Thionin, Weigert and Ammoniacal Silver methods were used to stain serial sections of the brain of the opossum. The olfactory bulb, anterior olfactory nucleus, and the olfactory stria, and related areas were examined.

The olfactory bulb presented a well developed configuration described as a "typical" lamination of the mammalian bulb. The anterior olfactory nucleus first appeared on the lateral aspect of the ventricle in a rostral to caudal series. As it extended caudally, this nucleus gradually encircled the ventricle and was divided into dorsal, ventral, medial and lateral portions. The dorsal part of the nucleus was continuous posteriorly into the region of the neopallium, the lateral portion blended insensibly into the piriform cortex posteriorly. On the medial aspect, this nucleus was gradually replaced by the hippocampus and septal nuclei while the ventral portion extended caudally into the region of the tuberculum olfactorium.

A very conspicuous lateral olfactory tract laid on the lateral surface of the bulb, crus and piriform cortex, and carried fibers caudally into the amygdaloid complex. An intermediate olfactory tract contributed fibers to the anterior commissure while the medial olfactory tract projected to the hippocampus, septal region, and tuberculum olfactorium.

The Histologic Structure of the Ligaments Supporting the Longitudinal Arch of the Human Foot

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The plantar calcaneo-navicular ligament, the long and short plantar ligaments, and the plantar aponeurosis were dissected from the amputated lower extremities of ten adults and one newborn infant, and were examined histologically, using three stains, the Verhoeff elastica stain, the von Kossa calcium stain, and the alizarin red S technique for calcium. Each ligament was found to have a particular arrangement of its components which enabled it to withstand the pressures projected upon it, and to successfully support the joints of the longitudinal arch. However, since the ligaments of the newborn are somewhat incomplete in their arrangement, it was thought that their structure must be modified with the assumption of erect posture. No elastic fibers were found in the ligaments of the infant, with the exception of a few in the long plantar ligament. However, it was significant that in older individuals, and in those individuals suffering from conditions which cause premature aging of the tissues, there appeared to be

an increase in the number of elastic fibers present in the ligaments and in the surrounding connective tissue. In very old individuals the elastic fibers appeared broken, split, and coiled. With age, there was also found within the ligaments an increasing amount of fibrocartilage, areas indicative of the process of calcification, and deposits of calcium. No fibrocartilage or calcification was seen in the infant ligaments. It was thought that these changes may be the result either of prolonged weight bearing, or the relaxation of the longitudinal arch, or may, in fact, be one of the contributing factors to the fall of that arch.

The Venous System of the Head and Neck of the Rhesus Monkey

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Even though the rhesus monkey is used extensively as an experimental animal, detailed accounts of the venous system of many areas of this animal are lacking in the literature. This study was concerned with the head and neck exclusively.

The chief drainage of the superficial head and neck is via the paired *vena jugularis externa* which is formed by the junction of the *vena retromandibularis* and the *vena auricularis postera*. The *venae jugulares externae* communicate with one another, with the *venae jugulares internae*, with the *venae cephalicae*, and receive blood from the *venae jugularis anteriores*, the *venae facialis*, the *venae temporales superficiales*, and the *venae transversae colli*.

The chief drainage of the deeper areas of the head and neck is accomplished by the paired *vena jugularis interna*. These veins drain, completely or in part, the larynx, pharynx, *glandulae thyroidea et lingula*, and the esophagus. Most of this blood enters this vein via a plexus around the origin of the *arteria carotis externa*.

The dural sinuses drain, for the most part, into the *venae jugulares internae*. The monkey possesses all of the sinuses seen in man with the probable exception of the paired *sinus sphenoparietalis*, and the *sinus occipitalis*. In addition, the monkey possesses a paired *sinus petrosquamosus*.

The *plexus pterygoideus venosus* is mainly drained by the *vena maxillaris* and the *vena facialis*. It communicates with various dural sinuses, and with the veins of the orbit.

Much of the drainage of the deep neck is accomplished via the *venae occipitales*, the *venae cervicales profundae*, the *venae vertebrales*, and the *venae transversae colli*. These veins communicate with one another.

The veins of the *columna vertebralis* drain into the *venae jugulares internae*, and the *venae vertebrales*. They communicate with each other and, indirectly, with the dural sinuses.

Some Observations on the Effect of Pyrimethamine on the Oviduct of the Domestic Fowl

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and Trinity College, University of Dublin, Ireland

Two experiments are described in which the effect of dietary pyrimethamine (2, 4 diamino-5- (4-chlorophenyl)-6 ethyl pyrimidine) on the growth of the reproductive tract of the fowl was investigated. Gonadal hormones (estradiol dipropionate plus testosterone propionate) were used to simulate many of those changes which occur in the fowl when it approaches the laying state.

The first experiment showed that pyrimethamine had the same inhibitory effect on hormone-stimulated oviduct growth as that already known to occur in birds suffering from dietary folic acid deficiency, or from the effects of folic inhibitors of the aminopterin type. The mean oviduct weight of the pyrimethamine treated group was 65 per cent that of the controls. The simultaneous addition of folic acid to the pyrimethamine treated diet resulted in the restoration of oviduct weight to 89 per cent that of the controls. Blood smears showed that the group receiving pyrimethamine were suffering from a macrocytic anemia, and that those birds which exhibited the greatest inhibition of oviduct growth also showed the greatest hematologic abnormality. The folic acid deficiency did not become marked until the hormones were given.

In a second experiment, the addition of penicillin to the pyrimethamine containing diet resulted in mean oviduct weight being increased from 31 to 49 per cent that of the controls. Penicillin did not improve the blood picture of the pyrimethamine treated birds.

Oviduct RNA and DNA values were examined. Although total tissue content was significantly affected, treatment had no signif-

icant effect when the nucleic acids were expressed as mg per gram of dry matter. Liver nucleic acids were examined in the second experiment. Treatment had no significant effect.

3 α - and 3 β -Hydroxy-C₁₉-Steroid Dehydrogenases in Liver and Kidney

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The activity of the DPN- and TPN-specific 3 α - and 3 β -hydroxy-steroid dehydrogenases of the liver and kidney of guinea pig, mouse, rabbit, dog, hamster, and rat were compared. There was no parallelism between the activities of the 3 α - and the 3 β -enzymes. The enzyme activities also varied among the species and between tissues. The 3 β -TPN enzyme was detected only in rabbit liver and trace amounts in guinea pigs; the kidneys of all species possessed no detectable activity. The TPN enzyme activity was in the soluble fraction of all species except guinea pig. On the other hand, the activity of the DPN-enzymes was distributed in varying proportions between the microsomal and the soluble fractions. The microsomal enzymes were precipitated by Mg⁺⁺ and by incubation with RNase. Triton X-100, Duponol C and desoxycholate solubilized the microsomal enzymes.

Urinary Excretion of 17-Ketosteroids and Individual Metabolic Patterns

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It is recognized that there are characteristic differences between individuals in metabolism of nutrients and that they cannot be satisfactorily explained by differences in body weight or height. In order to obtain information on factors which may possibly influence, or correlate with characteristic individual metabolic patterns, 17-ketosteroids were determined on urine samples collected during a metabolic study. Six women students, age 21-23 years, served as subjects during a 20-day study. Analysis of variance

showed a highly significant difference between subjects in amounts of 17-ketosteroids excreted in the urine.

Under the conditions of this study where normal women served as subjects, adrenal function, estimated by amounts of 17 ketosteroids excreted in the urine, was not significantly correlated with levels of urinary ascorbic acid, thiamine, riboflavin, nitrogen, calcium, phosphorus or magnesium. The highest correlation, although not significant, was with urinary ascorbic acid excretion.

Proliferation in the Adrenal Glands of Male and Female Rats Studied With the Aid of Radioautographs

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Radioautographs using thymidine- H^3 were obtained to determine the site and rate of adrenal proliferation and also whether centripetal migration of adrenal cortical cells occurs.

In immature male rats 35 to 50 days old, most labeled parenchymal cells occurred in the glomerulosa and outer fasciculata with some in the reticularis. More mature males, 60 to 90 days old, had few or no labeled reticularis cells except for non-parenchymal ones. Highest frequency occurred in animals killed at midnight, 6 hours after thymidine- H^3 . Sprague-Dawley rats showed much higher frequency than Long-Evans rats. A great increase in proliferation occurred in both the glomerulosa and the outer fasciculata 2 days after giving compound 48/80.

Animals killed 2 to 40 days after giving thymidine- H^3 showed no evidence of centripetal migration of cells.

In young mature female rats, a marked difference in the number and location of labeled cells can be correlated with the phases of the estrous cycle. In proestrus and estrus, labeled cells were at a minimum and were located mostly in the glomerulosa. The maximum number of labeled cells occurred at diestrus in all zones and especially in the outer fasciculata. This increased activity continued in early pregnancy for several days.

In both male and female rats, at all ages examined, some medullary cells were labeled.

Theoretical Basis for Presence of Competent Antigens in Autochthonous Neoplasms

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As reported elsewhere, we have, in preliminary experiments, produced immunological destruction of autochthonous mouse mammary adenocarcinomas (P less than 0.002) and autochthonous rat mammary fibroadenomas (P less than 0.00004) by injection of tumor extracts in suitable adjuvants. The presence of competent antigens in autochthonous neoplasm has been questioned, introducing question as to the nature of the above response.

It is our view that observable, functional differences between tissues, such as neoplastic and non-neoplastic, necessarily involve differences in cellular *protein*. DNA influences cellular function only by serving as template for synthesis of ribosomal RNA. Ribosomal RNA achieves functional expression only by operating as template in *protein* synthesis. Complex lipids and carbohydrates have many functional and structural roles (including antigenic); but these compounds exist only at the dictate of *protein* enzymes catalyzing their synthesis and hydrolysis. Cytoplasmic inorganic ions determine many critical cellular functions; however, their concentrations are determined by ionic membrane pumps (*protein*) and by membrane *proteins* and lipids, which determine permeability. On this basis, it appears certain that there are differences in *protein* of neoplastic and non-neoplastic tissues. These differences could be: (1) Increase or decrease (perhaps even to zero) in concentration of one or more types of *protein*; (2) Elaboration of unique (*protein(s)*) by neoplastic tissue.

If (1) is correct, there would be no antigen not "recognized as self" by immunologically competent host cells. If (2) is correct, the possibility exists of antigen(s) to which host cells would respond immunologically (this antigen could be either the "new" *protein* or a complex lipid or polysaccharide synthesized by it).

Determination of Acetyl Cholinesterase Activity in Small Amounts of Mammalian Nerve Tissue

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Measurement of acetyl cholinesterase activity in small amounts

of tissue with low activity levels has been difficult and relatively inaccurate using the prevalent methods of incubation and analysis. An incubation procedure utilizing the optimum parameters of the enzyme has been described and a spectrophotometric analysis for the determination of residual acetylcholine has been adapted to the method.

Rat sciatic nerve or whole rat brain was homogenized in pH 7.8, 0.15 M $\frac{\text{KH}_2\text{PO}_4}{\text{Na}_2\text{HPO}_4}$ buffer, and 10 mg. of sciatic nerve or 1.5 mg. of brain were incubated with 4.0 micromoles of acetylcholine bromide for two hours at 37° C. in a sealed 25 ml. Erlenmeyer flask with a total volume of three ml. Tissue blanks containing the same amount of denatured tissue in place of the active tissue were prepared and incubated concurrently with the active samples under the same conditions. The tissue blanks were denatured by heat following incubation. One ml. of N/3 HCl was added to each sample to protect the residual acetylcholine from alkaline hydrolysis during denaturation. All the samples were filtered and a 2.0 ml. aliquot was taken for spectrophotometric analysis.

The spectrophotometric analysis followed the method described by Hestrin. (J. Biol. Chem. 180:249. 1949). Four ml. of a mixture of 2 M hydroxylamine and 3.5 N NaOH were added to the sample to be analyzed. Two ml. of 4 N HCl and 2 ml. of 20% ferric chloride in 0.1 N HCl were added, the contents were well mixed, and the optical density was determined in the Coleman Junior Spectrophotometer at 450 m μ . The hydroxylamine and the residual acetylcholine stoichiometrically form acethydroxamic acid which, in acid solution, forms a soluble complex with ferric ions. The colored complex follows Beer's Law and can be used for the accurate determination of as little as 0.25 micromoles of acetylcholine. The only limitation of the method was the instability of the complex formed, but this can be overcome by determining the optical density within 15-30 seconds after addition of the ferric chloride.

A Comparison of Conditioned and Sensory Motor Learning of Identical Flexion Responses in Nearly Identical Learning Situations

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We have previously reported that in classical conditioning of the hind leg flexion response, in which unconditioned stimulus

(US) (electrical excitation of foot pain receptors) always follows conditioned stimulus (CS) (sound of bell), the conditioned response (CR) (contraction of flexor muscles of leg as recorded electromyographically), is established readily and increases in magnitude for a few trials after its appearance. However, instead of increasing in magnitude indefinitely with continued presentation of conditioning trials, the CR eventually becomes weaker and with still more trials disappears totally, followed with still more trials by the total disappearance of unconditioned response (UR) (hind leg flexion in response to US).

It is possible that the disappearance of the flexion responses to CS and US in the classical conditioning situation results from secondary establishment of an inhibitory circuit and/or weakening of primary US-UR circuit by the US, which constitutes an obligate nociceptive feedback in this classical conditioning situation.

In the present investigation, eight cats were presented with a stimulus situation identical to the above except that "US" followed "CS" only if the magnitude of the response to "CS" was below a low arbitrarily predetermined value. It should be noted that this change to a sensory-motor learning situation, with the general form of a conditioning situation, automatically makes each trial with a "CR" an extinction trial in the classical conditioning sense. In all 8 cats, the learned response became progressively stronger with presentation of additional trials and at the end of 100 "classical extinction" trials the response was invariably present in each cat. After nearly a year without training, one of the cats gave 10 consecutive brisk maximum responses to the stimulus. Paired comparison showed enormously greater response stability in the sensory motor learning situation. ($T=41.3$) (P less than 0.000,000,000,01).

The TSH-Like Activity of Thiols

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Recent work has shown that TSH (thyroid-stimulating hormone) stimulates thyroidal glucose oxidation *in vitro*. It has also been demonstrated that oxidized TSH is biologically inactive and that subsequent reduction restores activity. Since the most abund-

ant amino acid in TSH is half-cystine, and because cystine has been utilized as a reducing agent in restoring TSH activity, it was of interest to examine the action of cystine alone on thyroidal glucose oxidation and iodine uptake.

It was found that L-cystine (10^{-2} M) enhanced C^{14} O_2 production from glucose-1- C^{14} , in bovine thyroid slices, to the same degree over control values as did TSH (0.25 unit per vessel) (p less than 0.01). As with TSH, cystine preferentially stimulated oxidation of glucose-1- C^{14} . The effect of either TSH or cystine on the oxidation of glucose-6- C^{14} was minimal. A time study showed the effect of both TSH and cystine to be manifested at 5 minutes, and that the effect of combined TSH and cystine was not additive.

Cysteamine, cystamine (10^{-2} M and 10^{-3} M), and benzenethiol (10^{-2} M) gave a significant stimulation of glucose oxidation to CO_2 (p less than 0.001). Other non-sulfhydryl amino acids tested gave little or no response.

In preliminary experiments, it was found that cystine at low concentrations (between 10^{-6} M and 10^{-10} M) significantly increased the uptake of I^{131} by thyroid slices *in vitro*, while at high concentration (10^{-2} M), cystine demonstrated a marked inhibitory effect. It was of interest to note that TSH at high concentration (1 USP unit per vessel) demonstrates a similar inhibitory effect, while at slightly lower concentrations (0.25 units per vessel), I^{131} uptake was enhanced.

Standardization of TSH Testing

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An attempt has been made to standardize TSH (thyroid stimulating hormone) testing by determining the dose of TSH which gives the greatest separation between euthyroid, primary hypothyroid, and panhypopituitary patients. Four-, six-, and 24-hour radioactive I^{131} uptakes and protein-bound iodine (PBI) levels were determined. The patients were then given intramuscularly one of four different doses of a commercial thyrotropin preparation ("Thyropar," Armour, approximately 1 U.S.P. unit per mg). The four dose levels were as follows: 5 units once, 10 units once, 5 units three times, 10 units three times. Eighteen hours after the last injection

of TSH, a second tracer dose of I^{131} was given and the uptake determined as before. A repeat PBI was drawn 42 hours after the last TSH injection.

In the euthyroid patients (48), the 24-hour I^{131} uptake was no greater following higher or multiple doses as compared with a single injection of 5 units of TSH. The serum PBI concentration in the euthyroid patients was dose dependent, being directly proportional to the dose of TSH.

There was little, if any, increase in I^{131} uptake or PBI following TSH injection in patients with primary hypothyroidism.

In the patients with panhypopituitarism the increase in the 24-hour I^{131} uptake following TSH injection was found to be dose dependent in contrast with the euthyroid subjects. The post-TSH 24-hour uptake in these patients did not reach the levels seen in the euthyroid patients; however, the mean pre-TSH/post-TSH differences were comparable. The increase in PBI following TSH in the panhypopituitary patients was considerably less than in the euthyroid patients. An interesting, unexpected finding in the panhypopituitary patients was the relatively slight response of three patients with Sheehan's syndrome to TSH.

Amino Acid Transport in Thyroid Glands

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The present studies were aimed at investigating amino acid transport in bovine thyroid slices and the extent to which thyrotropin and possibly other hormones act on this process. An increased uptake of alpha-aminoisobutyric acid (AIBA), a non-metabolizable amino acid, was evidenced when bovine or dog thyroid slices were incubated in Krebs-Ringer Bicarbonate buffer, pH 7.4, for one hour in the presence of Thyrotropin (TSH), growth hormone, insulin, luteinizing hormone and oxytocin. TSH failed to enhance AIBA uptake in muscle or liver tissue indicating a specificity of this tropic hormone for the target organ. There was no significant alteration of the intracellular: extracellular water ratio in the presence of the hormones employed in these studies as determined by sucrose- C^{14} distribution studies. The ratio of intracellular to medium concentrations of AIBA was greater than unity

and significantly enhanced in the presence of these preparations suggesting active transport of AIBA. The significance of these findings was discussed.

Job Sobieski Weatherly

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Job Sobieski Weatherly was born at Bennettsville, South Carolina, on July 8, 1828, the year that Wohler performed the first organic synthesis. His father was from Maryland but the family had been in South Carolina several generations.

Young Job read medicine for two years under the direction of Dr. Alexander McLeod of his home town. He became a private pupil of Dr. P. A. Aylett of New York City and then entered the Medical Department of the University of New York and received the M.D. degree in 1849. Dr. Job opened his office in Adairsville, Georgia, in 1851, but moved to Palmetto after one month. In 1857, he moved to Montgomery, Alabama, where he enjoyed a lucrative practice among the best families of the city.

He helped organize the Montgomery Medical and Surgical Society and served as its president for three years. He helped reorganize the State Medical Association in 1868. He, along with Dr. W. O. Baldwin, attended the annual meeting of the American Medical Association at Washington, D.C. in May 1868 as delegates of the local medical society. Dr. Weatherly nominated Dr. Baldwin for president of the American Medical Association at that meeting, although both of them were elected to membership at that meeting. Baldwin was elected president on May 7, 1868.

Dr. Weatherly took an active interest in the American Medical Association and served as its Vice-President in 1871. He was president of the Medical Association of Alabama in 1875. In his presidential address he stressed the advisability of drainage and cultivation of farm lands to suppress malaria. His theory was put into practice in Michigan. He also was in the forefront concerning another disease, syphilis, and in an address before the State Association discussed what should be done to enlighten the people concerning the disease and mentioned that it could be communicated by kissing. He wrote several papers which appeared in the Transactions of the Medical Association of the State of Alabama. Dr. Weatherly died in 1892.

Charles Adolph Mohr

Emmett B. Carmichael
University of Alabama Medical Center

Charles Adolph Mohr was born in Louisville, Kentucky, on April 1, 1857. The family moved to Mobile where his father, Charles Theodore, owned a drugstore and published the famous book *Plant Life in Alabama in 1901*. Young Charles learned pharmacy in his father's drugstore and graduated from the Cincinnati College of Pharmacy in 1878 and was number one in his class. He was appointed Assistant Professor of Chemistry at the Medical College of Alabama in 1880. He enrolled in the Medical College and received the M.D. degree in 1884 and gave the valedictory address. In the catalogue for 1885, he was listed as Professor of Chemistry and Lecturer on Practical Pharmacy. In 1895, his title also included Medical Jurisprudence. In 1905, the title "Clinical Medicine" replaced Lecturer on Practical Pharmacy. In 1910, he was appointed Professor of Clinical Medicine and Physical Diagnosis. From 1913 until the school closed in 1920, he was Professor of Hygiene and Preventive Medicine. In 1911, Dr. Mohr was elected City Health Officer of Mobile and was elected County Health Officer a few years later.

Dr. Mohr took an active part in the local and state medical societies and served as president of the Mobile County Medical Society as well as the Medical Association of Alabama. He was a member of the Board of Trustees of the Alabama State Hospitals from 1931 until his death. He attended a meeting of the Board at Mt. Vernon the day before he died on November 27, 1949. The Mobile County Medical Society named its library, The Charles A. Mohr Library on October 16, 1937.

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Topography, Soil, and the Height of Planted Yellow-Poplar

Glendon W. Smalley

Southern Forest Experiment Station
Forest Service, U. S. Department of Agriculture

In northern Alabama its tall, straight, clean bole, rapid growth, and resistance to insects and diseases make yellow-popular (*Liriodendron tulipifera* L.) a desirable timber species. It does best on moist, well-drained bottoms and lower slopes. It grows on mid-slopes, but is seldom found on drier upper slopes and ridges.

The study reported here followed one made on the Flat Top Experimental Forest¹ near Birmingham, Alabama, in which the relation of yellow-poplar height to topography was found to be very pronounced (Smalley 1961). In that study one-year-old nursery seedlings were planted in seven clearings across the upper drainages of intermittent streams at a spacing of 5 by 6 feet. They grew in five years to heights ranging from an average of 18.2 feet in the bottoms to 11.8 feet on the upper north slopes and 6.3 feet on the upper south slopes. Some trees in the bottom were more than 25 feet tall. Survival ranged from 71 to 83 per cent except on the middle and upper south slopes, where it was 61 and 46 per cent, respectively.

In the spring of 1961, in an attempt to learn the cause of the significant differences in tree height, a study was begun on the physical characteristics of the soil in the various topographic positions. The soil data made possible an indirect evaluation of the soil moisture regime.

The study area lies on the southern end of the Cumberland Plateau. The surface is carved to maturity exposing strong formations of sandstone and shale. Occurring on the slopes are shallow sandy and shaly Muskingum and Pottsville soils. The ridgetops are occupied by moderately deep Hartsells and Enders soils. The bottom soils, derived from colluvium and alluvium of the uplands, are members of the Pope-Philo-Stendal-Atkins drainage catena. The elevation ranges from 260 to 620 feet above sea level.

METHODS

The study was superimposed on four clearings randomly selected from the original seven. The rows of trees extend from upper

1. Maintained by the Southern Forest Experiment Station in cooperation with U. S. Pipe & Foundry Co.

north-facing slope to upper south-facing slope. The slopes average 40 per cent in gradient and about 200 feet in length from steam channel to ridgeline. Each clearing had been divided into seven topographic positions: upper, middle, and lower slopes on both aspects, plus the bottom. A ridge site above the plantings was added to each aspect, for a complete edaphic cross section.

A soil pit was dug in the center of each topographic position. The depth of soil to bedrock was measured in the pit. This measurement was checked and augmented along the contour by a soil auger. Two undisturbed core samples were taken from the 0-6 and from the 6-12 inch layers of the soil pit, and one core each was taken from the 12-24, 24-36, and 36-inches bedrock layers. A 1-quart bulk sample was also taken from each layer. A description of the soil profile and an identification of the soil series completed the field measurements.

The core samples were processed according to standard procedures for measuring total pore volume, big pore volume, field capacity, stone content, and bulk density (Hoover, Olson, and Metz 1954). Duplicate mechanical analyses were made for each layer by the Bouyoucos (1951) hydrometer method. Wilting point determinations were made by following Richards' (1947) procedures with the pressure-membrane extractor. Available water was computed as the difference between field capacity and wilting point.

The amounts of soil and stone, porosity, and soil moisture constants were expressed as percent of total soil volume and inches of depth. Bulk density was computed for soil (particles less than 2 mm) and soil and stones.

Fifth-year average total heights were re-computed, by topographic position and block, and analyzed for significance. Variation among the seven topographic positions was tested by a predetermined orthogonal set of single-degree-of-freedom comparisons.

Soil properties tested included values for the 0-6 inch layer and an average for the entire profile, weighted by the thickness of each layer. Separate analysis of other layers was infeasible because the 0-6 inch layer was the only one common to all topographic positions and blocks. Each soil property was tested for difference due to topographic position by analysis of variance and Duncan's Test (1955).

Relations between total tree height and soil properties were evaluated by regression techniques (Grosenbaugh 1958). Variables were selected on the basis of plottings and by computing single-

variable regressions to determine significance by the F test. The variables were as follows:

Dependent

Y Total tree height 5 years after planting (feet)

Independent

- X₁ Soil depth (inches)
- X₂ Average weighted total porosity (per cent by volume)
- X₃ Total porosity (inches)
- X₄ Average weighted big pores (per cent by volume)
- X₅ Field capacity (inches)
- X₆ (X₅)²
- X₇ Available moisture (inches)
- X₈ (X₇)²
- X₉ Bulk density exclusive of stones (g/cc)

RESULTS

Although yellow-poplars on the four randomly selected blocks were slightly taller, the relation of tree height to topographic position was the same as on the original seven blocks (Fig. 1). Soil depth decreases upslope until halfway, where the soil is shallowest and the slope steepest. A similar relationship exists with inches of available water; there is less water midslope than either upslope or downslope.

Analyses of variance revealed that soil properties were not

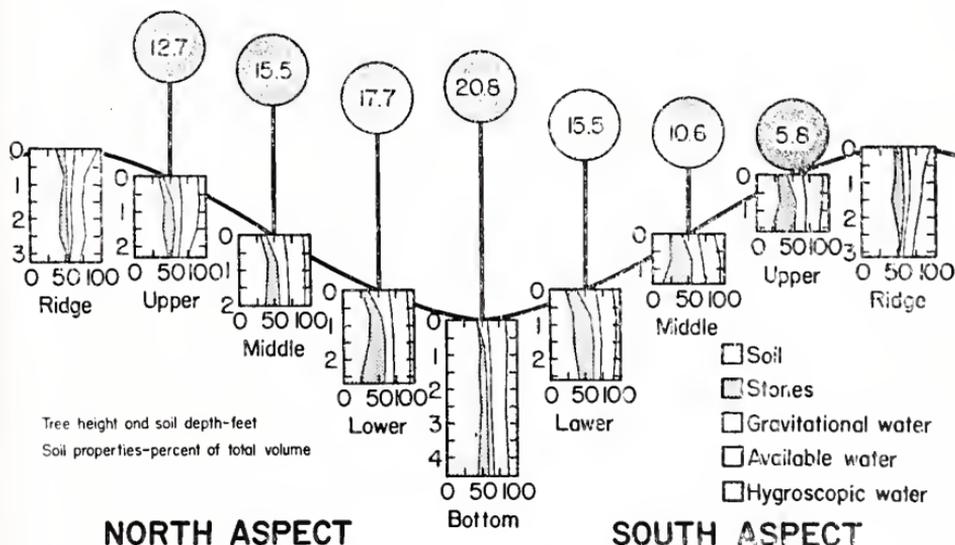


FIG. 1. Relation of topography and soil to height of planted yellow-poplar.

consistently related to topographic position. Differences between north and south ridges were not significant for any of the properties tested. With a few minor exceptions, the tested variables did not differ significantly between slope positions regardless of aspect (Figs. 1 and 2). The bottom had significantly more available water than any other topographic position. The ridges were similar to the bottoms except in moisture and sand content.

Even though upper slopes have a greater capacity for holding available water, the yellow-poplars are shorter on upper slopes than

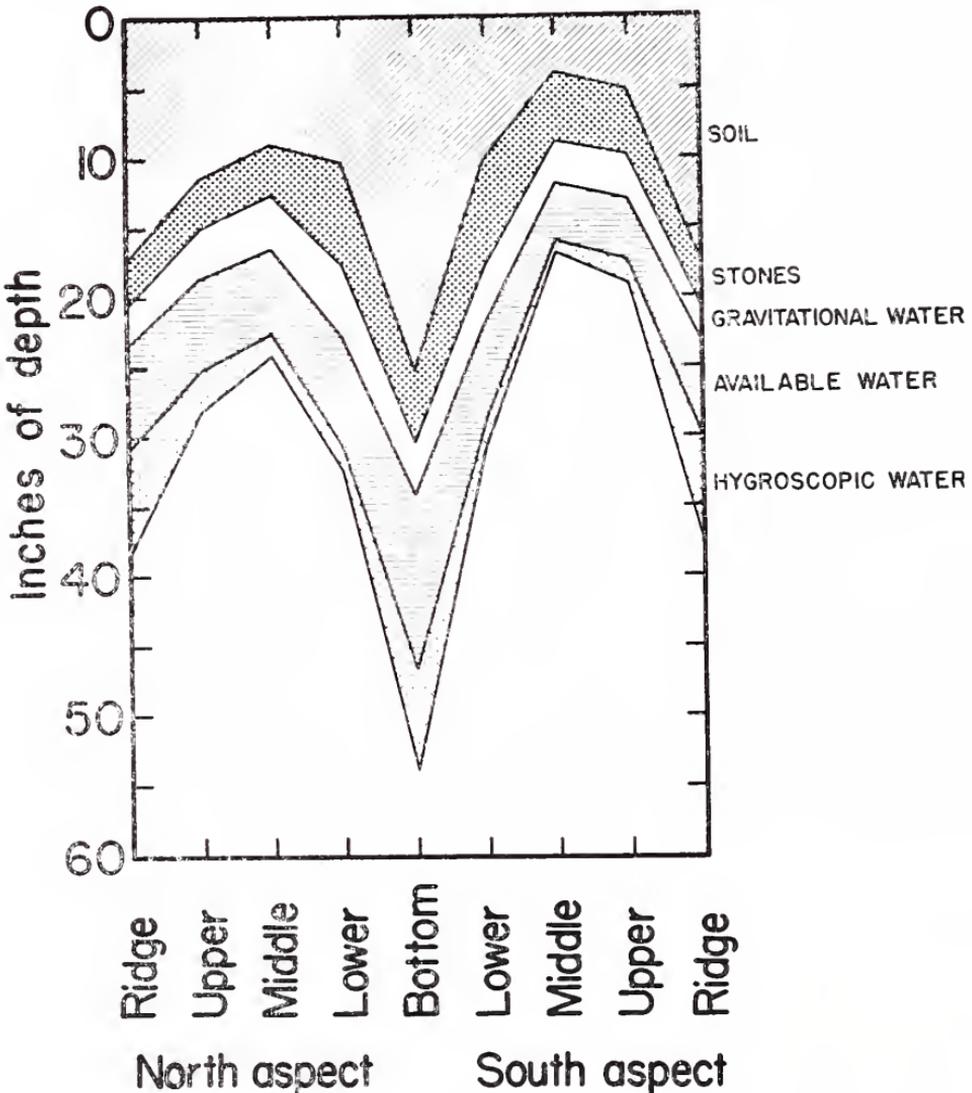


FIG. 2. Relation of selected soil properties and topographic position.

on midslopes. From a maximum in the bottoms tree height decreases upslope, at a greater rate on south slopes than on north slopes.

None of the physical properties for the top 6 inches of soil or for the entire profile was related to topographic position in the same manner as was tree height. It must be concluded that tree height is more closely related to topographic position than are the soil properties tested.

The best of the 511 regressions from the computer output was the single-variable function of inches of available water. It explained 43.6 per cent of the variation. The addition of more variables did not significantly reduce the residual sum of squares. The next best individual variable was soil depth, which accounted for 39.7 per cent of the variation. The nine-variable regression explained only 56.7 per cent of the total variation.

DISCUSSION

Obviously, there is a strong correlation between available water and soil depth. Soil depth, which is easily measured, could be used in regression equations in place of the moisture variable. The difference in tree height between aspects seems logical because evapotranspirational stress is usually greater on south slopes.

Usually site quality improves as available soil moisture increases, up to a limit. The results of this study indicate that, in areas of rolling to steep topography, availability of soil moisture is strongly affected by topographic factors whose influence is not apparent in the soil's physical properties. Additional evidence has been reported by Schomaker (1958) in Alabama and Stoeckeler and Curtis (1960) in Wisconsin.

Coile (1952) stated: "Degree of slope and extent of slope influence both surface and subsurface movements of water. Lower slopes have a greater potential supply of water than upper slopes and ridges with the same precipitation." Gaiser's (1952) year-long record of soil moisture in southeast Ohio supports Coile's idea on subsurface irrigation. Evidently, on lower slopes and bottoms the subsurface flow of soil moisture augments precipitation.

The mechanics of subsurface moisture movement is currently being studied, in soil masses confined in sloping concrete troughs, at Coweeta Hydrologic Laboratory in western North Carolina (Hewlett 1961, Hewlett and Hibbert 1963). A sustained subsurface, unsaturated flow of soil moisture from upslope that continually recharges downslope storage is indicated. Such a flow offers a logical explanation for the marked differences in site quality observed on

strongly sloping land. Further study is needed of the relation between soil moisture and site quality on mountain slopes.

SUMMARY

1. After 5 years, yellow-poplars planted across upland hollows in northern Alabama were tallest in the moist, well-drained bottoms. The trees decreased in height with position up the slope, at a greater rate on south slopes than on north slopes.

2. Physical properties of the soil on these sites and the ridges above them were not consistently related to topographic position.

3. Nine soil properties were correlated with total tree height by multiple regression analysis. The equations were not strong predictors; the best, a function of inches of available water in the profile, explained 44 per cent of the variation.

4. The results indicate that availability of soil moisture is strongly affected by topographic factors whose influence is not apparent in the physical properties of the soil.

LITERATURE CITED

- BOUYOUCOS, GEORGE JOHN, A Recalibration of the Hydrometer Method for Making Mechanical Analysis of Soils. *Agron. Jour.* 43:434-438. 1951.
- COLE, T. S., Soil and the Growth of Forests. *Advances in Agron.* 4:329-398. 1952.
- DUNCAN, DAVID B., Multiple Range and Multiple *F* Tests. *Biometrics* 11:1-42. 1955.
- GAISER, R. N., Readily Available Water in Forest Soils. *Soil Sci. Soc. Amer. Proc.* 16:334-338. 1952.
- GROSENBAUGH, L. R., The Elusive Formula of Best Fit: a Comprehensive New Machine Program. U.S. Forest Serv. South. Forest Expt. Sta., Occas. Paper 158. 1958.
- HEWLETT, JOHN D., Soil Moisture as a Source of Base Flow from Steep Mountain Watersheds. U.S. Forest Serv. Southeast. Forest Expt. Sta., Sta. Paper 132. 1961.
- HEWLETT, JOHN D., and HIBBERT, ALDEN R., Moisture and Energy Conditions within a Sloping Soil Mass During Drainage. *Jour. Geophys. Res.* 68: 1081-1087. 1963.
- HOOVER, MARVIN D., OLSON, DAVID F., JR., and METZ, LOUIS J., Soil Sampling for Pore Space and Percolation. U.S. Forest Serv. Southeast. Forest Expt. Sta., Sta. Paper 42. 1954.
- RICHARDS, L. A., Pressure-Membrane Apparatus — Construction and Use. *Agr. Engin.* 28:451-454, 460. 1947.
- SCHOMAKER, CHARLES E., Two-Year Results of Planting Yellow-Poplar in North Alabama. *Jour. Forestry* 56:37-38. 1958.
- SMALLEY, GLENDON W., In North Alabama, Topographic Position is Key to Yellow-Poplar Sites. *Forest Farmer* 20(12):14, 16. 1961.
- STOECKELER, J. H., and CURTIS, WILLIE R., Soil Moisture Regime in Southwestern Wisconsin as Affected by Aspect and Forest Type. *Jour. Forestry* 58:892-896. 1960.

Monthly Rainfall Pattern in Alabama

Arthur R. Long

U. S. Weather Bureau, Alabama

What are the driest and wettest months in Alabama? The average citizen would probably answer this question by stating that October was the driest and March the wettest month. Generally speaking, and for the State as a whole, the reply would be correct.

For a comparatively short period of record, or for a given short period, the records for any particular station might show some month to be the driest or wettest. Any unusual or rare occurrences, such as hurricanes, tropical storms, thunderstorms of cloudburst proportions, may disrupt the general pattern that would prevail over a long period of time.

Some twenty stations in South Alabama were selected for study (Table 1), and an attempt was made to use a 30-year period of record, ending with the year 1962, insofar as available records permitted. All data used in this paper are taken from the climatological records of the U. S. Weather Bureau.

October is normally the driest month in Alabama. Since October is a rather mild month in these latitudes, a sort of transitional period between summer and winter when thundershowers are few, we would expect it to be one of the driest months of the year. Furthermore, the few frontal systems which move across Alabama in October are weak and quite often become stationary or diffuse, and sometimes dissolve, over South Alabama or along the northern Gulf of Mexico.

According to Petterssen (1), in warm summer situations with indifferent pressure distributions, showers and thunderstorms occur preferably in indistinct pressure troughs or areas of low pressure, particularly when an isobaric minimum coincides with these systems.

These irregularities in the pressure field occur frequently where a front has dissolved or is dissolving. Such situations result in exceptionally heavy October rainfall amounts in South Alabama. For example, Robertsedale recorded 13.30 inches of rain in October, 1959, or about 5 times the normal amount, and only 0.85 inch in November of that year.

In the published "Climatic Summary of the United States—Supplement for 1931 through 1952," (2) it is shown that the average rainfall at Robertsedale, for the 19-year period ending with the year

TABLE 1.—AVERAGE MONTHLY, ANNUAL AND PERCENTAGE OF
SUMMER AND WINTER PRECIPITATION FOR SELECTED STATIONS

STATION	No. of Years	AVERAGE PRECIPITATION (Inches)												Percentage of Annual Amount Occurring in:		
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	An'al.	Sum.	W'ter.
Andalusia	25	4.35	4.77	6.74	6.35	4.48	4.55	6.41	5.05	4.90	1.70	3.53	5.27	58.10	55	45
Atmore	23	4.45	5.03	7.62	6.30	4.36	6.14	7.51	5.86	5.44	2.09	4.34	5.33	64.47	55	45
Bay Minette	25	4.79	4.67	8.09	6.70	5.08	5.73	7.87	6.15	6.13	2.59	4.03	5.00	66.83	56	44
Brantley	30	4.76	4.95	6.52	5.40	3.86	4.56	6.51	5.41	4.20	1.82	3.25	4.59	55.83	54	46
Brewton	30	4.73	5.11	6.63	6.26	4.46	5.54	8.01	5.78	5.38	2.21	3.61	4.59	62.31	57	43
Citronelle	30	4.71	4.74	7.21	6.07	4.75	5.70	8.12	5.82	5.51	2.36	4.54	5.82	65.35	55	45
Clayton	29	4.52	5.17	6.32	5.49	3.80	4.29	6.43	5.13	4.61	1.95	2.55	4.66	54.92	54	46
Coffee Springs	29	3.90	5.13	5.72	6.10	3.96	4.64	6.53	5.67	4.56	1.65	2.98	4.56	55.45	57	43
Columbia	27	3.86	4.86	5.31	5.41	3.49	4.26	6.63	4.97	4.56	1.67	2.82	3.99	51.83	57	43
Dorhan	30	3.93	4.79	5.75	5.20	3.30	4.25	6.29	4.98	4.65	1.54	2.61	4.09	51.38	56	44
Elba	30	4.29	4.65	6.16	5.89	3.87	4.46	6.51	5.12	4.42	1.80	3.17	4.91	55.25	55	45
Enfaula	29	4.35	4.79	5.85	5.81	3.79	4.29	6.79	4.79	3.79	1.65	2.80	4.87	53.57	55	45
Fairhope	30	4.31	4.29	6.45	6.05	4.88	6.56	8.65	6.31	7.11	2.87	3.40	4.84	65.72	60	40
Falco	19	3.71	4.55	6.47	5.60	4.12	5.66	7.75	4.57	5.08	1.79	2.72	5.48	57.50	57	43
Fort Morgan	15	2.66	3.29	6.01	3.91	2.43	4.44	6.24	4.86	8.76	2.88	3.44	3.83	52.75	58	42
Geneva	30	3.94	4.51	5.95	5.81	3.87	4.32	6.21	6.06	5.28	1.64	3.07	4.13	54.79	58	42
Mobile	30	4.70	5.04	6.71	5.22	4.46	5.79	7.59	6.59	5.52	3.30	3.68	5.16	63.76	55	45
Ozark	30	4.01	4.94	5.73	5.48	3.96	4.50	6.59	5.80	4.43	1.25	3.03	4.73	54.45	56	44
River Falls	30	5.11	5.94	6.64	6.31	4.08	4.58	7.62	5.69	4.58	2.03	3.96	5.00	60.64	54	46
Robertsdale	30	4.54	4.58	6.68	5.76	5.18	7.27	9.43	7.33	7.02	2.69	3.50	4.72	68.70	61	39
AVERAGE All Stations		4.28	4.75	6.43	5.76	4.11	5.08	7.19	5.60	5.30	2.07	3.35	4.78	58.70	56	44

1930, was 4.74 inches in October and only 4.19 inches in November. On the other hand, for the 22-year period, 1931-1952, the average rainfall at Robertsedale was 2.87 inches for October and 3.34 inches for November.

During the 30-year period, 1933-1962, the average rainfall at Robertsedale was 2.69 inches in October and 3.50 inches in November. Also, during this period, October rainfall was less than November rainfall in 18 out of the 30 years, or 60 per cent of the time. This is another way of considering the driest month of the year.

March is the wettest month of the year for the State as a whole (2). This might be expected, since frontal systems are usually stronger and more frequent at this time of the year.

One major exception is that July rainfall is heavier than March rainfall at many stations in south and southeast Alabama due to thunderstorms. During the summer half of the year (April through September), Mobile has an average of 69 days with thunderstorms while Montgomery has an average of only 49 such days.

Temperature contrasts between water bodies and the adjacent land (3) also determine preferred areas for development of cumulus and cumulo-nimbus clouds and thunderstorms. Some of these effects are so pronounced as to be reflected in the monthly means.

The diurnal maximum of the thunderstorm frequency over land occurs during the afternoon when convection is strongest (4), the minimum during the night or early morning; but there are important exceptions to this general rule. Over the sea, where the tendency toward instability is greatest at night, the thunderstorm maximum falls in the early morning hours.

Numerous thunderstorms form over the Gulf of Mexico at night and later move inland. These thunderstorms generally progress or move from southwest to northeast due to topography and other factors. The maximum inland effects of these nocturnal thunderstorms reach a line from Citronelle, in southwest Alabama, generally northeastward, passing near Atmore, Evergreen, Brantley, Clayton, and Eufaula. Effects of these thunderstorms result in most stations south of this line having more than one-half their annual rainfall occurring during the summer half of the year. These percentages, shown in Table 1, vary from 54 per cent of the annual rainfall occurring in summer at Clayton to 61 per cent at Robertsedale. No doubt, it is a good thing to have most of the annual rainfall occurring during our major crop-growing season or during the summer half of the year.

One exception is that Fort Morgan shows the greatest amount of

rainfall to be in September. In 3 of the 15 years, Fort Morgan had exceptionally heavy September rainfall; namely, 14.82 inches in 1948; 17.87 inches in 1957 when tropical disturbances "Debbie" and "Esther" moved across the Gulf of Mexico; and 25.48 inches in 1959. September rainfall was greater than July rainfall in 11 out of 15 years, or 73 per cent of the time. Also, Fort Morgan is located near the Gulf and may experience heavier September thunderstorm activity than stations further inland.

Table 1 shows that the wettest month of the year at Andalusia, Atmore, Bay Minette, and Brantley was March for the period studied. However, for the 34-year period ending in 1952, the average rainfall at Bay Minette was 8.33 inches in July and only 6.98 inches in March. At Brantley, for the 22-year period ending in 1952, the average March rainfall was 6.87 inches and the average July rainfall was 6.95 inches. It is believed that all four of these stations would

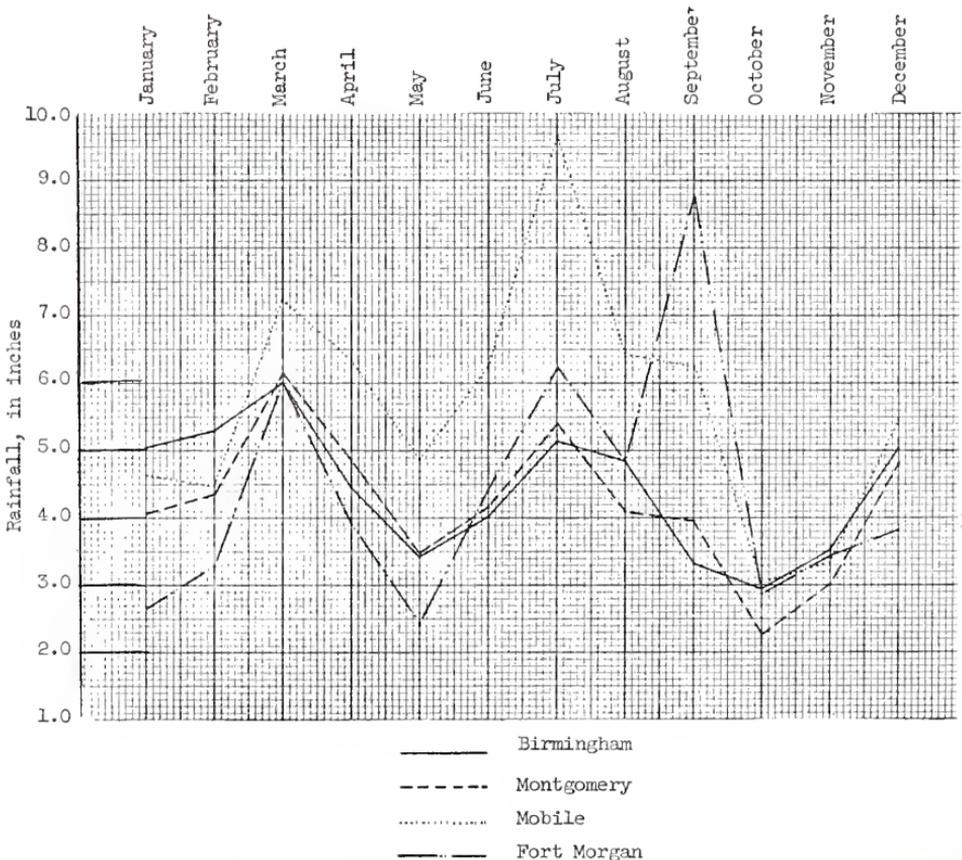


FIG. 1. Normal monthly rainfall at Birmingham, Montgomery, and Mobile, 1931-60, and at Fort Morgan, 1948-62.

show, for a 60-year period of continuous record, that July would be the wettest month.

Figure 1 shows the normal monthly rainfall at Birmingham, Montgomery, and Mobile, for the 30-year standard normal period, 1931-1960. It also shows the average monthly rainfall at Fort Morgan for the 15-year period, 1948-1962. An interesting feature of Figure 1 is the primary rainfall peaks in March at Birmingham and Montgomery, in July at Mobile, and in September at Fort Morgan. Also the primary least rainfall point is in October for all stations, except Fort Morgan where it occurs in May.

REFERENCES

- (1) PETERSSEN, S., *Weather Analysis and Forecasting*. McGraw-Hill Book Company, Inc. New York and London. 1940.
- (2) U. S. Weather Bureau, *Climatic Summary of the United States—Supplement for 1931 through 1952, Alabama Section*. U. S. Government Printing Office. Washington, D.C.
- (3) U. S. Weather Bureau, *The Tunderstorm, a joint research project of four U. S. Government Agencies: Air Force, Navy, National Advisory Committee for Aeronautics and Weather Bureau*, Washington, D.C. June, 1949.
- (4) HAURWITZ, B., and AUSTIN, J. M., *Climatology*. McGraw-Hill Book Company, Inc. New York and London. 1944.

Conservation and Use of Alabama's Beauty along Its Highways

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One usually thinks that where the riding surface of the complete contemporary highway ends, naturalness begins; much of this naturalness has been traditionally in the form of turf. It has long been recognized that highway construction scars must be healed and that soil erosion must be controlled. Turf used to be the universal answer; but with more modern concepts of highway construction and landscaping, we must make use of other plant materials to solve the many problems that now confront the highway departments, the highway users, and the individual whose property abuts on the highway. The most general reason given for not using plants other than turf more extensively in developing the roadside is an alleged increase in maintenance costs. If desirable native plants exist, what could be more economical than allowing them to remain; certainly this is feasible beyond the construction lines. These plantings cannot be retained and maintained economically if construction scarring is allowed. Specifications must be inserted for fining or penalizing the contractor if scars are visible on desirable plant materials beyond the construction line. The contractor must be made aware of saving trees and natural vegetation and he must be sympathetic to such a program and include in his forces men who understand landscape operations, who can coordinate all contract units that will naturally blend into one smooth operation.

From a practical standpoint, the conservation of existing plant material within the roadside areas should reduce the need for new materials and tend to cut down costs. Natural or existing growth may provide part or all of the desired planting effects. Natural growth is more economical and normally more effective than planted developments. Plants which are to be preserved are best provided for during the clearing and grubbing operations. This is the time the most attention should be paid to the project.

Good landscape plans are not "dressing up" during the last stages of construction. They are the result of a close working relationship of those responsible for planning and designing our

highways which is continuous from the beginning of plans and carried into maintenance.

It is now time to visualize the areas involved in a typical interstate cross section. Each mile of highway with a 300-foot right-of-way contains approximately 36 acres. The paving and shoulders along this mile contain approximately 10 acres.

Twenty-five acres remain for grassing and for shrub and tree planting. Approximately eight acres of this area ideally should be used for grassing or ground cover material on the front slopes, back slopes, and median areas. The remaining 17 acres of land, should, from an economic standpoint, in many instances become a natural area made up of conserved native trees and shrubs supplemented perhaps with some planted materials.

With a view of a highway cross section in mind, a review of the requirements and purpose of highway landscaping which is applicable to all highways will be made.

The following outline is used as our basic criterion for highway planting:

A. *Purpose.*

1. *Erosion Control.*

- a. Slope stabilization by use of approved grasses and mulches.
- b. Use of trees, shrubs, and vines on slopes that are too steep or rough to mow. Ground cover material must have dense twig growth and be able to regenerate.

2. *Highway Safety.*

- a. To indicate change in highway alignment.
- b. Provide traffic guidance.
- c. Accent for danger areas such as bridge abutments, culvert headwalls, and other structures near edge of pavement.
- d. Reduce headlight glare on frontage roads, interchanges, and across medias, where necessary.
- e. Screen unsightly areas.
- f. Reduce highway hyponosis resulting from monotony with vistas provided.
- g. Provide sound attenuation.

3. *Aesthetics—combination of (1) and (2).*

B. *General Planting Areas*

1. *Rural Areas.* Do not require extensive planting of woody plant materials except at interchanges, industrial areas, and where screens are needed for headlights and unsightly areas. Emphasis is placed on conservation of native plant materials outside construction limits.

2. *Urban Areas.* Planted where functional. Urban plantings like rural plantings must be justified. Availability of maintenance labor, particularly the first and second year after planting, is a major consideration in plant selection and quantities.

3. *Interchanges.* Sight line considerations are given top priority. Plantings in these areas to provide traffic guidance, reduce headlight glare and accent danger areas through mass plantings.

C. *Plan*

1. *Preservation of Natural Growth.* A mile-by-mile inventory requiring that any existing plant material be thoroughly checked as to whether it is feasible to save this material. Check existing plant screens that naturally exist between the highway and adjacent properties, such as railroads, heavy industries, etc. Care should be taken in the conservation of plant material that grading and drainage problems are adequately considered.

2. *Naturalistic Plantings.* Trees to be spaced at irregular intervals and irregular alignment with occasional group plantings.

3. Ground cover, vines, and low shrubs on foreslopes to be in mass plantings.

4. Plantings not to encroach on tile lines or drainageways except for erosion control.

5. Plantings must serve justifiable purpose.

6. Use only hardy plant material which is adaptable to the site and which requires a minimum of maintenance.

7. Plantings on right side of grade separations to be heavier than on left side.

8. Large trees should be permitted no closer than 35 feet from edge of surfacing.

9. Trees which may cast shadows on the roadway and cause frost patterns are to be placed at a suitable distance from the edge of the surfacing.

10. Between ramps and main lines with merge, no plantings shall interfere with sight distance.

11. Special areas are to be treated in an approved manner.

Anthropology and Counterinsurgency

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Since Lenin, Communist leaders have made it plain that they expect to conquer the world. They have demonstrated that they plan to do this by any means, overt and covert. But the Communists have also demonstrated clearly that they will not take unacceptable risks in reaching this goal.

World conflict may be thought of as occurring along a spectrum ranging from one extreme, total war, to the opposite extreme, total peace. Furthermore, this spectrum may be viewed as dividing roughly into three major degrees of opposition:

1. *Total War* (involving the major powers of the Communist and Free Worlds).
2. *Limited War* (limited geographically, major power participation, weapon systems employed, etc.).
3. *Cold War or Sublimited War* (gaining objectives thru propaganda, subversion, insurgency, violence, etc. Equivalent to Khrushchev's "Wars of Liberation of Popular Uprising.")

General War and Limited War are the classical and conventional forms of conflict and are fairly well understood throughout the Free World. The objective of such conventional combat is to win control of a nation by defeating the enemy's military forces in the field. Such wars are marked by admission of failure to settle differences through diplomatic negotiations and by resort to the traditional clash of arms. The protagonists are clearly defined.

Cold War, on the other hand, is an entirely different breed—it is unconventional warfare. It is the war that is being waged today in South Viet Nam and Laos. It is the war that the French fought in Indochina and Castro fought in Cuba.

Unconventional warfare differs profoundly from warfare in which regular armies are openly engaged in combat. The strategy of unconventional forces is to win control of the nation by first winning control of the civil population. For, without the disciplined support of the civil population, unconventional forces can have no hope of success.

Unconventional warfare is the direct result of our heading off the communistic advantage in major forms of warfare. Our military strength and nuclear striking power have denied them the short road

to conquest—Total War and Limited War—and have forced them to a lower, slower, and safer level of combat. The only acceptable avenue left to the Communist today is subversion, insurgency, and guerrilla warfare.

Mr. Khrushchev, himself, disclosed the communistic strategy in a speech in January 1961. It amounted to a comprehensive description of the communistic design for world conquest. In this speech, he said . . . “wars of liberation are justifiable and inevitable” . . . and that the Soviet Union would use *every* means, short of limited war and total war, to accomplish its objectives. When he made this statement he was also describing “peaceful co-existence,” the Comunist’s sugar-coated name for Cold War. The Soviets not only recognize wars of liberation and popular uprising—they consider them sacred wars of revolution—meaning that they further the world communistic aim. They are now actively fomenting such wars wherever they can.

With our power to confine communistic aggression to unconventional warfare (subversive insurgency, guerrilla wars), we are free to concentrate our efforts on countering this form of conflict which demands more in ingenuity than it does money, manpower, or complex weapons systems.

As yet, the United States has not developed a totally effective form of defense that is adequate against this form of warfare. We did conduct some guerrilla and sabotage activities behind enemy lines in World War II, and are currently active in assisting Viet Nam forces, but we have not mastered the principles and techniques for opposing insurgency and guerrilla warfare.

Proof of how effective such tactics can be lies, so far, mostly on the Soviet side—in insurgency movements and revolts led or encouraged by the Communists. In Indochina, Red guerrillas tied up French troops and drained the Paris treasury for eight years, finally defeating the French in 1954. In Cuba, Castro started with an invasion force of only 81 men, and succeeded in overturning the Batista government with its vastly greater force of 43,000 regular troops.

There are three reasons why the Communists have been able to do so much with so little in many areas of the world:

1. They have thoroughly learned the techniques of gaining control of the civil population by effectively combining the positive incentives of a political doctrine, applied from the grass roots up, with the negative pressures of terrorism applied against those who refuse to accept their leadership voluntarily. The political indoctrina-

tion process may take years—but gaining control of the civilian population is an absolute prerequisite to further action. Just as control of the air is a prime prerequisite for successful conventional warfare, so control of the population is a necessary prerequisite for successful unconventional warfare.

After once having gained control of the civilian population, the Communists are then in a position to initiate more advanced forms of insurgency such as guerrilla forces, with great advantage against equal or superior forces supporting the government in power.

2. They have mastered the principles and techniques of guerrilla warfare. A superb intelligence network, relying primarily on the subverted population, is a prime characteristic of guerrilla organization. Iron discipline, endurance, inurement to hardship, ability to live off the land, and an intimate knowledge of the terrain and local languages give guerrillas a decided advantage over the normal run of conventional troops.

3. They have been able to exploit effectively the pent-up hatreds against former colonial powers and the pent-up frustrations emanating from the slow pace of economic development.

What can be done to counter these unconventional tactics? Certainly, a combination of actions is required. These actions are specified in the United States counterinsurgency program, now in operation. The COIN program can be defined as: The entire scope of military, political, economic, psychological, sociological, and civic actions taken by or in conjunction with the government of a nation to defeat insurgency.

In simple terms, this means that prevention, suppression, or defeat of subversion insurgency calls for a combination of military and non-military actions.

Non-military actions are designed to eliminate the political, economic, and social ills that were the original rationale for the insurgency.

Military actions, primarily have to do with putting down insurgency once it erupts.

People threatened by subversion and insurgency must be the prime target of our endeavors. When we are called in to help, we must seek to win their allegiance, not necessarily to our way of life and form of government, but to the cause of preserving their national integrity and freedom of choice. Support must concentrate on helping them to help themselves fight and win the COIN battle. The major effort, in other words, must be indigenous.

Anthropology, and anthropologists, are making a significant con-

tribution to increasing our capability in counterinsurgency. For decades, anthropological research has been focused on the physical, technical, and social characteristics of the peoples of Asia, Africa, Latin America, and elsewhere. A major part of this research has been in remote tropical areas—areas which are now the scenes of subversive and insurgency movements.

Remote area conflict research is a prime prerequisite for the development of a successful program to counter communist-inspired insurgency. Through anthropological field research into indigenous socio-political systems and institutions, basic strengths and weaknesses that exist in indigenous societies in relation to insurgency—actual and potential can be ascertained.

Currently, the United States is assembling and employing social scientists for such remote area research. Studies on Viet Nam are nearing completion and a like study on Thailand is in progress. The Department of Anthropology, University of California, has conducted extensive remote area research and published some 25 reports and monographs in support of counterinsurgency. These reports pertain to such timely subjects as The Role of Chinese in Laos Society; Minority Groups in Northern Laos; Laos and her Tribal Problems; and Laotian Rural and Urban Economies.

Significant anthropological contributions in support of counterinsurgency are also being made in the fields of anthropometry and language studies. Anthropologists are assisting indigenous groups in collecting and compiling data to provide a sound basis for the engineering design of individual equipment and man-operated equipment to be used in counterinsurgency operations. Such anthropometric studies are being made of the Royal Thai army personnel and of selected groups in Viet Nam and Latin America.

Finally, it should be emphasized that anthropologists have unmatched training and experience which can be put to good use in countering insurgency. And, anthropologists will play an important role in the joint national counter-insurgency effort as long as the United States has to cope with Soviet covert aggression. The battle is one of ingenuity and wits and is likely to be with us a long, long time.

A Study of a Proposed Natural Area in Lee County

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In 1959 the Society of American Foresters Committee on Natural Areas began a field survey of prospective natural areas in the southeastern states (Eyre 1960). The Committee considered that a qualifying natural area "should not be less than ten acres provided that it is surrounded by an equal acreage to constitute a buffer zone" (Shanklin 1949). In addition, the stand had to be old-growth in character with no cutting on the tract (Eyre 1960).

One of the stands that has been inspected under these considerations and officially rated as qualified is an 18.8-acre tract of old-growth shortleaf pine-hardwoods east of Opelika in Lee County. The owner, Tom Murphy, is 92 years old; he has lived all his life within 100 yards of the tract.¹

The purpose of this report is not so much to comment on the qualification of the tract as a natural area, but rather to describe the structure and something of the dynamics of an unusual forest stand. It can, with some justification, be called "virgin;" certainly, it clearly reveals that the dominant shortleaf pine will be succeeded by an oak-hickory "climax."

PROCEDURE

Two sampling methods, nested quadrats (Oosting 1958) and random pairs (Philips 1959), were employed to determine the composition of the vegetation on the area. A nest of quadrats consisted of a .01-acre quadrat located at each sampling point with four .001-acre quadrats grouped within. The larger quadrats were used to sample the transgressives (tree stems less than one inch in diameter and from one to ten feet in height). The .001-acre quadrats were used to sample the reproduction (tree stems less than one foot in height). In both types of quadrat a count was made by species. The random pairs were located at the same sampling points as the quadrat nests. Two sets of random pairs were used at each point: one set of pairs for overstory stems (dominant, co-dominant and intermediate trees) and the other set for understory stems (trees larger than transgressives but not in the overstory). Diameters of the random tree pairs were measured with a diameter tape; distances between individuals of the pairs were paced. Measurements were taken at 89 sampling points.

¹ Since the writing of this paper, Mr. Murphy has passed away.

Soil samples were taken to establish an average profile description for each distinctive soil type that was present. These types were checked against the Lee County soil survey report (Wonser 1950).

The species in each stratum were grouped under four general species groups: shortleaf pine, oak-hickory, larger hardwoods, and smaller hardwoods. The individual species in each group are listed in Table 1.

TABLE 1. SPECIES GROUPS RECOGNIZED IN THE STUDY
(LITTLE, 1953).

Shortleaf Pine	Shortleaf pine	<i>Pinus echinata</i> Mill.
Oak- Hickory	Pignut hickory	<i>Carya glabra</i> (Mill) Sweet
	Shagbark hickory	<i>C. ovata</i> (Mill) K. Koch
	Mockernut hickory	<i>C. tomentosa</i> L.
	White oak	<i>Quercus alba</i> L.
	Scarlet oak	<i>Q. coccinea</i> Muench.
	Southern red oak	<i>Q. falcata</i> Michx.
	Blackjack oak	<i>Q. marilandica</i> Muench.
	Water oak	<i>Q. nigra</i> L.
	Northern red oak	<i>Q. rubra</i> L.
	Post oak	<i>Q. stellata</i> Wangenh.
	Black oak	<i>Q. velutina</i> Lam.
Larger Hardwoods	American beech	<i>Fagus grandifolia</i> Ehrh.
	Sweetgum	<i>Liquidambar styraciflua</i> L.
	Blackgum	<i>Nyssa sylvatica</i> Marsh.
Smaller Hardwoods	Red maple	<i>Acer rubrum</i> L.
	Alder	<i>Alnus serrulata</i> (Ait.) Wild
	Devils walking stick	<i>Aralia spinosa</i> L.
	Flowering dogwood	<i>Cornus florida</i> L.
	Persimmon	<i>Diospyros virginiana</i> L.
	American holly	<i>Ilex opaca</i> Ait.
	Black cherry	<i>Prunus serotina</i> Ehrh.
	Farkleberry	<i>Vaccinium arboreum</i> Marsh.

For the overstory and the understory strata, four quantitative sociological characteristics were calculated separately by species classes: relative density, stocking per cent (frequency), relative dominance, and basal area per acre. Relative density is the number of individuals of one species group expressed as a percentage of the total individuals in all species groups. Stocking per cent is the percentage of all the sampling points occupied by one or more species of a species group. Relative dominance is an expression

of percentage of total basal area in each species group. For the transgressive and reproduction strata, relative density and stocking percent were calculated. In addition, a range of heights and ages for the shortleaf pine in the overstory (based on increment borings and Abney level measurements) was calculated.

RESULTS

Stand Description. Frequency (%) and average diameter are found in Table 2. It should be noted that the frequency of shortleaf pine was greatest in the overstory (68.5%) with oaks and hickory somewhat less (47.0%). These values were reversed in the understory, transgressives, and natural reproduction (Table 2).

TABLE 2. A TABLE OF STOCKING PERCENT (FREQUENCY) AND AVERAGE DIAMETER BY SPECIES CLASSES AND VEGETATIVE STRATA.

SPECIES CLASSES	Overstory		Understory		Transgressives	Natural Repro- duction
	Fre- quency %	Ave. Dia. (in)	Fre- quency %	Ave. Dia. (in)	Fre- quency %	Fre- quency %
Shortleaf pine	68.5	15.6	24.7	6.3	2.2	2.0
Oak- Hickory	47.0	13.3	88.8	6.3	84.3	13.0
Larger Hardwoods	9.0	12.8	15.7	3.4	37.1	2.0
Smaller Hardwoods	0.0	—	11.5	3.3	55.5	5.0

The absolute figure for total basal area per acre for all species for the overstory was calculated to be 131 square feet. For the understory, the total basal area per acre was 24 square feet. The overstory shortleaf ranged in age from 76 to 135 years, from 90 to 110 feet in height, and from 10 inches to 26 inches in diameter.

Litter depth averaged 2.76 inches; topsoil depth averaged 5.16 inches. The soil types were Cecil sandy loam or Cecil sandy loam, eroded phase, on the upper slope and hill top positions and Cecil clay loam in the lower slope, draw, and creek bank positions.

Relative density and dominance. The important occupants of the overstory were in the shortleaf pine group; 70.2% of the total basal area and 62.9% of the stems were of this group. The oak-

hickory group should also be considered important; it contained 26.0% of the total basal area and 33.0% of the stems. Only 3.0% of the total basal area and 4.1% of the stems were of the larger hardwoods (Table 3).

The frequency of oak stumps of understory diameters and their stages of decay indicated that very light but frequent cuttings, probably for fuelwood, had been made in the understory for a number of years. The owner verified this fact. Apparently the red oaks were preferred for fuelwood, since most of the overstory oaks and the larger understory oaks were white oaks (*Q. alba* and *Q. stellata*). As a result of the persistent fuelwood cutting, most of the oak-hickory in the understory at the time of sampling, was probably of sprout origin. However, despite this cutting, the oak-hickory made up 73.6% of the basal area and 61.2% of the number of stems in the understory (Table 3). The more shade-intolerant shortleaf was found in much less abundance in the understory; its relative dominance was only 16.9% and its relative density

TABLE 3. A TABLE OF RELATIVE DENSITY (D%) AND RELATIVE DOMINANCE (BA%) BY SPECIES CLASSES AND VEGETATIVE LAYERS.

SPECIES CLASS	Overstory		Understory		Trans- gressives	Natural Repro- duction
	BA%	D%	BA%	D%	D%	D%
Shortleaf pine	70.0	62.9	16.9	14.0	.3	13.0
Oak- Hickory	27.0	33.0	73.6	61.2	57.0	54.0
Larger Hardwoods	3.0	4.1	3.5	8.3	19.1	7.0
Smaller Hardwoods	0.0	0.0	6.0	16.5	23.6	26.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

only 14.0%. The smaller hardwood group, which was nonexistent in the overstory, became of some importance in the understory.

The relative density of the shortleaf group in the transgressives was found to be almost zero. Any shortleaf reproduction which has reached this stage will soon die out. The relative density of the oak-hickory group (57.0%) remained about the same as it was in the understory. The larger and smaller hardwood groupings

were somewhat more important than they were in the understory.

In the reproduction stratum, the relative density of 13.0% for the shortleaf (Table 3) was greater than the corresponding figure for the transgressives; most of this reproduction was found in openings and at the edge of the stand. The relatively densities for the hardwood groupings were of about the same magnitude as in the transgressives. Since all cutting for hardwood fuelwood stopped about three years ago, there has been little sprouting since that time. The relative density figures for hardwood natural reproduction presumably represent stems of seed origin.

DISCUSSION

This tract has every appearance of imminent succession from shortleaf pine to an oak-hickory community: the shortleaf pine are mostly of advanced ages and are of importance only in the overstory. Oak-hickory, however, was the dominant species group in the understory, the transgressive, and the reproduction strata.

The stocking or frequency of the dominant oak-hickory in the reproduction stratum was actually quite low (Table 2), but this was attributed to the heavy competition of the upper strata for light, moisture and nutrients, and to the unusually thick leaf litter of the forest floor. Decadence and death of old overstory trees would presumably cause a prompt increase in oak-hickory in the reproduction stratum.

The forest community fits quite nicely into the shortleaf pine-oak type (Eyre 1954): on the dry, low ridges, flats, and south slopes were found post oak, southern red oak, black oak, blackjack oak, hickory, and scarlet oak in association with shortleaf pine. On the moist sites with a deeper topsoil were found white oak, blackgum, sweetgum, red maple, northern red oak and black oak in association with the shortleaf pine.

Disturbance. The owner has had little disturbing influence on succession in the stand. Yet, one cannot separate the owner and the stand. He was born in a small cabin a few feet from his trees. He lives there today, 92 years old. The present dominant pines were young seedlings when he was born; they will die a few years after he does. He has been cutting oak and hickory fuelwood out of the stand most of his life; his father probably did the same. One can see the stumps decaying and the sprouts growing back until the years dim the evidence. At any rate, he has probably converted much of the oak-hickory to sprout growth and has retarded the overall size development of the group. Around the turn of the century, he cut enough shortleaf to build a barn. This

created an opening of about 1-acre where an even-aged stand of young pole shortleaf is present today.

The dominating shortleaf in the overstory were about 100 to 120 years of age. The oak-hickory members in the overstory and understory were mostly somewhat younger, as determined by stem borings. It is assumed that a great many of them are of sprout origin due to past fuelwood cutting. Thus, the true ages of the oak-hickory rootstock and to what extent this group might have developed without the cutting are not known. It seems possible that it may have occupied a much more important position in the overstory than it does at present.

Oosting (1958) stated that in the Piedmont succession will progress to an oak-hickory climax after 200 years or more following the abandonment of an old field to invading trees. This stand is approximately half that age and seems to be on the verge of oak-hickory dominance. If the shortleaf pine could be removed without disturbing the other trees, oak-hickory would become the dominant and stable community.

Some historical assumption of the previous stand seems necessary. The evidence indicated that, at the time the present shortleaf was in the seedling stage, many oaks and hickories were al-

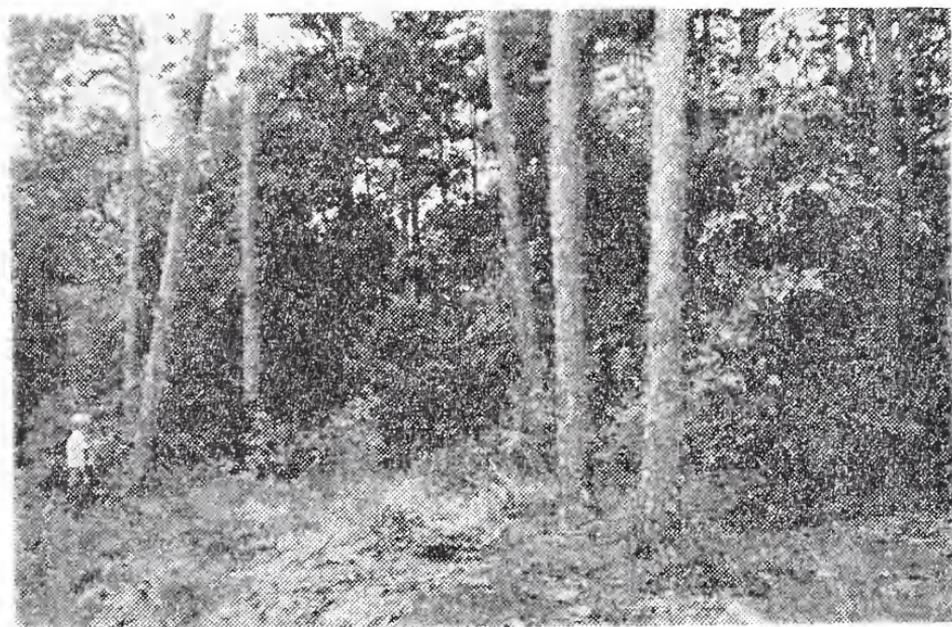


FIG 1. A general view into part of the Murphy tract. Overstory trees are shortleaf pine, up to 135 years. Understory trees are mainly oak and hickory.

ready present. Just previous to that some major disturbance probably took place—possibly an extremely hot fire—killing back a stand that was predominantly oak-hickory but leaving many living oak and hickory rootstocks. The shortleaf would then have seeded in from adjacent stands. Subsequently, the oak-hickory sprouts were kept back by the fuelwood cutting.

Perhaps a better explanation could be based on vitality. On such a basis, shortleaf pine would be considered an “ephemeral adventive” (Oosting 1958)—it came in originally from an outside seed source after a major disturbance, and thereafter did not reproduce itself except in good openings and after other disturbances. The oaks and hickories start in the early life of the stand maintaining themselves and completing the life cycle, by seed if they mature in openings left by dying old pines, and by sprouting from the stump if they are cut while still immature. The larger hardwoods will vary in classification with the species. Beech because of its shade tolerance is autochthonous, but gains slowly, if at all, in dominance because of its erratic seed production and its seed bed requirements (Putnam 1960). Sweetgum and blackgum will probably never be more than ephemeral adventives or at least vegetative maintainers in competition with the oak-hickory. The smaller hardwood group, being generally shade tolerant, will maintain itself and complete its life cycle.

SUMMARY

A proposed natural area, dominated by old-growth shortleaf pine, was studied to determine its vegetative structure and its probable successional pattern. The present stand characteristics indicate that the forest might have previously been a relatively stable oak-hickory community, but has reverted due to some major disturbance, probably fire. Subsequently, natural succession has been held more or less in check by frequent, light cuttings of oaks and hickories for fuelwood over an extended period of years. As the shortleaf decays and dies, the stand will again revert to an oak-hickory community.

LITERATURE CITED

- EYRE, F. H. Forest Cover Types of North America. Society of American Foresters, p. 26. 1954.
- Survey of Proposed Natural Areas in the Southeast. Society of American Foresters. 1960.
- LITTLE, E. L., JR. Check List of Native and Naturalized Trees of The United States. U.S.D.A. Agricultural Handbook No. 41. 1953.

- OOSTING, H. J. The Study of Plant Communities. W. H. Freeman and Co. 1958.
- PHILIPS, E. A., Methods of Vegetation Study. Holt-Dryden Co. 1959.
- PUTNAM, J. A., FURNIVAL, G. M., and McKNIGHT, J. S. Management and Inventory of Southern Hardwoods. U.S.D.A. Handbook No. 181. 1960.
- SHANKLIN, JOHN F. Report of the Committee on Natural Areas. Jour. Forestry 47:137-139. 1949.
- WONSER, C. H. Soil Survey Lee County, Alabama. U.S.D.A. 1950.

ABSTRACTS

Geology and Anthropology

A New Method for the Correlation of Carbonate Rock Sequences

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In the field of carbonate rock studies, Differential Thermal Analysis (D.T.A.) may prove to be one of the best laboratory correlative techniques presently available. Utilizing the Differential Thermal Analysis apparatus, the author and his associates were able to correlate limestones and dolostones on the basis of their Ca/Mg ratio content. The procedure involved using a standard curve derived from the D.T.A. analysis of standard mixture samples of calcite and magnesite at 5% mixture intervals from $\frac{100\% \text{ calcite}}{0\% \text{ magnesite}}$

to $\frac{70\% \text{ calcite}}{30\% \text{ magnesite}}$. This curve was then used to determine the Ca/Mg ratio for an unknown sample when it was subjected to the identical technique. The Ca/Mg ratio content of the unknown sample was read from the standard curve. The Ca/Mg ratio has been quantitatively determined by the Chittick gasometric technique and x-ray diffraction techniques to verify the Differential Thermal Analysis. The agreement was well within experimental error, and one can depend upon the rapid D.T.A. procedure without resorting to the more time-consuming techniques.

At the present time, this procedure is being used to correlate sections of limestone and dolostone in the Cahaba Valley of Alabama. Other possible applications of this procedure are: (1) determination of the physio-chemical structure of dolostone, a compound of $\text{Ca,Mg}(\text{CO}_3)_2$, a mixture of CaCO_3 and MgCO_3 , or a mixture of CaCO_3 and $\text{CaMg}(\text{CO}_3)_2$; (2) possible future correlative procedures utilizing the same techniques; (3) the possibility of the approximate determination of the salinity of the basin of deposition.

Ecological Implications of Certain Rhizoconcretions

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During recent field work involving the Hillabee chlorite schist at Pyriton, Clay County, Alabama, tubular, concentrically banded "rhizoconcretions" were noted in the recent alluvium adjacent to a small stream. The concretions ranged from 0.3 to 2.0 cm in diameter and from 5.0 to 15.0 cm in length. All contain tubular, hollow centers which ranged from 0.5 to 1.0 mm in diameter and which run the length of the form. Root fibers were found within some of these centers.

The concretions have clearly defined outlines and are discordant with the laminae of the enclosing alluvium. They are thought to form rather rapidly (*i.e.* time measured in terms of years). Their formation probably is caused either by oxidation of the sediments as a result of bacterial action on the roots, or by deposition of unabsorbed material because of osmosis. Either process would result in the induration of the sediments immediately surrounding the roots.

Similar "rhizoconcretions" have been noted in shales and siltstones of Pennsylvania age near Birmingham, Alabama, and in the black slates of the "Carboniferous" Erin member of the Talladega series near Erin, Alabama. These concretions are thought to be of an origin similar to those found at Pyriton and probably indicate a shallow water to intermittently subaerial environment.

Paleoecology of the Little Oak Facies of the Amended Lenoir Limestone

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Birmingham-Southern College

The Little Oak limestone and its lateral equivalent, the Athens shale, are the youngest members of the amended Lenoir limestone (Middle Ordovician) as their formation is represented in the Cahaba Valley, Alabama. The Lenoir grades to the northeast from a shale (Athens facies) at Alabaster through a dark gray, silty limestone with black chert nodules (Little Oak facies) at Pelham to a medium gray limestone (the Lenoir limestone proper) at the New Hope Baptist Church.

One hundred and seventy-four species of invertebrate fossils have been identified from the Little Oak by the author and his associates. The phyla represented are: Echinodermata; Porifera; Bryozoa; Coelenterata; Mollusca, including Pelecypoda, Gastropoda, and Cephalopoda; Arthropoda, represented by Trilobitomorpha and Ostracoda. One-half of the species collected never have been reported from this area. Ten species from the Little Oak are thought to be undescribed.

Based on the nature of the sediments and the diversity of organisms contained in them; it was inferred that the environment in which the Little Oak was deposited was warm, marine, and within the inner or middle neritic zone. The waters were shallow, turbid, and within the euphotic zone. The substratum was firm, but the firmness decreased toward the southwest from New Hope Church. Toward the southwest from New Hope Church, the turbidity and the depth of the water increased, and the diversity of organisms decreased.

Some Anticipated Lunar Mining Problems

Reynold Q. Shotts
University of Alabama

The removal and processing of lunar mineral resources undoubtedly will prove highly desirable in the light of the cost, difficulty and attendant uncertainty of transportation of materials from the earth. The nature of the mining and processing problems encountered will be dependent upon: (1) the kinds of materials present on the moon; (2) the ease with which the deposits can be discovered and evaluated, and (3) the nature of the lunar surface and sub-surface environments. We are in a position now to do little more than speculate regarding the first two factors but much is known or can be inferred from what is known, regarding the lunar environment.

Water is likely to be the mineral of greatest and most immediate value on the lunar surface although it has been suggested that sulfur and various rock products may eventually contribute to a lunar mineral technology.

The presence, nature of occurrence and the quantities of water available on the lunar surface are partly dependent upon the mode of formation of the lunar surface and partly upon whether the thermal history of the moon involved a "hot" or "cold" moon origin

In fact, the interpretations we place upon lunar geology are very largely dependent upon the use of "hot" or "cold" moon theories of origin.

Factors affecting equipment and methods of lunar mining, once deposits are located, will be influenced largely by the: (1) extremely low ambient pressure due to virtual absence of a lunar atmosphere; (2) extreme temperature changes that occur on the surface from sunlight to shadow, from lunar day to night and on the occasion of eclipses; (3) composition, density and physical properties of the surface "rock" and/or "soils"; (4) nature of subsurface openings, and the porosity and permeability of lunar materials; (5) presence or nature of possible minor "gangue" constituents such as liquified vapors (Cl_2 , H_2S , SO_2 , etc.), mixed with the "ores;" (6) lower surface gravity, the presence, strength and distribution of a magnetic field and/or surface electrical charges; (7) intensity of micrometeorite bombardment.

Nonpenetrative Methods of Prospecting for Coal

Reynold Q. Shotts
University of Alabama

Geophysical and related prospecting methods requiring no penetration of the surrounding rocks, have been highly developed for certain minerals having some detectable-at-a-distance property such as magnetism or radioactivity. Methods for the indirect determination of favorable structure and other geological conditions governing the occurrence of petroleum fluids, water and some other minerals, have also been advanced significantly in recent years. Up to the present time, however, little success has attended efforts to explore for deposits of coal by non-penetrative methods. The commonness of occurrence, the relative ease of location of coal-carrying sedimentary basins and the comparatively low value of coal per unit weight, as well as difficulties inherent in the application of possible nonpenetrative detection methods, have all contributed to the lack of success in the application of nonpenetrative methods of coal.

Early in 1962 the author made a brief literature study of non-penetrative methods of prospecting for coal for the Fuels Planning Section, Power Supply Division, Tennessee Valley Authority. As the largest single purchaser of coal in the world, T.V.A. has con-

siderable interest in the location of adequate future fuel supplies.

Past experience in the use of gravitational, seismic (reflection and refraction), electrical, magnetic and radioactive methods were reviewed. It was concluded that only: (1) seismic reflection; (2) seismic refraction; (3) electrical resistivity, and (4) spontaneous potential methods, may have applications to the direct detection of coal beds. Gravitational, magnetic and electrical methods and geothermic measurements were discussed as possible indirect methods of discovering coal deposits. The use of well logs, although not nonpenetrative, was discussed also. Electrical and the recently developed (in Russia) "Correlation Method of Refracted Waves (CMRW)" were discussed as probably the most promising methods for future study. It is probable that a wide diversity of methods, coupled with detailed local geological knowledge, will be required for the successful use of any nonpenetrative method or methods.

Geology of the Pisgah Dome, Limestone County, Alabama

Thomas W. Daniel, Jr., Geological Survey of Alabama

Earl L. Hastings, Eufaula, Alabama

In January, 1957 the Geological Survey of Alabama began a geological study of Limestone County in North Alabama. The field work was completed in 1959, resulting in a geologic map of the county, an economic mineral survey, and a study of the structure of the Pisgah area.

The outcrop pattern of the Chattanooga Shale of Devonian age indicated a structural dome in the vicinity of Pisgah in Township 2 South and Range 3 West. Exploratory drilling substantiated the presence of a structural dome which has an area of closure of 9 miles and 70 feet of vertical closure. A wildcat well, G. C. Bridges No. 1, was drilled in the southeast quarter of the northeast quarter of section 10, Township 2 South and Range 3 West to a depth of 2,505 feet.

Two slight gas shows were detected at depths of 1,055 feet in the Chickamauga Limestone of Ordovician age and at 1,810 feet in the undifferentiated Cambrian and Ordovician dolomites. A slight show of oil was detected at a depth of 2,086 feet, also in the undifferentiated Cambrian and Ordovician dolomites.

There is oil and gas production in Tennessee from limestones of Ordovician age. The producing wells are located north and

northeast of the Nashville Dome at approximately the same distance as the Pisgah Dome. Although the G. C. Bridges No. 1 was a dry hole, additional exploratory drilling may bring oil and gas production to this area of North Alabama.

Notes on the Deposition of the Upper Part of the Warsaw Limestone, Colbert County, Alabama

W. Everett Smith

Geological Survey of Alabama

The upper part of the Warsaw Limestone in Colbert County was studied to determine its probable depositional environment. Several microfacies of the upper part of the Warsaw are recognized. These microfacies reflect depositional conditions and are differentiated on the basis of relative particle sorting, the character and relative percentages of constituent particles and the character of cementing material.

Preferential orientation of elongate-clastic grains was observed in several thin sections cut parallel to the bedding plane. This preferred orientation of clastic grains was attributed to the action of ancient tidal currents, and may be indicative of the contemporaneous shoreline location. Additional studies of grain orientation in the upper Warsaw may yield information which would aid in locating shorelines.

The study indicated that the following physical conditions probably existed during the deposition of the upper part of the Warsaw:

- water depth—less than 50 meters
- current velocity—from 0 to 15 cm./sec
- water temperature—from 28 to 33 degrees C.
- water salinity—above that of normal ocean salinity of today.

Preliminary Study of the Paleocology of a Biofacies of the Lenoir Limestone in Cahaba Valley, Alabama

Marjorie A. Jackson

Birmingham-Southern College

The purpose of this study was to determine the environment represented by a biofacies of the Lenoir limestone (Middle Ordo-

vician) as it is exposed at New Hope Church, Cahaba Valley, Alabama. This study was based on both paleontologic and lithologic evidence.

The stratum containing this biofacies is a dark gray, fine-grained limestone which on weathering produces tan cavernous chert and red clay soil. Within the weathered limestone, there is an abundance of well-preserved, silicified invertebrate fossils. To date, seventy species of several invertebrate phyla have been identified from this location.

Included in the faunule collected are thin-shelled brachiopods and sponges which are considered to be environmental indicators. Based on the total aspects of the faunule, and specifically, the thin-shelled brachiopods and sponges, a tentative reconstruction of the environment is possible. The environment definitely was marine, and the faunal evidence indicates that the environment was most probably sublittoral. Based primarily upon the variety of organisms that lived in this area, the environment was warm and well within the euphotic zone. Wave action was effective in this zone but not violent except in unusual conditions. The substratum appears to have been well cemented and non-shifting and was covered by an ooze or a silt layer.

Eufaula Bauxite District, Barbour and Henry Counties, Alabama

Otis M. Clarke, Jr.

Geological Survey of Alabama

Small masses of bauxite, bauxitic clay, and kaolin occur in the sands of the Nanafalia Formation of the Wilcox Group in Barbour and Henry Counties, Alabama, approximately ten miles south of Eufaula, Alabama. The bauxite zone unconformably overlies the Clayton Limestone of the Paleocene series.

The occurrence of bauxite in the Eufaula district is complicated by the solution and collapse of the underlying Clayton Limestone. The bauxite is postulated to have been formed when this area was a karst topography and was covered by a series of lakes during the early Eocene, similar to the Ocala area of Florida today. Lakes filled the sink hole areas in the underlying limestone. Kaolinitic clays originally derived from the feldspathic rocks about fifty miles north of this area were deposited in the lakes and ponds. Bauxitization occurred after the sediments were deposited.

The solution of underlying limestone, accompanied by the collapse of the surface, continued after the formation of bauxite and

probably during the formation of bauxite. This resulted in local faults and comparatively steep dips found in some of the deposits today. Any collapse which occurred during the formation of bauxite would have improved drainage within the clay deposits and thus would facilitate the removal of silica.

Geology of Wolf Ridge, Mobile County, Alabama

George Brockman
Mobile, Alabama

Wolf Ridge, located in the northwestern part of the city of Mobile, was taken as representative of a portion of the west shore of Mobile Bay. The ridge is five miles from the water and approximately parallels the shoreline. The core of the ridge is composed of Miocene sand and clay overlain by Pleistocene and Recent sands and associated deposits. The hill is capped by Coharie terrace sands up to twenty-five feet in thickness. On the eastern slope are found Sunderland terrace sands, and the ridge is lapped at the base on the eastern side by Pamlico and more recent deposits.

At least two north-south normal faults, dipping eastward, have deformed the sediments since Sangamon time, with total displacement up to one hundred feet.

Mineralogy of Acid and Alkaline Montmorillonitic Clays of the Black Belt of Alabama

B. F. Hajek and J. B. Dixon
Auburn University

Two distinctly different groups of soils dominate the Black Belt of Alabama. One group is represented by Houston clay, a neutral or alkaline soil. The other group is represented by the strongly acid Vaiden soil.

Two profiles of Houston and two of Vaiden were studied. The two profiles of Houston consisted of a black surface layer, subsurface layers of progressively lighter color that graded into olive gray at about 3 feet, and underlain at about 6 feet by chalky limestone of the Selma group. The two Vaiden soil profiles had a dark gray or brown surface a few inches thick with a yellowish brown layer beneath, which was mottled with yellowish red and light brown. Olive colors increased with depth in the Vaiden soils.

The clay fractions (less than two microns) of both soils were dominated by montmorillonite and contained similar amounts of other minerals. Total expansible minerals (montmorillonite plus vermiculite) comprised about 65 per cent of the clay fractions. Kaolinite was the second most abundant mineral. Vermiculite, quartz, and feldspar were present in lesser amounts. Mica comprised about 5 per cent of the clay of both soils.

The only evidence of weathering in the Houston soil was the dissolution of carbonates. The relative abundance of the different clay minerals in the Houston soil and the underlying chalk was similar, suggesting little or no weathering of these minerals. However, weathering in Vaiden profiles was evidenced by the accumulation of expanding layer silicates and free iron oxides in a B₂ horizon. The clay mineralogy of the calcereous clay beneath a Vaiden profile differed slightly from the soil over it.

The persistence of montmorillonite in these soils leads to the conclusion that it has a high resistance to subaerial weathering under acid and alkaline conditions when it is a major part of a clayey soil.

CONSTITUTION OF THE ALABAMA JUNIOR ACADEMY OF SCIENCE*

ARTICLE I—NAME

This organization shall be known as the Alabama Junior Academy of Science.

ARTICLE II—PURPOSE

The purpose of the Junior Academy shall be (1) to focus attention on science; (2) to stimulate interest in science; (3) to encourage and inspire a desire for scientific experimentation.

ARTICLE III—ADMINISTRATIVE DIVISIONS¹

Sec. 1. Relationship of Senior and Junior Academies. The Alabama Junior Academy of Science is a branch of the Alabama Academy of Science, Inc.—hereinafter known as the Senior Academy. The Junior Academy is subject to the jurisdiction of the Senior Academy.

Sec. 2. Counselors. The Senior Academy shall elect such counselors as it deems fit to counsel, aid, encourage and supervise the activities of the Junior Academy.

Sec. 3. Establishment of Regional Divisions. The Junior Academy of Science, under the direction of and with the concurrence of the Senior Academy, may establish Regional Divisions which shall correspond with Science Fair Regions. Such Regional Divisions shall be fully recognized as auxiliary divisions of the Alabama Junior Academy of Science.

Sec. 4. Regional Divisions. Under the direction of the Junior Academy of Science, each Regional Division, upon its formation, shall enact Regional By-Laws; however, such Regional By-Laws may not conflict with this constitution.

ARTICLE IV—MEMBERSHIP²

Sec. 1.1 Full Membership. Full membership of the Junior Academy shall consist of high school students interested in scientific activities and who shall meet such other requirements as established by the By-Laws of their respective chapters of the Alabama Junior Academy of Science.

Section 1.2 Associate Membership. Associate membership of the Junior Academy shall consist of junior high school students interested in science and who shall meet such other requirements as established by the By-Laws of their respective associate chapters of their Regional Division.

Sec. 2.1 Chapters. Each chapter shall consist of the sponsor from the science faculty of a high school together with such interested students in a senior high school who have met the requirements for membership as laid down in the By-Laws of that chapter.

Sec. 2.2 Associate Chapters. Associate chapters shall consist of the

*Constitution published in A.J.A.S. Newsletter, Issue II, Nov. 1961 with amendments as indicated.

1. Article III (Administrative Divisions) has been added causing all subsequent Articles to be renumbered one successive digit according to *The Journal of the Alabama Academy of Science*, Vol. 31, No. 1, July 1959, p. 68.

2. Article IV as amended, *loc. cit.*

sponsor from the science faculty of the junior high school together with such interested students in the junior high school who have met the requirements for membership as laid down in the By-Laws of that chapter.

Sec. 3.1 Chapter Application. Science clubs interested in becoming affiliated with the Junior Academy should submit to the Permanent Counselor an application accompanied by a list of the club members and dues for the first year. Any senior high school in Alabama that offers eleventh grade courses and meets the standards of the Alabama Junior Academy of Science is eligible for consideration of acceptance by the Alabama Junior Academy of Science at its next annual meeting.

Sec. 3.2 Associate Chapter Application. Science clubs interested in becoming affiliated with the Regional Junior Academy should submit to the Regional Counselor an application accompanied by a list of the club members and dues for the first year. Any junior high school in Alabama that offers eight grade courses and meets the standards of the Regional Division is eligible for consideration of membership.

Sec. 4.1 Chapter Limitations. Each high school shall be limited to one chapter, although a chapter may consist of more than one science club in that school.

Sec. 4.2 Associate Chapter Limitations. Each junior high school shall be limited to: (1) One chapter, although a chapter may consist of more than one science club in that school; (2) Participation in the activities of their respective region; (3) Participation in the regional business meeting by having only one voting delegate; (4) Positions on regional committees—they shall not hold elective offices of their region.

ARTICLE V—OFFICERS

Sec. 1. Officers. The officers of the Junior Academy shall consist of a President, a Vice-President, a Secretary and a Treasurer. These officers shall be elected by the delegates from the several chapters represented at the regular annual meetings of the organization. Candidates for office shall be limited to students who shall be bona fide members of a high school at the next annual meeting.

Sec. 2. Duties. The above officers shall perform the duties usually pertaining to their respective offices, and in addition give their full cooperation to the Counselors appointed from the Alabama Academy of Science. In the event of non-performance of duty by any officer, and upon the recommendation of the Executive Committee, the Chapter represented by that officer shall be excluded from the nomination of officers at the Convention affected and at the two conventions immediately following.³

ARTICLE VI—DUES

Sec. 1. Amount. Each chapter shall pay to the Junior Academy an annual fee of two dollars. The initial fee of two dollars shall include the cost of a charter, and shall in addition, be credited as the first year's dues.

Sec. 2. Penalty for default. Any chapter in arrears in dues for two years and failing to respond to notification from the Treasurer shall be dropped from the Junior Academy and its charter revoked.

3. Sec. 2 of Article V (Officers) has been amended by the addition of the last sentence according to *The Journal of the Alabama Academy of Science*, Vol. 30, No. 1, July 1958, p. 62.

Sec. 3. **Reinstatement.** Any chapter dropped from the Junior Academy for failure to pay dues may be reinstated by payment of dues for the current year, subject to approval at the annual meeting.

ARTICLE VII—DELEGATES

Sec. 1. **Official.** Each chapter shall be limited to one official delegate at the annual meeting. Only the official delegates of the various chapters shall vote on the matters representing the official business of the organization.

Sec. 2. **Unofficial.** The number of unofficial delegates that a chapter may send to an annual meeting shall be determined by the executive committee at its fall meeting.

ARTICLE VIII—ADMINISTRATION OF FINANCES

Sec. 1. **Limitation of Expenses.** No bill in excess of five dollars shall be incurred by the Junior Academy without authorization from the Permanent Counselor.

Sec. 2. **Control of Finances.** The Permanent Counselor shall be custodian of Junior Academy funds, and shall directly supervise the Treasurer's administration of finances.

Sec. 3. **Auditing.** The Treasurer's books shall be audited once a year by a committee appointed by the Alabama Academy of Science.

ARTICLE IX—MEETINGS

Sec. 1. **Annual.** The Junior Academy shall have an annual meeting concurrently with the Alabama Academy of Science at such time and place as that organization shall designate.

Sec. 2. **Group.** Additional meetings of any appropriate group of chapters may be held at any time subject to the approval of the Permanent Counselor.

Sec. 3. **Chapter.** Local chapter meetings shall be determined by the individual chapters.

Sec. 4. **Executive Committee.** Executive committee meetings shall be held at least twice a year, in the fall to make plans for the annual meeting, and during the annual meeting.

ARTICLE X—RATIFICATION

This Constitution shall become effective at such time as it is ratified by a two-thirds majority of the chapters eligible to vote on April 1, 1955, and subject to the approval of the Alabama Academy of Science.

ARTICLE XI—AMENDMENTS

This Constitution may be amended at any time by the following procedure:

Any chapter may recommend amendments or revisions to the Constitution during the school year. These recommendations shall be discussed and voted on at the annual meeting and shall be adopted if they are approved by two-thirds of the delegates present and by the Alabama Academy of Science.

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Affiliated with the
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HONORARY MEMBERS



Roger Williams Allen was born in Birmingham, Alabama in 1897. He received B.S. and M.S. degrees from Auburn University, A.M. degree from University of Michigan, and Ph.D. from Columbia University. He has been a chemist with industry and has taught at Howard College. He became Professor of Chemistry at Auburn University in 1928, and in 1941 became Dean of Auburn's School of Science and Literature and serves at present in the latter capacity. Dean Allen served as President of the Alabama Academy of Science during 1937-38.

Emmett W. Price received the D.V.M. degree from George Washington University, M.S. from American University, and Ph.D. from George Washington. He came to Jacksonville State College in 1957 as Professor of Biology, Parasitology, and Bacteriology. Previously he was associated with the Pennsylvania Bureau of Animal Industry, Texas A & M College, and the U. S. Department of Agriculture. Dr. Price is a co-founder of American Society of Parasitologists and served as its president in 1952. Among other organizations to which he belongs, in addition to Alabama Academy of Science, are A.A.A.S., American Veterinary Medical Association, and American Microscopical Society.



Reforestation in North Alabama

John H. Hinton

Tennessee Valley Authority

The Tennessee Valley is the area drained by the Tennessee River and includes parts of seven states (Alabama, Georgia, Tennessee, North Carolina, Kentucky, Virginia, and Mississippi). Although Tennessee contains the largest portion of the Valley, Alabama ranks second with some 17 per cent. Though most of this discussion will be on a Valley-wide basis, it will be heavily weighted toward that portion of the watershed in Alabama.

The earliest known record of reforestation in the Valley can still be seen today in Madison County, Alabama. Here Mr. W. W. McCrary planted a 6½-acre eroded and abandoned corn field sometime in the 1880s. Wild seedlings were used to reforest this area. Today the plantation averages 66 trees per acre. Sawtimber volume runs 22,130 board feet to the acre. The average tree is 18 inches d.b.h., has three 16-foot logs and contains 336 board feet. The largest tree in the plantation is 31 inches in diameter and contains 1,265 board feet.

However, reforestation did not gain much headway until the early 1930s. Since TVA's inception in 1933, it has cooperated with many agencies to promote reforestation. During the first few years primary emphasis was on planting trees to stop erosion. Two nurseries were established, one at Wilson Dam, Alabama, the other at Clinton, Tennessee, to help supply the quantities of trees needed. The Civilian Conservation Corps provided manpower for the nurseries and the tree planting. Extension services and state divisions of forestry in the seven states helped make arrangements with landowners. There was no charge for the trees. All a landowner had to do was give his permission; but even so, not all gave it.

When the CCC era ended in 1942, trees were still furnished without charge; but the landowner had to do the planting, or hire it done. Planting activities virtually ceased during World War II but were resumed at a faster pace as soon as the war ended. By 1958, state forestry agencies had developed the nursery capacity to supply the demand for seedlings; so TVA discontinued large-scale production.

Even without assistance from the CCC and free seedlings, tree planting continued to soar. The earlier tree plantings were then serving as obvious demonstrations of wise use of abandoned or idle fields. Through 1960, 600 million seedlings had been planted

in 86,000 plantations. The area reforested was more than a half million acres.

In the fall and winter of 1961-62 state forestry agencies, state extension agencies, and forest industries joined TVA in a survey of these plantations to find out how many were still in existence, how many were being managed, and what the owners planned to do with them.

This survey yielded much valuable data. It was perhaps the most extensive of its kind ever attempted in this country. Here are the highlights:

1. Ninety-eight per cent of the 493 million seedlings delivered to private landowners were planted, a high proportion on eroded land.

2. Of 85,700 plantations established, 81 per cent (69,400) are still in existence. They are on 68,200 ownerships, total approximately 401,700 acres, and average 5.8 acres.

3. Ninety-two per cent of the existing plantings controlled erosion satisfactorily; 85 per cent are well stocked with trees—in good shape to grow timber.

4. Products, mostly pine pulpwood and black locust posts, have been harvested from 6,050 of the older plantations.

Beginning in the late 1940s and continuing at an increasing rate, tree planters and prospective tree planters were asking, "What financial return can I expect from an acre of planted pine?" There was only a meager amount of information available on which to base an answer. The common rule of thumb on growth was "one cord per acre per year," but this was far from the whole story.

In search of answers, TVA in 1963 sampled the plantation area, which by this time had reached 800,000 acres. Briefly this is what the foresters learned.

Idle land planted to pine trees can yield a long-time average annual yield of \$15 per acre. Depending on how badly eroded the land was to begin with, the return may be as high as \$26 or as low as \$7. Considering the full rotation of a plantation (45 to 50 years), loblolly pine may be expected to yield an annual stumpage return of \$20 per acre on good sites and \$10 on poor sites. Short-leaf pine returns should range from \$13 to \$5, white pine from \$23 to \$10. (The bulk of the plantations in northern Alabama are loblolly pine.) Within 20 years of planting, a landowner can make a thinning of five to seven cords per acre. This much pulpwood on the stump is worth about \$25, and thus, it more than covers the cost of planting.

Thinning can be repeated every five to eight years until the trees are mature, and with most pines maturity comes at about age 45 when many of the trees will be 16 to 18 inches in diameter. As trees increase in size, the harvest will change from pulpwood to poles and sawlogs.

Most of the plantation owners say they gave little thought to harvesting a crop from the trees when they were planted. Their primary interest was erosion control, and only in recent years have they seen clearly the financial return. They have realized some income, and they are looking forward to more in the future.

These are economic benefits to the landowner. Now, what about the effects of tree planting on the economy of a county, a state, or a region?

The report just issued on the third Forest Survey of Alabama by the Southern Forest Experiment Station says that "Alabama is the most extensively wooded state in the Midsouth. Forests now cover 67 per cent, 21.8 million acres, of the land." This is an increase of one million acres since the 1953 survey. Some of this, of course, has resulted from abandoned fields reverting to woodland through natural regeneration. But a considerable portion has resulted from tree planting.

Alabama now has approximately 1.2 million acres of planted pines. Forest economists state that each 1,000 acres of planted pine creates the base for 10 new full-time jobs in the industry and an equal number in related trades and services. The importance of Alabama's forests to the economy of the State can be further emphasized by the fact that the timber industry is the second largest industry in the State based on value of products. One of every four wage earners obtains his living in some phase of the forest industry; thousands more are employed in businesses servicing this industry.

How does this employment affect other businesses? American Forest Products Industries, Inc., (a national organization of forest industries and forest landowners) estimates that a timber industry worker's income is distributed as follows: food, 26.4 per cent; household furnishings, 11.1 per cent; transportation, 9.3 per cent; housing, 10 per cent; clothing, 8.3 per cent; recreation, 4.2 per cent; personal services, 4.3 per cent; medical institutions and services, 4.1 per cent; taxes, 11.8 per cent; charitable contributions, 1.2 per cent; savings, 6.4 per cent; and other personal expenses, 2.9 per cent.

The Alabama State Planning and Industrial Development Board reports that more than one-half of the 1963 industrial ex-

pansion in Alabama was in the timber industry, and that this expansion and development is continuing into 1964. Pulpwood production is now at an all-time high. The State ranks third in the South in lumber production. It is the number one producer of Southern pine poles and piling.

Of course, this employment and industry expansion is tied to a rapidly expanding population. What about the immediate future? The U.S. Forest Service predicts that by year 2000—just 36 years from now—we will be consuming 83 per cent more wood than we did in 1952, and further, that wood growth will be far short of needs. It should be kept in mind that it requires 20 years to grow a crop of pulpwood and 40 years to grow sawtimber.

In an effort to meet this almost immediate increased need for wood, the seven Tennessee Valley state governors during the Southern Governors' Conference in 1962 endorsed a Plant Trees—Grow Jobs reforestation promotion program designed to reforest all of the idle, abandoned land (some 13 million acres) in the seven states by 1970. (One million of these acres are in the Tennessee Valley.) This, without parallel, is the most ambitious reforestation goal ever conceived. It will require 10 billion seedlings, twice the number of seedlings produced by these states to date. It will represent an investment of \$245 million for seedlings and labor. Most of all, it will require public cooperation. But everyone stands to profit. It is a job for leaders in government, industry, education, and business. It is a job for the press, radio, and television. It is a job for the watershed organization, the soil conservation district, and the county committee that administers the agricultural conservation program. It is a job for the civic club, the sportsman club, the Boy or Girl Scout troupe, the 4-H Club, and the garden club. It is most certainly a job for the state forestry agencies, the agricultural extension services of Land-Grant Colleges, and the Federal forestry and conservation agencies operating in the region.

Prospects are that reforestation in the north Alabama Valley counties this year will exceed last year's record, but not substantially. Last year 17,000 acres were reforested, reversing a two-year downward trend. But I am confident these idle acres will be reforested, not only in the Valley but throughout the State. We know that today there are over 190 million Americans and that soon there will be some 300 million. The economic demand for wood and wood products will force every available acre into production. The big question is, "Will we start early enough to provide the wood when it is needed?"

Alabama's Regional Trade Balance with Emphasis on Agriculture and Economic Development

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Regional trade balances and other concepts of regional economic analysis have received more than ordinary interest in the past decade. The geographical scope of an area or region is largely undefined, but generally it may be thought of as a unit over which some kind of investment policy, public or private, may be most effective. More than 100 Federal programs now provide assistance for community and regional redevelopment. In addition to these Federal programs, most states also support rural and urban development action. In all, an estimated 10,000 public and private agencies in the United States are concerned with some form of area development. If these programs are to be soundly conceived and implemented, a maximum amount of knowledge is required concerning the needs and capabilities of an area and the possible impact of its growth on the surrounding economy. The discussion presented in this paper relates to research that can be used in an analytic approach to development planning.

The number of specialized research programs involving regional analysis has grown at a rate described as phenomenal in a recent survey of regional economic research (5). In this survey, Meyer classified the theoretical roots of regional research as being: (1) revitalized classical location theory; (2) international and inter-regional multiplier theory; (3) Leontief interindustry input-output analysis; and (4) mathematical programming.

This paper is primarily concerned with input-output analysis and will touch briefly on the other areas. Data for input-output analysis are the sales of each industry to all other industries (intermediate demands) and sales and transfers to a final demand sector. Research interest in this somewhat detailed flow of transactions may be traced to the "Tableau Economique" prepared by the Physiocrats of the 18th Century. However, an acceptable theory of general economic equilibrium among industries was not completed until the works of Walrus and Pareto. Their theories are highly idealized, however, and empirical implementation is difficult. Until the development of mathematical programming during the past 15

years, input-output analysis was the only empirical tool of inter-industry analysis that carried the essence of general equilibrium theory. Leontief's initial input-output study of the U.S. economy has been followed by other models developed in this country and by national models in about 15 other countries (4). Considerably less work has been done in the area of interregional input-output models possibly because of the complexity and cost of obtaining sufficient data.

In an interregional input-output model, transactions must be identified not only according to sales among industries within each region but also according to sales of each regional industry to all industries in all other regions. Data-gathering difficulties are apparent and are compounded by the aggregation problems encountered in obtaining a practical definition of a region and of an industry. Despite such problems, the models have a pervasive type of rationality because interindustry transactions do occur and because of accepted ability of reasonably abstract models to yield insights about the real world. At the least, an input-output model is a convenient way of summarizing descriptive data and if basic underlying assumptions hold true valuable information is gained about: (1) the structure of the economy; (2) effects of public policy on an industry as they are traced through many trade relationships; and (3) prediction of industry output for given changes in economic structure. The assumptions, however, are stringent. They are: (1) constant returns to scale implying that increases in outputs are proportional to increases in inputs; (2) an output is available from only one industry implying no substitution possibilities; (3) no errors of aggregation; and (4) constant technology. Objectives of this paper do not warrant discussion of these assumptions as they are amply covered elsewhere (2, 3). But the assumptions should be kept in mind for evaluation of results to be presented later.

Significant connections may be made among three of the theoretical areas cited by Meyer, input-output, location, and multiplier analyses. An essential phase of regional multiplier analysis is to determine what forces are external or exogeneous to the region's economic growth. Political and social forces are difficult to evaluate in this respect, and the principal evaluation is to determine how the region's "export base" for goods and services affects total regional economic activity. One hypothesis is that as demands for exports increase, money flows into the region to stimulate invest-

ment in a still larger export base. Export base industries increase their requirements from service industries of the area thereby exerting a multiplier effect on the regional economy. This can be an empirical multiplier which is measured by observing the relationship between export activity, as determined by interregional input-output analysis, and total economic activity in the region over time. A critical factor would be the make-up and stability of the export base. Questions as to the optimum composition of the base, one indication of stability would be characteristically those of location theory. In the classical tradition of Von Thunen, Weber, and Loasch, this is still an analysis of comparative costs among regions which emphasizes transportation and processing costs and locations of factor supplies and product demands.

Input-output theory thus joined with location and multiplier analysis of the export base gives rise to a general, though empirical, analysis of regional economic development. From regional input-output study, quantitative estimates of import-export flows are obtained which suggest hypotheses about the relevant export base of the region. Industries in the export base, as well as import industries, may then be examined from the standpoint of location theory as to their optimum growth potential. If future growth of the export base can be predicted, these predictions may be used in a multiplier analysis to evaluate total economic growth in the region.

Under competitive conditions, high growth potential industries are those located optimally with respect to raw materials and markets, and which use the best technology to produce volumes that nearly exhaust known economies of size. In general it is far easier to develop existing export industries, because of existing skills, physical capital, and locational advantages, but input-output models may help in outlining the magnitude of development possibilities in industries which are major importers into the region's economy. In relatively large regions one must examine very closely the competitive conditions of regional import industries before investing in their growth. Substantial growth in these industries under relatively stable market demands would doubtless mean important relocations of firms within the industry. Probably the most important industry redistributions in recent years have occurred in the textile and apparel industries. The rationale (tax advantages and low cost labor in the South) for these changes fits well into the comparative cost scheme of location theory. Comparative cost studies should be extremely favorable if investments

are to be made in a region's import industry that would affect locational structure of the industry. While investment in export industry serves to strengthen its locational and competitive advantage, investments in an import industry usually compete with similar investments at more competitive locations.

Estimating the Import-Export Flows

The United States is one of the largest free trade or common markets in the world and to describe the import-export balance of a sub-region of this market is difficult to say the least. Typically, data on trade among regions are scant and in many instances nonexistent. The most straight forward approach requires costly surveys to determine both the consumption and production mix of imported and locally-produced goods. In addition to costs of defining the economic base, if the data are used in an input-output analysis it is not unusual for the additional study to require several years of costly work.

As an example and as a pilot study in short-cutting costs, the author has attempted to assess the import-export position of agriculture in the Alabama economy by updating a 1954 interregional input-output model by Carter and Heady (1). Their model contained 9 agricultural producing industries, 7 agricultural processing industries, 5 agricultural furnishing industries, and 1 sector containing all other industries. Carter and Heady estimated flows among industries in 10 regions of the United States which coincided with 10 types of farming regions used by the Agricultural Research Service, United States Department of Agriculture. Region 5 of the study consisted of Alabama, Georgia, South Carolina, and Florida. Two principal types of information were given in a table of transactions for each region: (1) columns of the table contained the various inputs for each industry; (2) rows of the table showed the values of each industry's output as it was distributed among all other industries (intermediate demand) and the distribution of outputs to final demand, principally household consumption.

Values of total output and import-export flows of the Alabama economy were not, of course, available in the Carter and Heady study. Total output from Alabama agriculture is reported regularly, but outputs from other industry sectors were estimated from the 1958 census of manufacturers in Alabama. The estimated value of outputs was used as a starting point in this paper to estimate input-output coefficients of the various industries. The

22-sector model by Carter and Heady was used to describe the Alabama economy on the assumption that the production, distribution, and consumption estimates of Region 5 were representative of Alabama conditions. As an example, if 5 per cent of total livestock output in Region 5 was represented by internal sales to the livestock industry, then 5 per cent of Alabama livestock sales was assumed to be made to the livestock industry. Because of the double entry nature of the transactions table, an internal sale in an industry is the same as the internal purchase of an input in the same industry. Given the value of one purchased input for the industry, value of the industry's other inputs were then estimated using the Carter and Heady coefficients. Production inputs for each Alabama industry were estimated in this manner. Consumption relationships were also assumed to exist in Alabama as existed in Region 5.

These estimates were used in an input-output analysis and the results are summarized briefly in Table 1.

Implications of the Flows

Table 1 represents a gross summary of the input-output analysis and does not reveal all of the industry estimates that were made of net imports and exports. In agriculture, quantitative estimates were as follows: (1) 74 million dollars net exports of livestock; (2) 16 million dollars net imports of feed grain; (3) 63 million dollars net imports of fresh and processed fruits and vegetables; (4) 43 million dollars net exports of cotton; (5) 2½ million dollars net imports of tobacco; (6) 12 million dollars net exports of oil crops. Some other important flows were: (1) 79 million dollars net imports of meat products; (2) 36 million dollars net exports of prepared feeds; (3) 17 million dollars net imports of fertilizers; (4) 59 million dollars net imports of chemical products; and (5) 278 million dollars net exports of textile products.

Some of the most interesting estimates from the standpoint of agriculture were the livestock exports, meat product imports, feed grain imports, and prepared feed exports. At first glance it appears grossly inefficient to export a raw material (livestock) and bring it back as processed meat. Equally perplexing is the reverse process of bringing in a raw material (feed grain) and shipping it out in processed feed. A thorough interregional analysis is needed at this point, but one hypothesis is that feed grains are the key to the entire complex. This hypothesis is that feed grain (corn) may be barged down the Mississippi and up the Ten-

Table 1. The Flow of Trade in Alabama, 1958 (Thousands of Dollars^a).

PURCHASING INDUSTRY

Producing industry	Agri-culture (1)	Agri-cultural processing (2)	Agri-cultural furnishing (3)	All others (4)	Final demand government (5)	Final demand household (6)	Inter-mediate demand (7)	Total demand (8)	Total output (9)	Net flow of funds (10)
Agriculture	168,586	288,548	35,649	1,998		64,409	494,781	559,190	680,340	121,150
Agricultural processing	224	124,722	41,010	151,706	18,232	711,521	317,662	1,047,415	928,803	-118,612
Agricultural furnishing	147,761	52,045	365,009	184,252	36,383	453,900	749,067	1,239,350	1,221,575	-17,775
All others	77,645	83,507	475,873	1,778,092	496,189	2,891,588	2,415,117	5,802,894	5,042,150	-760,744
Government	14,924	60,622	67,883	444,523	72,769	688,653	587,952	1,349,374	1,314,844	-34,530
Household	234,488	298,283	467,691	2,489,329	706,574	34,922	3,489,791	4,231,287	3,840,300	-390,987
Total	643,628	907,727	1,453,115	5,049,900	1,330,147	4,844,993	8,054,370	14,229,510	13,028,012	-775,981 ^b

^aIn producer values.

^bThis sum does not include the Government and Household accounts.

nessee Rivers to supply the large feed processing industry located along the Tennessee, but overland transportation costs from the rivers are too high to support finished feeding in the livestock industry. Thus, we have net exports of live animals and processed feed. One other hypothesis, that meat processing cost differentials explain present flows, has recently been examined in part in a study by Rohdy (6). Rohdy states that "results of this study show that under certain conditions the Southeast can compete favorably with the Northcentral region in the slaughter of hogs even to the extent of shipping hogs in from the Northcentral for slaughter in the Southeast"(6). The principal condition of Rohdy's conclusion was that the Southeast must have processing costs at least \$0.75 per hundredweight pork equivalent less than non-Southeast areas. However, if there is a zero differential, his conclusions are the opposite. In that case "the deficit pork condition in the South is most economically satisfied (from the standpoint of the entire United States hog-pork industry) by slaughtering hogs produced in the Northcentral region in the Ohio River Valley and then shipping the pork on to the Southeast"(6).

Both of the foregoing hypotheses appear to have relevance to current speculations about the possible effects of lower transportation costs on feed grains. Southern Railway's "Big John" aluminum boxcar is a genuine technological breakthrough that cost the railway more than 12 million dollars. These cars can haul a minimum payload of 90 tons or about twice that of a conventional boxcar, and as a result the railway has asked for rate decreases of as much as 60 per cent below present rates. If these rates are effected; if feed grain is a principal key to reducing livestock exports; and if the Southeast enjoys a competitive advantage in processing as indicated by Rohdy, then the future does indeed look good for the livestock industry in Alabama. However, several important questions must be answered. Will the expected reduction in feed prices be enough to support expansion of the livestock industry? What are the effects of markets, locations of meat processing, and meat processing costs on the location of livestock feeding? Rohdy's study for hogs indicates that if the Southeast loses its supply of low-cost labor for processing then from the standpoint of the entire hog-pork industry it is feasible to import processed pork, and one might add, it may be more feasible to ship processed pork into the State than to ship corn.

Fruit and vegetable flows provide other development possibilities. Here we encounter similar problems of economic effi-

ciency as exist in the livestock sector, although there are no particular technological breakthroughs to encounter. As an import industry, vegetables are of particular interest because of the large deficit in production with respect to consumption. Since processing for fresh market is relatively simple, this provides some hope that vegetable production in Alabama can be increased without significant relocation of firms that handle fresh produce. Interregional competition in farm production appears to be the most important problem. Processing for the canned and frozen market requires a higher level of technology and this disadvantage must be balanced against the advantages of market location. Again, the competitive position of farm production must also be evaluated before anything can be said about development potentials in this activity.

There are probably other implications that may be drawn from the data in Table 1. So far, only the elementary structural elements of the table have been discussed. The so-called "interdependence coefficients" must be computed in order to fully utilize the descriptive and predictive ability of input-output analysis, and to obtain these the data may be incorporated into a 22-equation model¹. Much work remains to be done in determining the kinds of regional trade data that are needed and how these data may be interpreted as aids in decision-making to those who are interested in area development.

1. Coefficients of the model are available on request.

LITERATURE CITED

- (1) CARTER, HAROLD O. and HEADY, EARL O. An Input-Output Analysis Emphasizing Regional and Commodity Sectors of Agriculture. Agricultural and Home Economics Experiment Station Bul. 469. Iowa State University of Science and Technology. 1959.
- (2) DORFMAN, R., SAMMUELSON, P and SOLOW, R. Linear Programming and Economic Analysis. McGraw-Hill Book Company. New York. Chapters 9 and 10. 1958.
- (3) FISHER, W. O. Criteria for Aggregation in Input-Output Analysis Review of Economics and Statistics. 40:3. pp. 250-260. 1958.
- (4) LEONTIEF, W. Quantitative Input-Output Relations in the Economic System of the United States. Review of Economics and Statistics. 18:3. pp. 105-125. 1936.
- (5) MEYER, JOHN R. Regional Economics: A Survey. The American Economic Review. 53. pp. 19-54. 1963.
- (6) ROHDY, DONALD DAVID. Interregional Competitive Position of the Hog-Pork Industry in Southeast United States. Unpublished Ph.D. thesis. Department of Economics and Sociology. Iowa State University of Science and Technology. 1963.

The Archives and the Study of Early Indian-European Contacts

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The study of the prehistoric inhabitants of the southeastern United States is a subject for archaeologists, whose scientific conjecture has been reduced through increasingly perfected methods to what must be considered remarkable accuracy. Legends transmitted from generation to generation out of the obscure past also provide a source of information concerning the American aborigines. There is yet another source at least for studying the last stages of their cultural development independent of alien influences, and that is the accounts of European explorers who gave to the American Indians their first recorded history. Since the superimposition of foreign systems do not immediately obliterate all native characteristics, the study of the historical Indians should be an aid in prehistoric considerations as well as a worthwhile subject in itself.

It is the accounts by Europeans of their contacts with the American Indians primarily in the geographical area which is Alabama with which this paper is concerned. Although the Indians retained many of their ancient customs up to the time of their removal from Alabama in 1837, and even longer, attention is turned only to the two and a half centuries prior to the Peace of Paris which gave the United States dominion over most of what is now Alabama. As the territory passed from Spain to France and from France to Great Britain, each country's officials and adventurers viewed the natives almost *de novo*, so that in a certain sense William Bartram's contacts with the Alabama Indians were as original as that of the Gentleman of Elvas.

Contemporary printed accounts have long been at the command of such scholars as John R. Swanton and have been carefully gleaned for studies such as *Early History of the Creek Indians and Their Neighbors*, *Indian Tribes of the Lower Mississippi Valley*, *Indians of the Southeastern United States* (Bureau of American Ethnology Bulletins 43, 73, 137) and Swanton's contribution to the 42nd Annual Report of the Bureau of American Ethnology. They were also used by historians such as Albert J. Pickett. To these early printed sources students of the Old Southwest such as Peter J. Hamilton, author of *Colonial Mobile*, Verner W. Crane whose book, *The South-*

ern Frontier, has been reissued in paperback, the eminent colonial historian, John Richard Alden, and most recently, Daniel H. Thomas, have added a second dimension, the great quantities of manuscript material stored in foreign archives in France, England, and Spain.

However thorough research in these sources may have been, neither the books nor the manuscripts should be relegated to the dusty shelves and flies of libraries and archives as if they had been used up. Particularly is this true now that through their accumulation in the Archives and the larger libraries located over the state and through reprints and transcriptions these sources for research are more available than ever. Continuing study with new information and fresh approaches may very well be productive of new insights into the culture of the American Indians.

The earliest of these accounts are those related by three of DeSoto's expedition: Ranjel, Biedma and the Hidalgo of Elvas. A fourth account dictated by a member of the expedition to Garcilaso de la Vega some thirty years after the fact is perhaps less valuable. All four are available in English, that of the Hidalgo having been translated as early as 1609 for Richard Hakluyt.

The attempt of Tristan de Luna to establish a Spanish colony on the Gulf Coast provided the next observations on the vicinity. *The Luna Papers*, translated and edited by Herbert Ingram Priestly for the Florida State Historical Society, is an easily obtainable source for the student. It is also an example of the fact that one piece scholarly work does not preclude further investigation, for the pamphlet, *The First Colony*, by James Yancey Brame, written in 1960, contending that Ochuse was located at Montrose rather than Pensacola, includes the following interesting quotation of a letter from Prof. Priestly to Mr. Brame:

You gentlemen who go over the route with documents in mind and the scenery before you can, much better than one who never saw the country, make decisions about localities.

The observations of travelers and sometime residents in the new world supplement the official reports and correspondence which also devote much attention to the Indians, but as colonial officials were more concerned with colonial administration, this voluminous source is not quantitatively so rich as might otherwise be expected. The first and most extensive treatment on the part of colonial officials is that pertaining to the French domination of the Gulf Coast.

Pierre Margry, responding on the eastern side of the Atlantic to the interest of Francis Parkman, published a multi-volume work

entitled *Decouvertes et Etablissements des Francais dans l'ouest et dans le Sud de l'Amerique Septentrionale*. Much of the last third of the compilation, which contains both official and unofficial manuscripts relating to Louisiana, remains encrypted in French. Few scholars interested in the area have had the time or the talent to make these volumes available in English thus creating a dependence upon secondary sources. While much translation is yet to be done, much has been made available to the uni-lingual American. Some of the reports of Le Moyne de Bienville can be found in Margry's works, and some have been translated and printed by the Mississippi Department of Archives and History in four volumes entitled *Mississippi Provincial Archives*. Of the three subtitled *French Dominion*, Volume One is primarily devoted to French-Indian relations. Unfortunately the work of publishing the provincial records was discontinued before it was half finished, but the transcripts at Jackson are available on microfilm at least at the Archives in Montgomery, at the University of Alabama, and at Auburn University. Between the Mississippi transcripts and photostats in the Library of Congress almost all of the French and English records are in the United States. Very little of the English records have been printed. One volume of the *Mississippi Provincial Archives* subtitled *English Dominion* and Edmund Atkin's report leading up to establishing of the British Indian departments (*Edmund Atkin's Report and the Plan of 1755*, Wilbur Jacobs, ed.) virtually complete the list.

Some translated French records and some English records have appeared in the *Louisiana Historical Quarterly*. The State of Georgia, a number of years ago under the editorship of Allen D. Candler, published twenty-five volumes entitled *The Colonial Records of Georgia*, and the State of South Carolina is currently issuing a similar set, two of the three volumes on Indian affairs having been issued to date.

First among the so-called histories of the French period is that of Andre Penicaut. Not only did it merit inclusion in Margry's *Decouvertes* but was translated for B. F. French's *Historical Collections* of Louisiana. Penicaut has had the further good fortune of attracting the attention of Prof. Richbourg G. McWilliams at whose hands his *Relation* has received a thoroughly creditable translation, editing, and publication under the somewhat whimsical title *Fleur de Lis and Calumet*.

Two other noteworthy translations in French's *Historical Collec-*

tions are Bernard Le Harpe's *Journal Historique de l'établissement des Français a la Louisiane* and Lt. Dumont de Montigny's *Memories historique sur la Louisiane*. With some overlapping La Harpe and Dumont recount the history of Louisiana from 1698 to 1737. Complementing them is Antoine Le Page du Pratz's *Histoire de la Louisiane* which the author himself translated into English. The scarcity of the English edition resulted in a new translation in 1937.

Jean Bernard Bossu, a military intriguer, made a trip up the Alabama River to Fort Toulouse in 1759. His *Nouveaux Voyages*, giving an account of what he observed during ten years in the new world, went through two publications in the late 1760's and was translated into English in 1771. The scarcity of this English edition was remedied in 1962 by the University of Oklahoma which issued a translation by Seymour Feiler under the title *Bossu's Travels*.

The English period is dominated by two works: William Bartram's *Travels through North & South Carolina, Georgia, East & West Florida*, and James Adair's *History of the American Indians*. In spite of Adair's conviction that the Indians came from the lost tribes of Israel, many years spent among them makes his book uniquely authoritative among contemporary sources.

Under the auspices of the Colonial Dames, Newton Mereness compiled from photostats in the Library of Congress an interesting volume entitled *Travels in the American Colonies*. With unusual impartiality, Mereness included four accounts of importance to Alabama: "Journal of Diron d'Artaguiette, Inspector General of Louisiana, 1722-1723", "Journal of Captain Tobias Fitch's Mission from Charleston to the Creeks, 1726", "Journal of Beauchamp's Journey from Mobile to the Choctaws, 1746", and "David Taitt's Journal of a Journey through the Creek Country, 1772".

While it has not been the intention of this paper to present a complete bibliography of published and unpublished works shedding light on Indian-European contacts in the area that is now Alabama and incidentally its adjoining states, it is to be hoped that interest will increase in the original source material with a possible dual result: that more material heretofore unavailable because it has not been translated or published will be placed at the disposal of students of the historic Indian period, and that less dependence on the accepted authorities will broaden the general area of knowledge of this early period in American history.

Major Postwar Developments in the Municipal Bond Market

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The market for municipal bonds has undergone some major changes in the post World War II period. The rise in incomes and the standard of living since World War II has led to a tremendous increase in the demand for social goods and services (1). State and local government expenditures to finance these increased requirements have exceeded revenues and the debts of the American states and local governments have increased 448 per cent since World War II (2).

The municipal bond market has undergone some important and significant changes in the process of absorbing the great quantities of bonds placed on the market during this period. These adaptations and changes in the market are examined in this paper.

CHANGES IN OWNERSHIP OF MUNICIPAL BONDS

Holdings of municipal obligations by the various investor groups have fluctuated during the postwar period. As one group liquidated its holdings another group increased its portfolio. Changes in the tax liabilities and the stability of stock market prices have been the factors influencing the municipal holdings of the various investor groups. A discussion of each of these investor groups follows.

Individuals

Municipal bonds have long been favorite investments of individuals in the high income brackets, because interest paid on them is exempt from federal income taxes and generally is free of taxation by the state of issue (3). Individuals are the most important owners of municipal bonds. The holdings of individuals in municipal securities have fluctuated considerably. At the end of the 1940's individuals held approximately 60 per cent of the privately owned municipal obligations. This ration gradually declined during the mid-1950's, but increased again near the end of the decade, because of the high price level of the stock market during this period. Individual owners reasoned that if the stock market should decline, the bond market would go up. Anticipating such developments individuals changed from the stock market into long term tax-exempts (4). Individuals currently own approximately \$32 billion of municipal bonds, or about one-third of those outstanding (2).

Commercial Banks

Commercial banks are the second most important group of investors in municipal securities. They are by far the most important of the institutional investors. Purchases of municipal bonds by banks have fluctuated just as have those of individual purchasers. Banks have tended to dominate the municipal securities market during periods of easy money. They have withdrawn from the market as money tightened. Thus bank participation in the market for municipal securities appears to be especially sensitive to monetary policy (5).

Commercial banks are attracted to municipal securities because of the tax exemption provisions of these securities and the availability of securities with short maturity dates. Few financial institutions are more exposed to tax pressures than commercial banks. Commercial banks are denied by law and tradition the investment outlets used by some other investors to minimize their tax liabilities. Before the removal in 1941 of the tax exemption provisions on federal bonds, banks held large quantities of these treasury securities. With the removal of the tax exemption provisions from treasury obligations, banks changed to municipal bonds which retained their exemption status (6).

The fact that banks are allowed to underwrite and deal in municipal general obligations also accounts for some bank purchases of these securities. The Banking Act of 1933 prohibits banks that are members of the Federal Reserve System from underwriting or dealing in corporate securities. But municipal securities based on the full faith and credit are not affected by this prohibition (7).

Commercial bank holdings of municipal bonds hit their peak in early 1952 when they accounted for over 35 per cent of all private holdings (8). Since the time commercial banks have added to their holdings but total sales have increased more rapidly than commercial bank purchases causing the proportion they held to decline to approximately 33 per cent (2).

Insurance Companies

While there is a significant difference between the investment policies of fire and casualty insurance companies and life insurance companies the two are considered together here. The difference in the investment policies of the two institutions stem from the difference in their tax status. Fire and casualty insurance companies, unlike life insurance companies, are subject to the full corporate tax rate. Life insurance companies, on the other hand, have always enjoyed special tax treatment, which has tended to minimize for

them the attractions of the tax exemption status of municipal securities. Each life insurance company is taxed according to a special formula. Thus each company must consider separately the attractiveness of municipal bonds. Some life insurance companies, because they pay little in federal taxes find municipal bonds unattractive, whereas other life insurance companies with differing effective tax rates find municipal bonds attractive to varying degrees (9).

Life insurance companies purchased few municipal securities during the early part of the postwar decade. However, their demand for municipal securities increased late in the postwar decade when yields on some of the new revenue obligations became more attractive to them. In 1959 a change in the tax law greatly increased the tax load for most life insurance companies, thus making the purchase of tax-exempt municipal bonds much more advantageous (10).

Prior to 1948 fire and casualty insurance companies accounted for only a small proportion of total municipal securities. Since 1948, however, fire and casualty insurance company ownership of tax-exempts has become significant, and a large proportion of their new funds have been channeled into the purchase of municipal securities. One explanation for recent fire and casualty insurance companies' increased interest in municipal securities is the fact that these securities can now serve as liquidity reserves against underwriting risks (11).

As the decade of the 1950's progressed both fire and casualty insurance companies and life insurance companies became more active participants in the market for state and local securities (12). Insurance companies currently own approximately \$15 billion, or about 16 per cent, of the total state and local securities outstanding (2).

State and Local Governments

State and local governments invest in municipal securities, primarily their own. Special funds controlled by the states and local governments are used to purchase most of these securities. Obviously, the participation in the market by these instrumentalities is not occasioned by the tax exemption privilege associated with municipal bonds because these governmental agencies are exempt from all taxes. State and local governments invest in their own bonds primarily for two reasons. First, the issuing units want to maintain a secondary market for their outstanding securities; these purchases help to do this. Secondly, the laws governing investment of state

and local governmental pension and retirement funds often require investment in state and local securities (13).

Participation of the state and local governments in the market for municipal securities is becoming more significant. State and local governments are currently fourth, when ranked in order of ownership of municipal bonds. They own approximately \$7.2 billion of these bonds, or 9 per cent of all municipal securities outstanding (14).

CHANGES IN THE TYPES OF BONDS MARKETED

A steady increase in the proportion of revenue-type bonds available in the market has been fully as significant as the changes in the ownership of tax-exempt securities. One must look to the states and local units for the reasons for this increase in nonguaranteed indebtedness. The reasons are very involved. Many state and local governments are reaching their constitutional debt limits and voters are often reluctant to approve large bond issues to finance expensive projects. State and local governments are thus avoiding both their voters and their debt limits by creating separate authorities, which finance these projects by issuing revenue type bonds that are not subject to the constitutional debt limits and do not require public approval.

The true revenue bond is repaid from income generated by the project it finances. Another, more controversial, type is repaid indirectly from taxes. An authority may, for instance, build an office building and rent it to a governmental agency. Funds to pay the rent are derived from the governmental agency's tax collections. The rent produces the revenue to service and pay for the bonds. This last type of bond has been modified in so many ways that it has become extremely difficult to classify many issues under the familiar heading of revenue bonds. Governmental units are issuing more and more of these controversial obligations and the market is absorbing them readily.

The most controversial of all of these modified revenue bonds are the industrial aid bonds. These bonds are sold by local development authorities to finance commercial plant construction. The bonds are secured by a long-term lease of the plant by a commercial corporation, which obligates itself to rental payments adequate to pay the interest and principal. The Investment Bankers Association, The American Bar Association and the Association of Municipal Finance Officers have warned against the use of government securities to finance private plants. The American Bankers Association fears that industrial aid bonds threaten the tax-exempt position of

all municipal bonds. It also fears that abuses may lead the Securities and Exchange Commission to decide on regulations not only for industrial aid bonds but eventually for all municipal bonds.

These warnings notwithstanding, the volume of industrial revenue bonds continues to increase as communities find them an apparently successful means of attracting new industry. In 1950, nine states permitted industrial aid bonds. Today they already have been sold by local units in 15 states and are authorized in 11 additional states (15).

APPLICATION OF THE MUTUAL FUND TECHNIQUE TO MUNICIPAL BONDS

Another postwar development in the municipal bond market, and one probably destined for greater future significance, is the application of the mutual fund technique to the selling of state and local securities. The Nuveen Tax-Exempt Bond Fund offers a diversified investment in interest-bearing bonds of states, counties, governmental authorities and municipalities of the United States. Nuveen advertises that income from this fund is exempt from federal income taxes. The promoters of this technique hope to attract investors interested in the familiar advantages offered by a mutual fund with the added attraction that interest income will be exempt from federal taxation. This idea appears to have considerable appeal to high income investors desiring to minimize tax liabilities (16).

CHANGES IN THE DENOMINATION OF BONDS ISSUED

Another change of lesser importance has been the willingness of the market to accept state and local bonds in greater denominations than the traditional \$1000 bond. Beginning in 1962 state and local units issued bonds in \$5000 denominations. The Federal Reserve Bank of New York and some of the more prominent investment houses are actively supporting the state and local units in this break with tradition. Finance Officers of the various state and local units issuing the larger denominations have indicated that considerable savings in the cost of printing, signing and handling the bonds are realized.

Savings resulting from the use of larger denomination bonds have been estimated by state and local issuing authorities to be as much as 30 per cent of the cost of issue on sales exceeding \$10 million (17). Considerable savings should also be realized on the investor side of the market as a result of the use of the large denominations.

Summary

Important changes in ownership of municipal securities have

occurred in the postwar period. Individuals are still the most important purchasers of municipal bonds. The proportion owned by individuals, however, has declined during the postwar period. Commercial banks are the second most important owners of municipal securities and the proportion owned by commercial banks has increased during the post war period. Insurance companies have also increased their holding of municipal securities during this period.

Important changes in the types of bonds issued have also occurred during the postwar period. There has been a steady increase in revenue-type bonds issued and marketed. Many issues of revenue bonds have been of a controversial type, serviced indirectly from taxes. The most controversial of all of these modified revenue bonds are the industrial aid bonds used by communities to attract new industry.

Another postwar development has been the application of the mutual fund technique to the municipal bond market, and finally municipal bonds have been issued in denominations greater than the traditional \$1000 denomination.

LITERATURE CITED

- (1) McCONNELL, CAMPBELL R. Social Imbalance: Where Do We Stand? Quarterly Review of Economics and Business. pp. 7-23. May, 1961.
- (2) The Wall Street Journal. Controversy Rises as State Authorities Issue "Revenue" Bonds Outside Debt Limits. p. 1. February 18, 1961.
- (3) ROBINSON, ROLAND I. Postwar Market for State and Local Government Securities. Princeton University Press, Princeton. p. 22. 1960.
- (4) GRUEND, WILLIAM C. and LEE, MURRAY G. Investment Fundamentals. The American Bankers Association, New York. p. 70. 1960. Robinson, *op. cit.*, pp. 70-81.
- (5) ROBINSON, *op. cit.*, pp. 81-88.
- (6) *Ibid.*, p. 84.
- (7) *Ibid.*, p. 86.
- (8) O'DONNELL, JOHN. Some Postwar Trends in Municipal Bond Financing. Journal of Finance. XVII. p. 267. May, 1962.
- (9) TATE, JAMES A. What Factors Determine Life Insurance Company Purchases of Municipal Bonds. The Daily Bond Buyer. Special Conference Issue No. 1. p. 17. May 22, 1961.
- (10) ROBINSON, *op. cit.*, p. 93.
- (11) *Ibid.*, pp. 89-95.
- (12) O'DONNELL, *op. cit.*, p. 264.
- (13) ROBINSON. *op. cit.*, p. 96.
- (14) Moody's Municipal and Government Manual. Moody's Investors Service, New York. p. 16a. 1963.
- (15) Business Week. pp. 45-49. December 14, 1963.
- (16) O'DONNELL. *op. cit.*, p. 268.
- (17) DAVIS, FELIX T. Bond Denominations—\$5000 Units Now Common-place. The Daily Bond Buyer. Municipal Finance Officers Association—Special Conference Issue No. 1. p. 25. May 28, 1962.

ABSTRACTS

Medical Sciences

Histological Differences in Ligaments of the Longitudinal Arch in Individuals of Different Ages

Jan Eagles

University of Alabama Medical Center

The ligaments of the longitudinal arch of the human foot were examined histologically in order to describe differences in the components at various ages. The specimens were dissected from the amputated lower extremities of ten adults and one newborn infant. The infant ligaments differ from those of the adult both in the type of components present and in the arrangement of components. This is thought to be due to the fact that the infant ligaments have not yet assumed a functional role in the maintenance of the arch. No elastic fibers are found in the ligaments of the infant and very few in those of the young adult; those of the middle-aged and old adults exhibit quite a large number of elastic fibers. These fibers are arranged in networks and in many areas are curled, clumped, and fragmented. Possible explanations for the increase in elastic fibers with age are that they are the result of prolonged tensions from various directions, or they represent an attempt by the ligaments to compensate for the deterioration of the aging collagen in the ligaments of older subjects. There are also mineralized areas, and, in the oldest ligaments, large deposits of calcium are present throughout the structures. These changes in the collagen are thought to be responsible to some extent for the loss of resiliency in ligaments of old individuals and may possibly be a contributing factor to the fall of the arch.

A Cyto-architectural Study of the Amygdaloid Complex in the *Didelphis marsupialis*

Virginia Sparks Volker

University of Alabama Medical Center

The area of the amygdaloid complex in the opossum is located on the ventro-medial surface of the telencephalon, separated rostrally from the *tuberculum olfactorium* by the posterior arc of the

fissure rhinalis arcuatus. The *fissure amygdaloidea* delimits it from the *area piriformis medialis*. The *fissure rhinalis ventralis* separates it from the *diagonal band of Broca* while more caudally the *fissure di-telencephalica* separates the amygdaloid area from the *tuber cinerum*. At the most caudo-medial angle of the area the *gyrus dentatus* may be seen. At times the *fissure amygdaloidea medialis* marks the separation from the *area piriformis posterior*.

Two eminences may be recognized in the amygdaloid area. The smaller, most rostral eminence is that formed by the *nucleus of the tractus olfactorius lateralis*. The fibers of the *tractus olfactorius lateralis* are seen converging on this eminence from a lateral aspect, medial to the *fissure amygdaloidea*. The remaining caudal eminence is that formed by the *nucleus amygdalae corticalis*.

The amygdaloid complex can be divided into two major groups of nuclei with intercalated cell masses occurring in part between these two divisions. The phylogenetically more primitive cortico-medial group includes the *nuc. amyg. corticalis*, *nu. amyg. medialis*, *nuc. amyg. centralis*, and *nuc. of tr. olf. lateralis*. The later appearing basolateral group contains the *nuc. amyg. basalis*, *nuc. amyg. access. basalis*, and *nuc. amyg. lateralis*.

The amygdaloid nuclei receive fibers mainly from the *tr. olf. lateralis*; however, their relation to the external capsule provides possibilities for direct connections with the piriform cortex as well as with the neo-cortex.

The major discharge path of the amygdaloid nuclei is considered to be the *stria terminalis*. The components of the stria interconnect the nuclei with the preoptic, hypothalamic, and epithalamic regions, as well as providing a means of interconnection between the nuclei of the *tractus olfactorius lateralis* of the opposite sides.

Intrinsic Factor Activity in Homogenates of Sheep Stomach Mucosa

Daniel R. Farnell
Auburn University

Homogenates of mucosa from the fundic and pyloric regions of the abomasum or glandular stomach of the sheep were assayed for their intrinsic factor activity in various species. The assay method used was the everted intestinal sac technique, whereby living everted segments of intestine from a donor animal were incubated *in vitro* in a medium containing radioactive cobalt-labeled vitamin B₁₂ plus the material whose intrinsic factor activity

was to be determined. The uptake of B_{12} by the intestinal tissue was proportional to the intrinsic factor activity present. The crude sheep intrinsic factor stimulated B_{12} absorption in intestinal sacs from rabbits and guinea pigs, but was ineffective in stimulating absorption in intestinal sacs from rats or hamsters. In the only assay which was performed with sheep intestinal sacs, no enhancement of B_{12} uptake occurred with either sheep or rat gastric mucosa homogenates. This lack of response of sheep intestine to intrinsic factor of either sheep or rat origin may have been because of the presence in the intestinal wall of numerous lesions of the parasitic nematode, *Oesophagostomum*. Another possible explanation could be that the section of sheep intestine used for the assay was not from the area which normally absorbs B_{12} in response to intrinsic factor stimulation.

The Effect of Insulin on Cl^{36} Flux Across the Guinea Pig Gastric Mucosa

R. Shoemaker, B. I. Hirschowitz, and G. Sachs
University of Alabama Medical Center

It was reported from this laboratory that it was possible to obtain a functioning guinea pig gastric mucosa *in vitro* (Fed. Proc., 1964), and since we observed that insulin inhibits acid and electrolyte secretion in the intact dog, independently of hypoglycemia or vagal connections, we conducted a preliminary investigation of the action of insulin on Cl^{36} flux and electrical parameters in the *in vitro* guinea pig gastric mucosa.

It was found that with a dose of 0.50 units/ml crystalline insulin, acid secretion fell from 8 μ Eq/hr/cm² to 3 μ Eq/hr/cm² and Cl^{36} flux decreased (nutrient to secretory) 15 to 5.5 μ Eq/hr/cm² and (secretory to nutrient) 8.8 to 6.3 μ Eq/hr/cm² i.e. net N-S flux of Cl was markedly depressed. The potential difference (PD) decreased, resistance increased and the short circuit current (I_{sc}) decreased within twenty minutes after administering insulin.

Under similar conditions no effect was observed on the isolated frog mucosa. It is concluded that insulin has a direct inhibitory action on the gastric mucosa affecting secretion of acid, PD, I_{sc}, and Cl flux. This work was supported by USPHS Grants T1 AM 5286 and CA 04980

Science Education

New Trends in the Biology Curriculum

David J. Cotter

Alabama College

A survey of the college catalogues for the current biology course offerings of the twelve undergraduate colleges in Alabama revealed 33 courses. The average department consisted of four instructors offering 19 courses per year for an average load of five courses per instructor per year. The standard curriculum is very conservative although the course content may be very modern.

Some of the other new approaches in biology were discussed:

1. Honors program in biology and the possibility of the participation of the entire staff.
2. Undergraduate research grants.
3. Use of matching funds for the expansion of departmental offerings.
4. In-Service and Summer Institutes.
5. Institutes for teaching outstanding high school students.
6. Institutes for research for outstanding high school students.
7. Atomic Energy Commission Programs:
 - a. mobile radiation laboratory.
 - b. courses for teachers and research for students during the summer.
 - c. equipment grants.
8. Biological Stations.
9. Series of Visiting Lectures.

PROGRAM

FORTY-FIRST

ANNUAL MEETING

of the

A l a b a m a A c a d e m y

of

S c i e n c e

With The

GORGAS SCHOLARSHIP FOUNDATION

And The

ALABAMA JUNIOR ACADEMY OF SCIENCE

APRIL 2-4, 1964

AUBURN UNIVERSITY

AUBURN, ALABAMA

ALABAMA ACADEMY OF SCIENCE**THURSDAY, APRIL 2**

- 6:00 P.M.—Executive Committee Dinner Heart of Auburn Motel
 7:30 P.M.—Executive Committee Meeting (open) ... Heart of Auburn Motel

FRIDAY, APRIL 3

- 8:00 A.M.—Registration Commons Building
 9:00 A.M.—12:00 Noon—Section Meetings Commons Building
 I. Biological Sciences Room 307
 II. Chemistry Room 254
 III. Geology and Anthropology, Geology Session Room 248
 Anthropology Session Room 246
 IV. Forestry, Geography and Conservation Room 252
 V. Physics and Mathematics Room 213
 VI. Industry and Economics Room 217
 VIII. Social Sciences Room 222
 X. Engineering Room 256

1:30 p.m.—Joint General Session and Business Session, AAS and
 AJAS Room 307

- 2:30 P.M.—Section Meetings Commons Building
 I. Biological Sciences Room 307
 II. Chemistry Room 254
 III. Geology and Anthropology, Geology Session Room 248
 Anthropology Session Room 246
 IV. Forestry, Geography and Conservation Room 252
 V. Physics and Mathematics Room 213
 VI. Industry and Economics Room 217
 VII. Science Education Room 256
 VIII. Social Sciences Room 222
 IX. Medical Sciences Room 250

4:00-5:30 P.M.—Junior Academy of Science Exhibits open to the public
 Main Floor, Funchess Hall

7:00 P.M.—Joint Banquet of Junior and Senior Academies
 Auburn Union Ballroom

Host: E. H. Sargent and Company

SATURDAY, APRIL 4

8:00 A.M.—12:00 Noon—Exhibits of Alabama Junior Academy of Science
 open to Academy members Main Floor, Funchess Hall

- 8:00 A.M.—Section Meetings Commons Building
 I. Biological Sciences Room 307
 II. Chemistry Room 254
 VIII. Social Sciences Room 222

10:30 A.M.—General Session with Alabama Junior Academy of Science
 Room 307

—Presentation of New A.J.A.S. Officers

—Presentation of A.A.A.S. Awards

—Presentation of Award to Outstanding A.J.A.S. Region

- Presentation of Undergraduate and Graduate Research Awards
- Introduction of A.A.S. Officers, 1964-1965
- Address: Dr. H. A. Borthwick, Chief Plant Physiologist, United States Department of Agriculture. Topic: "Control of Plant Development by Light."

12:00 Noon—Adjourn

EXHIBITS

- Regional Science Fair winners Main Floor, Funchess Hall
- A.J.A.S. Clubs Main Floor, Funchess Hall
- General Gorgas Scholarships Exhibits Room 208, Funchess Hall

GORGAS SCHOLARSHIP FOUNDATION

THURSDAY, APRIL 2

- 3:00-5:00 P.M.—Registration Main Floor, Funchess Hall
- 5:00 P.M.—Demonstration of Exhibits to Judges 208 Funchess Hall
- 6:30 P.M.—Banquet for Gorgas Finalists and Judges
Banquet Room, Auburn Union
- 8:00 P.M.—Personal interviews of Finalists by Judges
Main Floor, Funchess Hall

ALABAMA JUNIOR ACADEMY OF SCIENCE

FRIDAY, APRIL 3

- 8:00 A.M.-12:00 Noon—Registration Funchess Hall
- 8:00 A.M.-10:00 A.M.—Preparation of Exhibits Funchess Hall
- 10:00 A.M.—Caucus of officers and official delegates 243 Funchess Hall
- Conference of sponsors and counselors 247 Funchess Hall
- 10:45 A.M.—Business Meeting 243 Funchess Hall
- 12:00 Noon—Luncheon for AJAS Executive Committee Union Building
- 12:30 P.M.—Meeting of AJAS Executive Committee Union Building
- 1:30 P.M.—Joint General Session and Business Session, AAS and AJAS
Room 307, Commons Building
- 2:30 P.M.—Section Meetings of the Alabama Academy of Science. (Junior Academy members are encouraged to attend one of these meetings.)
—Tours provided by the Alpha Phi Omega Fraternity of the University.
- 3:00 P.M.—Judging of Exhibits Funchess Hall
- 7:00 P.M.—Joint banquet Union Ballroom
- 8:30-11:00 P.M.—Junior Academy Party—Dance and Hootenanny
Union Ballroom

SATURDAY, APRIL 4

- 8:00 A.M.-12:00 Noon—Exhibits on Display Funchess Hall
- 8:00 A.M.—General Assembly for presentation of scientific papers by AJAS Regional Finalists Duncan Hall Studio
- 9:00 A.M.—Business Meeting Duncan Hall Studio
- 10:30 A.M.—Joint Meeting with Alabama Academy of Science
Room 307
Commons Building
- 12:00 Noon—Luncheon for old and new Executive Committee, Union Building

SECTION PROGRAMS

9:00 A.M., FRIDAY, APRIL 3

SECTION I, BIOLOGICAL SCIENCES

Urban L. Diener, Vice President

1. **Blotched Leaf Gene on Chromosome 2 in Zea mays.**
E. M. Clark, Auburn University.
2. **A Reason for Eventual Failure of Antileukemic Agents Against Experimental Mouse Leukemia.**
J. Richard Thomson, Southern Research Institute.
- *3. **Distribution of Darters (Genus Etheostoma) in Mobile Basin.**
William Mike Howell, University of Alabama.
- *4. **The Evapo-transpiration of Pot Chrysanthemums.**
T. Harmon Straiton, Jr., Auburn University.
- *5. **The Effects of Adrenalectomy and Andrenergic Blockade upon the Cold-stressed White Rat.**
Margaret C. Frady, Auburn University.
6. **Preliminary Studies on the Electrophysiology of Taste in the Honey-bee.**
Mary L. Faggard, Alabama College.
8. **A Comparison of Various Methods of Delaying the Onset of Maturity**
Leland C. Clark, Jr. and Kamal S. Yackzan, University of Alabama Medical Center.
- *7. **Effect of Radiation on the Uptake of Minerals in Tomatoes. in Domestic Fowl.**
J. R. Howes and G. J. Cottier, Auburn University.
- *9. **Distribution of the Genus Percina (Family Percidae) in Mobile Basin of Alabama.**
James D. Williams, University of Alabama.
10. **Business Meeting. Report of Nominating Committee.**
11. **Further Studies on the Effect of Chloral Hydrate as an Irradiation Modifier in Escherichia coli.**
Carolyn Moncrief, Mary Lucas, and Robert F. Pittillo, Southern Research Institute.
- *12. **The Effects of Hybridization on the Histogenesis of Gonads in Hylid Treefrogs.**
A. W. Hayes, Auburn University.
13. **Studies of Radiation Effects on Plant Communities.**
David J. Cotter, Alabama College.
14. **Physiology and Pharmacology of 5-hydroxytryptamine.**
Dan Kimbrough and Kenneth Ottis, Auburn University.

* This paper is an entry for the graduate student research award.

** This paper is an entry for the undergraduate student research award.

SECTION II, CHEMISTRY

William R. Mountcastle, Jr., Vice President

11:00 A.M.—Business Meeting, Report of Nominating Committee.

SECTION III, GEOLOGY AND ANTHROPOLOGY**GEOLOGY SESSION**

Douglas E. Jones, Vice President

1. **Potassium-Argon Dating. A Progress Report.**
Morris A. Simon, III, University of Alabama.
2. **Strip Mining and Soil and Water Conservation in Alabama and Georgia.**
Earl L. Hastings, Eufaula.
3. **Reverse Drag Structures.**
Thomas A. Simpson, Alabama Geological Survey.
4. **Experimental Investigation of Uranium Uptake by Calcite.**
Robert B. Deininger, University of Alabama.
5. **Development of Bauxite on Karst Topography.**
Otis M. Clarke, Jr., Alabama Geological Survey.
6. **Coal in Alabama.**
Thomas W. Daniel, Jr., Alabama Geological Survey.
7. **Some Unsolved Problems in Alabama Geology and Geography.**
Roland M. Harper, Alabama Geological Survey.
8. **Joint Business Meeting (Geology and Anthropology).**

ANTHROPOLOGY SESSION

Paul H. Nesbitt, Vice Chairman

1. **A Construct of Projectile Point Styles Indicating a Hypothetical Cultural Development.**
David L. DeJarnette, University of Alabama.
2. **The Occurrence of Copper Projectile-point Pendants within Alabama.**
John W. Cottier, Auburn University.
3. **A Salvage Project on the Tallapoosa River Involving Exploration of an Early Middle-Mississippian Village.**
David W. Chase, Montgomery Museum of Fine Arts.
4. **The Archives and the Study of Early Indian-European Contacts.**
Milo B. Howard, Jr., Alabama Department of Archives and History.
5. **Joint Business Meeting. (Geology and Anthropology) Room 248**

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

Glendon W. Smalley, Vice President

1. **Some Characteristics of Small Woodland Owners.**
Ivan R. Martin, Auburn University.
2. **Hailstorms in Alabama.**
Arthur R. Long, U.S. Weather Bureau.
- *3. **The Bases and Applications of Cruising Timber with a Wedge Prism.**
Walter D. Kelley, Auburn University.
- *4. **Processing and Storing Pollen of Southern Pines.**
Arthur G. Hunter, Auburn University.

5. **Recent Developments in Forest Engineering.**
Heyward T. Taylor, Jr., Southern Forest Experiment Station, U.S. Forest Service.
6. **Business Meeting.**

SECTION V, PHYSICS AND MATHEMATICS

Hoyt M. Kaylor, Vice President

1. **Phase Velocity and Damping of Torsional Waves in Rubber Tubes Filled with a Viscous Fluid.**
Willem Klip and D. A. Klip, University of Alabama Medical Center.
2. **Some Battery-Powered Electric Motors of Long Ago.**
Roland M. Harper, Geological Survey of Alabama.
3. **Some Remarks About Programming a Determinant.**
Mrs. D. A. Klip, University of Alabama Medical Center.
4. **The Cambridge Conference Report on School Mathematics.**
W. L. Furman, S.J., Spring Hill College.
5. **A General and Simple Method Which Permit to Have the Velocity and Acceleration in Curvilinear Orthogonal System of Coordinates.**
Rafael M. Fiterre, Athens College.
6. **The New Recommendations for College Physics Curricula.**
Walter J. Rhein, Spring Hill College.
7. **Business Meeting.**

SECTION VI, INDUSTRY AND ECONOMICS

H. Ellsworth Steele, Vice President

1. **Major Postwar Developments in the Municipal Bond Market.**
Deward E. Benton, Auburn University.
2. **Relationship between Size of Firm and the Ability to Pay Supplemental Unemployment Benefits.**
Truly E. Kincey, Auburn University.
3. **Prosperity without Inflation.**
Wayne C. Curtis, Auburn University.
4. **The Communist Blueprint and the Fall of China.**
Boyd A. Evans, Jr. and Raymond W. Ritland, Auburn University.
5. **Business Meeting.**

10:00 A.M.

SECTION VIII, SOCIAL SCIENCES

Eleazer C. Overton, Vice President

1. **The Sociologist's Role: Paging Auguste Comte.**
Chester W. Hartwig, Auburn University.
2. **The Physiocrats and Their Contribution of the Economics of Distribution.**
Lyndon E. Dawson, Jr. University of Alabama
3. **Contemporary Southern Sentiment About the 1848-49 Liberal Revolutions in Europe.**
Sandor Szilassy, Auburn University.
4. **Some Alabama Influences on the Development of Antebellum Florida.**
Edwin L. Williams, University of Alabama.

5. **Family Problems of a Man and Wife Space Engineering Team.**
Mr. & Mrs. Phillip J. Pincha, Huntsville Arsenal.
6. **Business Meeting.**

11:00 A.M.

SECTION X, ENGINEERING

Hal W. Maynor, Vice President

1. **The Effect of Certain Variables on Fracture Appearance Transition Temperature and Critical Fracture Toughness of an Ultra High-Strength Sheet Steel.**
Hal W. Maynor, Auburn University.
2. **Business Meeting.**

2:30 P.M., FRIDAY, APRIL 3

SECTION I, BIOLOGICAL SCIENCES

Urban L. Diener, Vice President

Biologists have 2 options for this period.

Option A. A local trip for field biologists and science education teachers has been arranged. The group will gather on steps of Comer Hall with Drs. Dusi, Goslin, and Miss Blanche Dean.

Option B. Series of 4 papers followed by an optional tour of the Biological Science Facilities in Funchess Hall and Animal Science Building or joining the field trip.

1. **Inhibition of Non-proliferating Escherichia coli by Tryptophan.**
Annie Jo Narkates and Robert F. Pittillo, Southern Research Institute.
- *2. **The Effect of Gibberellic Acid on Flowering of Camellia japonica.**
Dough H. Dorough, Auburn University.
3. **Comparison of Blood Types of Passerines.**
Francis M. Bush, Howard College.
4. **A Comparison of Egg Formation and Oviposition Time in Various Species of Domesticated Birds.**
J. R. Howes, Auburn University.
5. **The Incidence of Trypanosoma cruzi (Chagas) in Wild Mammals and Insects in Eastern Alabama.**
Kirby L. Hays, Auburn University.

SECTION II, CHEMISTRY

William R. Mountcastle, Vice President

1. **Determination of the Niobate Species in Strongly Basic Solutions by Light-Scattering Techniques.**
R. W. Conrad and James E. Land, Auburn University.
- *2. **Preparation and Pyrolyses of Xanthates of cis- and trans-4-t-Butylcyclohexylcarbinol and cis- and trans-1-Methyl-4-t-butylcyclohexanol.**
Glenn Esslinger, University of Alabama.
3. **Niobium Bromo Complexes in Hydrobromic Acid Solutions.**
Margaret Jackson and James E. Land, Auburn University.

4. **The Application of Gas Chromatography to the Study of the Decomposition of 1, 3-bis (2-chloresthyl) nitrosurea in Biological Media.**
Ruby James, Southern Research Institute.
5. **The Ultra-violet Spectra of Some Quinoline Derivatives.**
Tak Jin Moon, Auburn University.
6. **Transference Numbers in Aqueous NaCl and KCl at Elevated Temperatures.**
J. E. Smith, Jr. and E. B. Dismukes, Southern Research Institute.
7. **Evaluation of Factor V Activity and Adsorption to Thrombocytes.**
B. Ravatti, Druid City Hospital, Tuscaloosa.
8. **Spirit in a Universe of Science.**
Leo B. Roberts, Alabama Department of Agriculture and Industry.

SECTION III, GEOLOGY AND ANTHROPOLOGY

GEOLOGY SESSION

Douglas E. Jones, Vice President

1. **Lunar Prospecting and Drilling.**
Reynold Q. Shotts, University of Alabama.
2. **Geochemical Prospecting in Alabama: A Progress Report.**
Robert F. Ehinger, University of Alabama.
3. **Evidence on the Origin of the Hillabee Schist in Talladega, Coosa and Chilton Counties, Alabama.**
Thomas J. Carrington and Perry Wigley, Birmingham-Southern College.
4. **Chalk Production in the East Gilbertown Field?**
Donald B. Moore, Alabama Geological Survey.
5. **Stratigraphic Studies on the Talladega Series in Talladega, Clay, Coosa, and Chilton Counties, Alabama.**
T. J. Carrington, M. J. Gainey, P. Wigley, and Henry Gary, Jr. Birmingham-Southern College.
6. **Calcareous Porcellanite Lenses in Pleistocene Sands, Mobile Alabama.**
George F. Brockman, Courtaulds North America, Mobile.
7. **Fauna of the Fartselle Sandstone at Blount Springs, Alabama.**
J. Gordon Melton, Birmingham-Southern College.
8. **Pseudomorphs after Kyanite from Turkey Heaven Mountain, Cleburne County, Alabama.**
Thornton L. Neathery, University of Alabama.

ANTHROPOLOGY SESSION

Paul H. Nesbitt, Vice Chairman

1. **A Study of Geophagy (Dirt Eating) Among Negroes in Barbour County, Alabama.**
Margaret V. Clayton, University of Alabama.
2. **A Migrant Work Camp: A Multi-Component Aggregation.**
Allyn G. Spence, University of Alabama.
3. **Pre-School Learning of Sex Roles through Clothing and Adornment.**
Mrs. Tommie Hamner, University of Alabama.
4. **The Functions of the Wedding Invitation List.**
Mrs. Shirley Edwards, University of Alabama.

5. **The Informal Organization of Funerals: The Role of the "Arranger."**
Frank Lee, University of Alabama.
6. **A Cultural Approach to Prison Administration.**
John C. Watkins, Draper Correctional Center.

SECTION IV, FORESTRY, GEOGRAPHY AND CONSERVATION

Glendon W. Smalley, Vice President

1. **Some Plant-Habitat Relationships in the Longleaf Forest of Southwestern Alabama.**
Earl J. Hodgkins, Auburn University.
2. **Relation of Weather to Forest Fire Losses in Alabama—1963.**
Charles A. Pigg, Alabama Division of Forestry.
3. **Prospects for a Southern Pine Plywood Industry in Alabama.**
D. B. Richards, Auburn University.
4. **Reforestation in North Alabama.**
John H. Hinton, Tennessee Valley Authority.

SECTION V, PHYSICS AND MATHEMATICS

Hoyt M. Kaylor, Vice President

1. **Space Travel and the Symmetry of Relativity.**
George F. Brockman, Courtaulds North America, Mobile.
2. **A Look at the New Mathematics and its Concepts.**
Ida Bell Phinney, Slocomb High School.
3. **Multiple Regression Techniques with Digital Computers in Medical Research.**
W. H. Bancroft, Jr., Veterans Administration Hospital, Birmingham.
- *4. **Study of Radioactive Decay Schemes with a 2^{14} Channel Two Dimensional Pulse Height Analyzer.**
Donald W. Peak, Auburn University.
- **5. **A Linear Gate Circuit for a Multichannel Analyzer.**
William H. Butler, Auburn University.
- *6. **Pulse Height Distributions in Cerenkov Detectors.**
Edward L. Wills, Auburn University.
- *7. **A Carbon-14 Dating Laboratory.**
James Lynn Smith, Auburn University.
8. **Preliminary Results on Radial Dependence of Current Density in a Highly Ionized Plasma with Cylindrical Symmetry.**
R. F. Askew, Auburn University.
9. **Electrical Conductivity of Plasmas in Uniform Electric Fields.**
Tsun-hsinung Kao, Auburn University.

SECTION VI, INDUSTRY AND ECONOMICS

H. Ellsworth Steele, Vice President

1. **Minimum Resource Requirements and Resource Adjustments for a \$5,000 Farm Income in the Wiregrass Area of Alabama.**
Gary C. Jones, Auburn University.
2. **Alabama's Outdoor Recreation Industry—Present Development and Future Opportunities.**
John Mack Huie, Auburn University.

3. **An Analysis of Alabama's Regional Trade Balance with Emphasis on Agriculture.**
Bill R. Miller, Auburn University.
4. **Agricultural Economics in Southern Land-Grant Institutions: Enrollment and Employment Opportunities of Graduates.**
Lowell E. Wilson, Auburn University.

SECTION VII, SCIENCE EDUCATION

Ruby Countryman, Vice President

1. **The Scientific Method as Presented in Science Textbooks as Described by Eminent Scientists.**
Ernest D. Riggsby, Troy State College.
2. **A Symposium—Introductory College Chemistry.**
Moderated by Richard Tatum, Murphy High School, Mobile.
3. **Tips on Field Trips.**
Blanche E. Dean, Editor of "Trees and Shrubs of Alabama," Birmingham.

SECTION VIII, SOCIAL SCIENCES

Charles G. Summersell, Vice Chairman

1. **Low Income Rural People and Prospects for Adjustment.**
John E. Dunkelberger, Auburn University.
2. **Some Observations on Suburbia and Municipal Financing.**
Eleazer C. Overton, Councilman, City of Birmingham.
3. **Oratory as American Cultural Document.**
Clarence Mendale, University of Alabama.
4. **What is the Impact of the Newspaper on the Social Structure?**
Vincent Townsend, Vice President, Birmingham News.
5. **What is the Impact of the Social Structure on the Operation of a Newspaper?**
John W. Bloomer, Managing Editor, Birmingham News.

SECTION IX, MEDICAL SCIENCES

Margaret S. Klapper, Vice President

1. **Intrinsic Factor Activity in Homogenates of Sheep Stomach Mucosa.**
Daniel R. Farnell, Auburn University.
2. **The Effect of Liquid Ration on Structure and Function of Salivary Glands of Rat.**
H. David Hall and Charlotte A. Schneyer, University of Alabama Medical Center.
3. **A Cyto-architectural Study of the Amygdaloid Complex in the *Didelphis marsupialis*.**
Virginia Sparks, University of Alabama Medical Center.
4. **The Effect of Insulin on Cl^{36} Flux Across the Guinea Pig Gastric Mucosa.**
R. L. Shoemaker, University of Alabama Medical Center.
- *5. **Histological Differences in Ligaments of the Longitudinal Arch in Individuals of Different Ages.**
Jan Eagles, University of Alabama Medical Center.

6. **Studies on Remineralization of Tooth Enamel.**

Frederick F. Feagin, Theodore Koulourides, Ward Pigman, University of Alabama Medical Center.

8:00 A.M., SATURDAY, APRIL 4

SECTION I, BIOLOGICAL SCIENCES

Urban L. Diener, Vice President

1. Mortality of the Little Blue Heron.
Julian L. Dusi, Auburn University.
2. Response of Six Shrub Species to Contrasting Light Regimes in Two Controlled-environment Rooms.
Donald W. Davidson, University of Alabama.
- *3. Depth Distribution of Root-Knot Nematodes in the Soil.
Ralph E. Motsinger, Auburn University.
4. A Comparison of the Drug Response of Some Experimental Animal Tumors and Certain Classes of Human Cancer.
Jack H. Moore, Southern Research Institute.
- *5. Differences in Levels of Volatile Fatty Acids in Rumen Fluid From Cows Grazing Coastal Bermudagrass and Millet.
James W. Huff, Auburn University.
6. Influence of a Strontium Replacement for Calcium on the Development of Gametophytes of *Woodsia obtusa* (Spreng.) Torr.
Abbie Lou Bryan and Joseph C. O'Kelley, University of Alabama.
7. Thermogenesis of Adrenal Hormones in the White Rat.
Ruth Lanier and Kenneth Ottis, Auburn University.
8. Growth of *Tetrahymena pyriformis* HSM in Natural Media Prepared from Algal Material Grown in Calcium or in Strontium.
Tommy E. Denton, University of Alabama.
9. Relation of *Aspergillus flavus* Invasion to Maturity of Peanuts at Harvest.
Urban L. Diener, Auburn University.

SECTION II, CHEMISTRY

William R. Mountcastle, Jr., Vice President

- 8:30 A.M.—Chemical Education—Trends in College Chemistry, Symposium, moderated by W. R. Mountcastle, Jr., Birmingham-Southern College.

SECTION VIII, SOCIAL SCIENCES

Eleazer C. Overton, Vice President

1. The Role of New Orleans in Mexican Filibustering, 1934.
Raymond Estep, Montgomery.
2. The First Muscle Shoals Project, 1783-1798.
Adrian G. Daniel, Troy State College, Troy.
3. The Knights of St. John as a Naval Power in the Mediterranean.
Bernard C. Weber, University of Alabama.
4. Four Years with the Coast Survey; A Chapter in the Life of a Nineteenth Century Naval Officer.
Robert E. Johnson, University of Alabama.

ANNUAL BUSINESS MEETING

Auburn University

April 3, 1964

The Annual Business Meeting of the Academy was called to order at 1:45 p.m. President Sensenig introduced Dr. Ralph B. Draughon, President, Auburn University. Dr. Draughon extended a cordial welcome to Academy members and guests. He spoke briefly on the importance of science and history in society to both the present and future generations.

The president called for the reading of the minutes of the 1963 Annual Business Meeting.

237. Motion by Yancey, seconded by Thomson that the minutes of the 1963 Annual Business Meeting be approved as mimeographed and mailed to the membership. Motion passed unanimously.

The President called for reports from officers.

REPORT OF THE TREASURER (THOMSON). A summary of the detailed financial report submitted to the Executive Committee follows:
SUMMARY

BALANCE, January 1, 1963 (savings and checking)	\$ 2,188.33
Receipts	<u>3,444.34</u>
Total	\$ 5,632.67
Expenditures	3,047.16
Balance, December 31, 1963	
Savings Account	1,177.04
Checking Account	<u>1,408.47</u>
Total	\$ 5,632.67
Excess of Receipts over Expenditures for period	
January 1, 1963 to December 31, 1963	397.18

* * * * *

NATIONAL SCIENCE FOUNDATION GRANT NO. GE 1602

Amount of Grant:	\$11,500.00
Received to December 31, 1963	10,103.28
Receivable in 1964	1,396.72
Expenditures	6,494.67
Balance, December 31, 1963	<u>3,608.61</u>

REPORT OF THE SECRETARY (DEVALL). Members in good standing, according to the By-laws of the Academy, have received during the year, copies of the minutes of the 1963 Business Meeting, all issues of the *Journal*, the Newsletter, and announcements of the 1964 Annual Meeting. Registration at this the Forty-First Annual Meeting of the Academy totaled 235. Sixty-four agencies, institutions and organizations were represented. Registration of members by sections was as follows:

I	Biological Sciences	57
II	Chemistry	29
III	Geology and Anthropology	33
IV	Forestry, Geography and Conservation	20
V	Physics and Mathematics	21
VI	Industry and Economics	8
VII	Science Education	26
VIII	Social Sciences	17
IX	Medical Sciences	13
X	Engineering	2
	Not identified	9
	Total	235

REPORT OF EDITOR OF THE *JOURNAL* (CHASTAIN). The current Editor and Editorial Board assumed responsibilities for the *Journal* in August, 1963. Since that time, all issues for 1962 have been released. All issues for 1963 have been completed and have been released or are ready for release. The January and April issues for 1964 are in the final stages of processing by the printer. Within the next few weeks, the *Journal* will be on schedule.

Special acknowledgement for cooperation and assistance is due the printers, The Bulletin Publishing Company of Auburn; without their cooperation and energetic efforts, our objective could not have been achieved. Acknowledgment is also due the administrators of Auburn University who provided the necessary administrative concurrence and secretarial support for the work of the Editor. All articles and abstracts have been subjected to reviewers in appropriate fields; the efficient and timely responses from these reviewers helped tremendously toward meeting our objectives. Mr. E. L. McGraw of the Auburn University Publications staff has served as an Editorial Consultant for the *Journal*.

All articles and abstracts submitted for publication are currently being reviewed by at least two people in the appropriate discipline. In addition to articles and abstracts made available at the Academy's annual meetings, members and non-members are strongly encouraged to submit other articles for *Journal* consideration. Recent changes in the general format and content of the *Journal* will make it possible in the future to publish more proceedings papers rather than abstracts, and also more contributed articles.

REPORT OF THE COORDINATOR WITH SCIENCE CLUBS AND THE DIRECTOR OF VISITING SCIENTIST PROGRAM (WHEELER). Under the Visiting Scientist Program made possible by the National Science Foundation, more than 260 visits were made to Alabama High Schools. Two petitions for financial assistance from the National Science Foundation are designed to further support the Visiting Scientist Program and to intensify it during the coming school year.

The President called for reports from Standing Committees.

NOMINATING COMMITTEE (CARR). The Nominating Committee consisting of Paul C. Bailey, R. E. Wheeler and Howard Carr, Chairman, submits the following slate of officers to serve the Academy for the ensuing year. All of these persons have been contacted and are amenable to having their names placed in nomination.

President-elect: James F. Sulzby, Jr.

Editor of the Journal: E. D. Chastain, Jr.

Associate Counselor of Junior Academy: Reuben Boozer

Coordinator with Science Clubs: R. E. Wheeler

Chairman of the Board of Trustees: R. Vance Miles, Jr.

Trustee: E. V. Smith

(Nominees for Vice Presidents and Vice-Chairmen of Sections are listed on the inside front cover.)

238. Motion by DeJarnette, seconded by Yancey that nominations be closed, that the nominees be unanimously elected to their respective offices and that any unfilled vice-chairmanship occurring during the year be filled by the vice-president and that any vice-president's position becoming vacant during the year be filled by the President of the Academy. Motion passed unanimously.

RESOLUTIONS COMMITTEE (DEJARNETTE). Your Resolutions Committee submits the following resolutions:

1. WHEREAS the Alabama Academy of Science is successfully engaged in the Forty-First Annual Meeting on the campus of Auburn University, therefore, be it resolved:

- a) That the Academy express appreciation to the officials of Auburn University and to its President, Ralph B. Draughon for their hospitality;
- b) That special appreciation be expressed to James A. Lyle, chairman of the Local Arrangements Committee for the Senior Academy, and to Donald E. Davis, chairman of the Local Arrangements Committee for the Junior Academy, and their co-workers whose untiring efforts contributed in no small way to the success of the meeting;
- c) That the gratitude of the Academy be expressed to H. F. Milling and the Birmingham Division of the E. H. Sargent and Company for their hospitality in providing the annual dinner.

2. WHEREAS during the past year, death has deprived the Academy of the valued services of five members; now, therefore, be it resolved that the Academy extend its sympathy to the families of LOUISE CASON, PERCY G. COWIN, JAMES BURNS, J. G. HITCHCOCK, and HAZEL L. STICKNEY; and express its appreciation for the loyal and valuable services these members have given to the Academy.

3. WHEREAS Troy State College is a Contributing Member of the Academy, and its president Frank R. Stewart died on March 24th, 1964, now, therefore, be it resolved that the Academy extend its sympathy to the family of Frank R. Stewart and express its appreciation for his loyal and valuable service to the Academy.

239. Motion by DeJarnette, seconded by Shotts that the resolutions proposed be adopted and that appropriate action be taken where specified. Motion passed unanimously.

SPECIAL COMMITTEE FOR REVISION OF BROCHURE (DEJARNETTE). Copy for a revised brochure describing the program and activities of the Academy was presented to the Executive Committee on April 2, 1964. The proposed letter size folder will be reviewed by the incoming president and when approved will be turned over to a printer. The new brochure should be of value to Academy members when soliciting new memberships.

ADMISSION TO MEMBERSHIP (DEVALL).

Total membership, December 31, 1962	653
Increase in membership during 1963	63
Loss in membership	129
Total membership, December 31, 1963	587
Net loss in membership for 1963	66

The Executive Committee has approved a new procedure to be followed in offering membership to prospects. Forms will be printed on which members will nominate persons. This form and an invitation to membership form, both printed in the last issue of the Newsletter, will be available soon. A supply of the nomination form will be sent to each officer, including section vice-presidents and section vice-chairmen.

AUDITING COMMITTEE, JUNIOR ACADEMY (BAILEY). The accounts of the Alabama Junior Academy of Science were examined and found to be in order.

AUDITING COMMITTEE, SENIOR ACADEMY (EISELE). The accounts of the Alabama Academy of Science were examined and found to be in order.

PLACE OF MEETING COMMITTEE (BAILEY). The Academy has been invited by Florence State College to hold its 1965 Annual Meeting on the college campus. The committee recommended that the invitation be accepted and that the dates of April 1-3, 1965 be approved.

240. Motion by Bailey, seconded by Thomson that the report of the Committee on Place of Meeting be accepted and that the 1965 Annual Meeting be held April 1-3 at Florence State College. Motion passed unanimously.

The President called for items of Old Business.

The President called for items of New Business.

The Chairman of the Admissions to Membership Committee announced the election to honorary membership in the Academy of two long-time supporters of the Academy:

ROGER W. ALLEN, Dean of Science and Literature, and formerly Professor of Chemistry, Auburn University. President, Alabama Academy of Science 1937-38.

EMMETT W. PRICE, Professor of Biology, Jacksonville State College, and formerly, Assistant Chief, Bureau of Animal Industry, Agricultural Research Service, U.S. Department of Agriculture, Beltsville, Maryland.

Officers for 1964 were introduced by Dr. Sensenig.

Announcements were made by Dr. James A. Lyle regarding arrangements for the Academy banquet and special guest speaker at the Saturday morning session. Dr. Donald Davis announced plans for the Junior Academy outlining activities and plans after the banquet. He encouraged all Junior Academy members and their sponsors to attend the lecture by Dr. H. A. Borthwick, Chief Plant Physiologist, United States Department of Agriculture, Crops Research Division, Beltsville, Maryland, at the joint session on Saturday morning.

Meeting was adjourned at 2:25 p.m.

W. B. DeVall, Secretary

THE JOURNAL

of the

ALABAMA ACADEMY OF SCIENCE

Affiliated with the
American Association for the
Advancement of Science

OFFICE OF THE EDITOR
AUBURN UNIVERSITY
AUBURN, ALABAMA

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NUMBER 4

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VOLUME 35

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NUMBER 4

EDITOR

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Auburn University

ARCHIVIST

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The Journal of the Alabama Academy of Science is published four times a year and is sent without charge to all members of the Academy.

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The Effect of Certain Variables on Fracture Appearance Transition Temperature and Critical Fracture Toughness of High Strength Sheet Steel

Hal W. Maynor, Jr.
Department of Mechanical Engineering
Auburn University

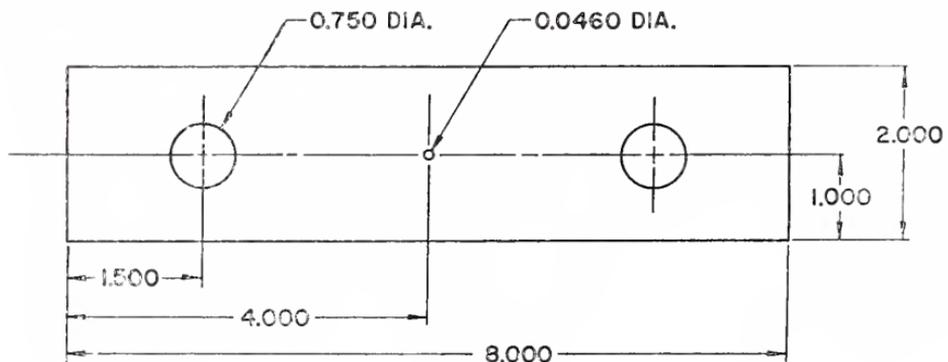
I. INTRODUCTION

In recent years designers have been faced with the problem of providing for the operation of systems at previously unprecedented yield strength levels. The incentive is, and promises to be, the attainment of ever increasing strength-to-weight ratios. Realization of this end involves, however, a compromise between increasing strength and accompanying decrease in critical fracture toughness. In order, therefore, to design intelligently it is necessary to employ criteria that are reliable and, desirably, quantitative. Designs advanced on this basis would be expected to minimize the occurrence of brittle failures and in particular, those of the catastrophic variety. Accordingly, the interest of the present investigation was in the acquisition and analysis of experimental data, under conditions designed to reveal changes in susceptibility to unstable crack propagation, which would contribute to the confidence with which fracture toughness may be assessed.

The primary purpose of the experimental work described in this paper was to study changes in fracture mode (FATT) of AMS 6434 steel and, secondly, to determine the critical fracture toughness parameter, K_{c3} ; in both cases, under conditions of varying sheet thickness, tempering temperature and test temperature. For all phases of the investigation, nominal sheet thicknesses were within the range 0.020 to 0.120 in. and test temperatures were within the range -300 to 475° F. Stated simply, FATT represents a transition (with decreasing test temperature, increasing sheet thickness, or decreasing tempering temperature) from a ductile (readily plastically deformable), or shear, mode to a brittle (not readily plastically deformable), or flat fracture, mode of failure. The critical fracture toughness parameter, on the other hand, is a relatively quantitative assessment of the stress level at which a flaw (incipient crack, nonmetallic inclusion, or void) gives rise to a slow growing crack which, upon reaching a critical size, may then propagate at speeds of, or approaching, the speed of sound.

For the enlightenment of the reader who may be unfamiliar with brittle fracture phenomena, it is desirable to depress FATT (in metals subject to this phenomenon) with respect to the lowest temperature to which the metal, as a structural component, will be exposed during service. By so doing, the probability of subtle or catastrophic failure is minimized. It has been observed, however, that taking such a precaution does not guarantee structural infallibility insofar as absolute prevention of brittle fracture is concerned (1). There is, though, a firm basis for placing confidence in the reliability of the critical fracture toughness parameter (derived from linear fracture mechanics), especially K_{IC} , the concept of which has been extended and refined since 1959 by the Committee on Fracture Testing of High Strength Metallic Materials (an *ad hoc* committee sponsored by the American Society for Testing and Materials) and other cooperating groups and individuals. As it is desirable, then, to depress FATT, so it is desirable that K_{c3} or K_{IC} be of maximum magnitude in order to insure the utmost in load carrying ability without an attendant large risk of failure via brittle fracture.

As of the initiation of the present work, the now well established and more reliable plane strain methods (2) of determining the critical fracture toughness parameter, K_{IC} , were not described in the literature (especially that of the Committee on Fracture Testing of High Strength Metallic Materials). The reported advantages of expressing fracture toughness in terms of the plane strain parameter, K_{IC} , rather than the plane stress parameter, K_{c3} , are: the



NOTE: 1. TOLERANCE ON ALL DIMENSIONS EXCEPT THAT OF PIN HOLES (SEE NOTE 2) ± 0.001 IN.

2. PIN HOLE TOLERANCE $+0.0005$
 -0.0000

FIG. 1. Fracture Toughness Specimen

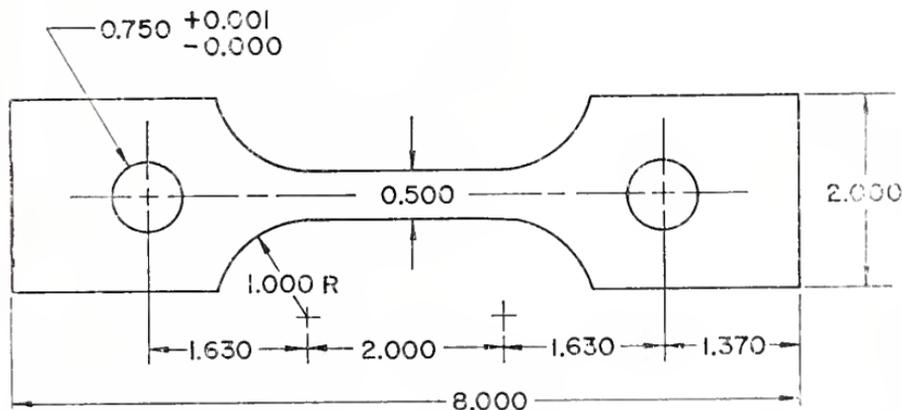
former represents minimum values and supposedly is independent of thickness and metallurgical condition (tempering and other processing operations). Research, initiated by the present investigator, involving the application of one of the plane strain techniques to one of the newer ultra-high-strength steels has been underway for more than six months and will be reported in the near future.

II. EXPERIMENTAL WORK

Fracture toughness specimens (Figure 1) and standard tensile specimens (Figure 2) were produced from AMS 6434 sheet in as-received thicknesses 0.050, 0.070, 0.090, 0.110 and 0.130 in., and the laboratory-rolled thickness 0.030 in. The as-received material was in the hot rolled and annealed condition. The laboratory-rolled material was cold rolled from 0.050 in. sheet. All thicknesses were surface ground to a depth of 0.005 in. per side to remove the decarburized layers. Material used was from a single heat, the composition of which was

C	Mn	P	S	Si	Ni	Cr	Mo	V
0.385	0.71	0.012	0.017	0.33	1.74	0.74	0.35	0.19

Specimens were oriented with their major axes parallel to the rolling direction and conformed in geometry and dimensions to ASTM recommendations (3). Since the technique of crack introduction is of particular importance and may affect the validity of crack toughness data, a brief discussion of this phase of the investigation would appear to be in order. The method of introducing



NOTE: TOLERANCE ± 0.001
EXCEPT AS SPECIFIED

FIG. 2. Standard Tensile Specimen

fatigue cracks involved the use of a jeweler's saw (blade thickness, 0.005 in.) in cutting a through-the-thickness center slot in each specimen. Center slots were extended to predetermined lengths ($2a_0$) by stressing in tension-tension fatigue. A Tatnall direct stress fatigue machine (capacity, 20 kips) was regulated to apply loads which fluctuated between minima and maxima corresponding to net section stresses of 15 and 50 per cent of the yield strength (0.2% offset), respectively. Random measurements indicated crack-root radii consistently were less than 0.001 in. Specimens were austenitized in an endothermic atmosphere (dew point, 50 to 55° F) at 1650° F for time periods equivalent to 1 hour per inch of section and oil quenched. Tempering was designed to produce two different levels of yield strength, namely, 200 and 240 ksi (actual values 191.5 and 236 ksi, respectively). These strength levels, hereafter referred to as Groups 1 and 2, respectively, were obtained by single tempering at corresponding temperatures of 1075 and 475° F; tempering time was two hours in each instance. Micro-hardness determinations established the absence of decarburization, as well as carburization, in finally-processed specimens. The use of standard sheet (0.080 in.) tensile specimens to determine yield strength (0.2% offset), fracture toughness specimens to determine FATT and K_{cs} , methods of providing elevated-temperature and sub-room temperature environments, and test procedures, generally, were in accordance with a previous paper (4). Yield strength, as a function of test temperature, of Groups 1 and 2 specimens is shown in Figure 3.

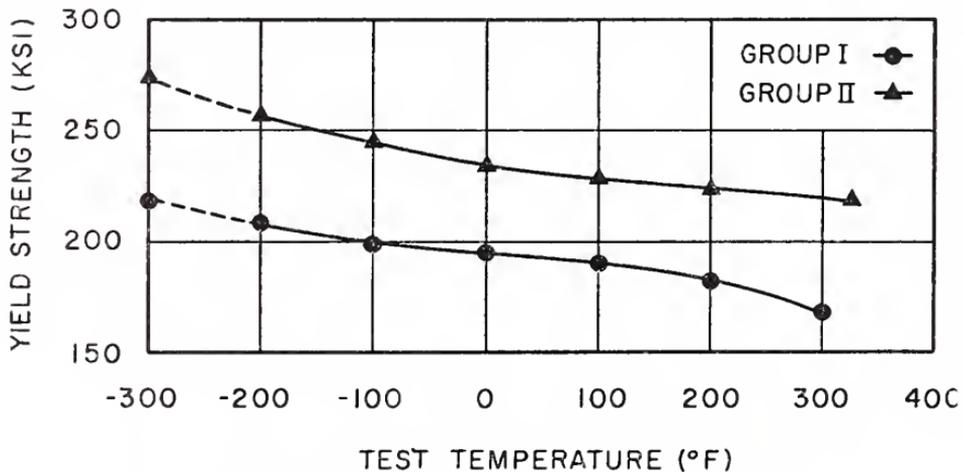


FIG. 3. Yield Strength as Function of Test Temperature

Since the methods of arriving at FATT and K_{c3} have been described in detail in the literature (3, 4), only brief reference will be made to them here. Determination of the former involved tension testing of fatigue-cracked fracture toughness specimens and, subsequently, an examination of fracture surfaces. When a given test specimen (having been tempered at one of the two tempering temperatures employed, existing in a given thickness and subjected to the lowest of a series of test temperatures) exhibited a fracture surface consisting of a shear lip extending across its width, it was considered that the FATT had been attained. It follows that with all conditions except the test temperature remaining the same, the test temperature was reduced, by a small increment, below that corresponding to FATT to establish that 100 percent shear no longer existed or that the previous temperature was, in reality, the FATT.

Determination of K_{c3} was based on the Griffith-Irwin relationship:

$$K_{c3} = \sigma_m (q_{c3}W)^{1/2}$$

$$\text{where } \sigma_m = P_m/WB$$

$$\text{and } q_{c3} = \text{stress distribution factor}$$

III. DISCUSSION OF RESULTS

FATT vs. Thickness

The elevation of FATT with increasing specimen thickness (Figure 4) was continuous for Group 2 specimens, but tended to reach a constant value in the instance of Group 1 specimens. Considering only specimen thicknesses in the range 0.060 to 0.120 (specimen-width-to-specimen-thickness ratio, $W/B = 33.3 - 16$), FATT for Group 1 specimen appeared practically independent of thickness. FATT exhibited a rather well defined relationship to specimen thickness at both yield strength levels.

In some instances it was necessary to extend the fatigue crack, in order to induce fracture in the plane of the fatigue crack, which resulted in crack-length-to-specimen-width ratios ($2a_0/W$) greater than the 0.4 recommended by the ASTM. This procedure was necessitated for certain Group 1 (0.020, 0.040 and 0.060 in.) and Group 2 (0.020 in.) specimens. Since fatigue cracks were introduced prior to heat treatment, such crack extensions were made in the heat treated condition. The limited tendency toward notch insensitivity was offset, ultimately, by providing the specimen grips with set screws.

FATT vs. Tempering Temperature

The influence of tempering temperature on FATT also is shown by the curves of FATT vs. thickness for the strength levels corresponding to Group 1 and Group 2 specimens (Figure 4). This method of presenting the data was chosen since the investigation involved the use of just two tempering temperatures, namely, 475 and 1075° F. FATT was observed to increase with increasing strength level for specimen thickness in excess of 0.060 in. The higher strength level (Group 2) specimens were especially sensitive to lower W/B ratios (within the range of 16 to 45). This fact is apparent upon considering the divergence, beginning at $B = 0.060$

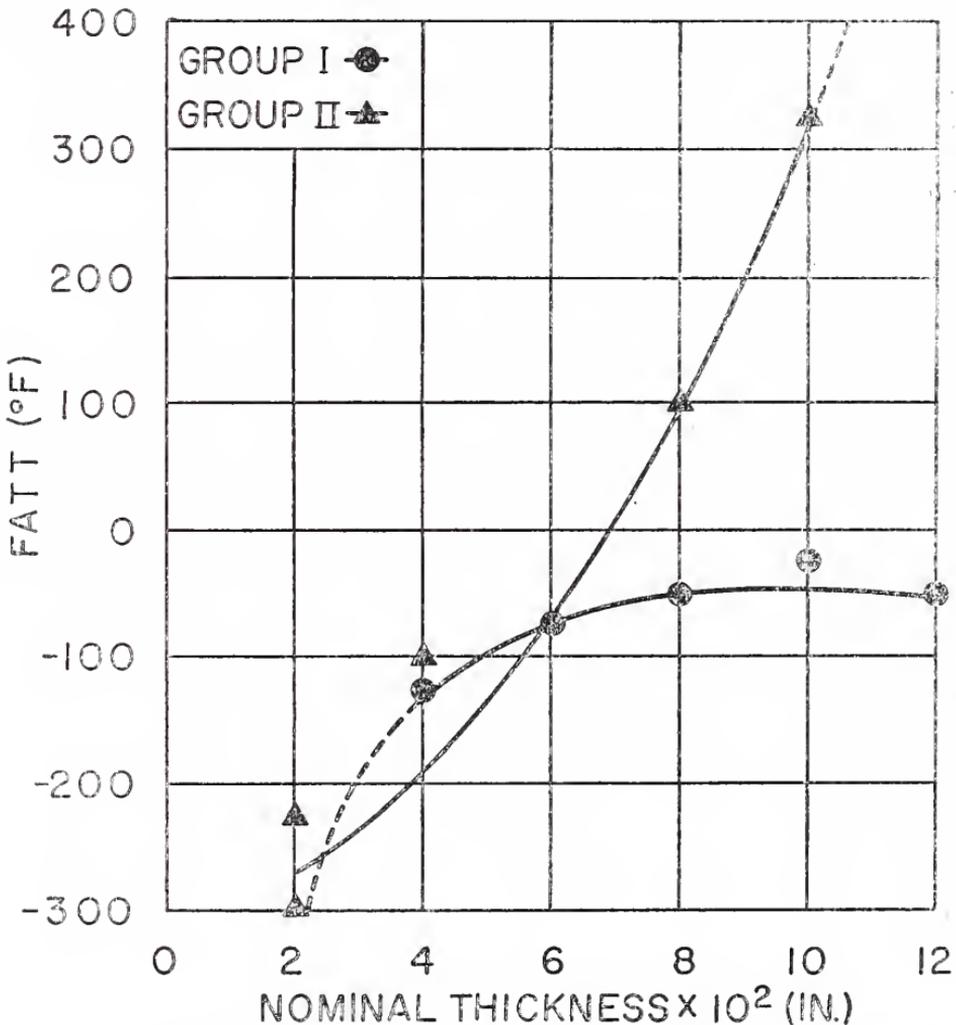


FIG. 4. Fracture Appearance Transition Temperature as a Function of Specimen Thickness.

in. ($W/B=33.3$), of the Group 2 curve from the relatively flat Group 1 curve, over the thickness range 0.060 to 0.120 in. The corresponding increase in FATT caused by decreasing tempering temperature approximated 575°F .

K_{C3} vs. Specimen Thickness

One of the boundary conditions pertaining to K_{C3} (or K_{IC}) determinations requires that the σ_N/σ_{VS} ratio not exceed 0.8 (otherwise

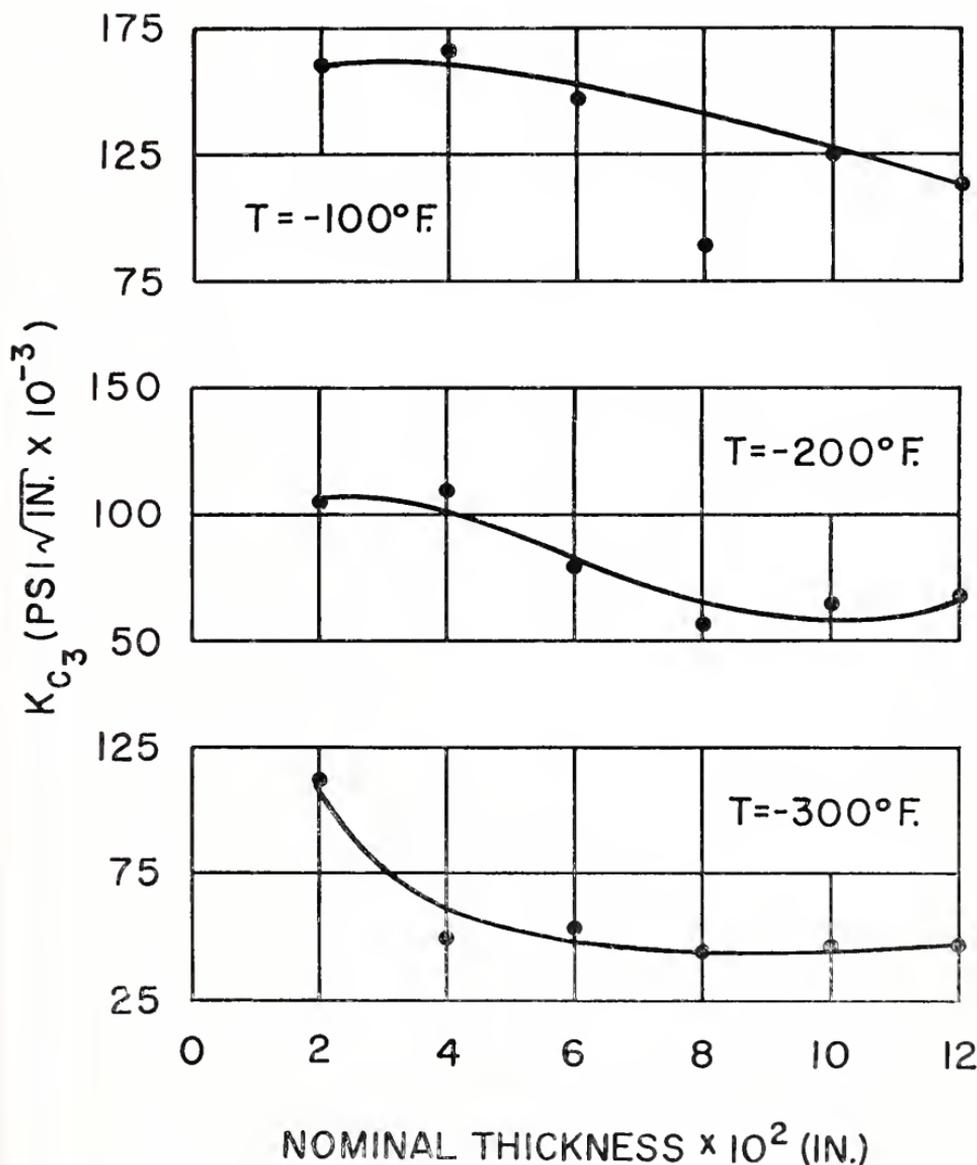


FIG. 5. Critical Fracture Toughness (K_{C3} , Group 1) as a Function of Nominal Specimen Thickness

plastic deformation in the vicinity of the crack tip probably will occur to a degree such that the crack propagation phenomenon can no longer be considered primarily elastic and linear mechanics,

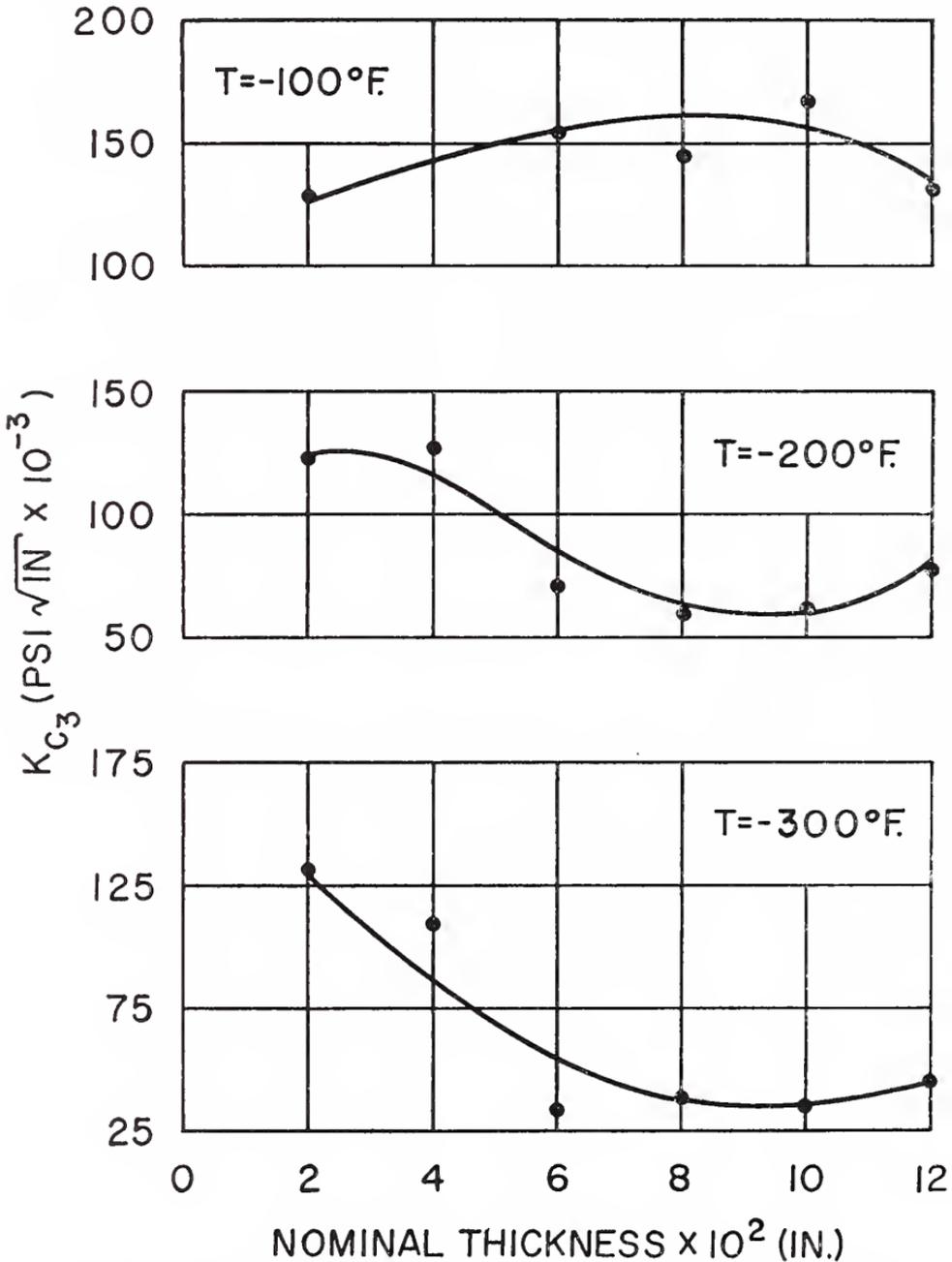


FIG. 6. Critical Fracture Toughness (K_{C3} , Group 2) as a Function of Nominal Specimen Thickness

the basis of the method of evaluating fracture toughness, will no longer be applicable) (3, 5). The fracture appearance method of determining the parameter (K_{c3}), however, includes no provision for measuring slow crack growth and hence, calculating the numerator (σ_N) of the σ_N/σ_{YS} ratio. In view of these facts, test temperatures (-100 , -200 and -300° F) were employed as shown in Figures 5 and 6, that would tend to have the effect of reducing the size of the plastic zone (at the crack tip) and thereby decrease the probability of the σ_N/σ_{YS} ratio being greater than 0.8. As can be seen, smooth curves have been fitted to the points of Figures 5 and 6. On this basis, the resultant configurations suggest, with one exception (Figure 6, -100° F), a trend toward a decrease in K_{c3} with increasing sheet thickness and a dependence of the parameter upon the thickness factor. On the other hand, were it not for the element of uncertainty, horizontal straight line curves could be drawn, in a number of instances, which would indicate K_{c3} to be independent of thickness. The curve of Figure 5, -300° F, is one such example, five out of six points falling on a horizontal straight line curve. In another instance, Figure 6, -100° F, a horizontal straight line curve might have been drawn at a K_{c3} level of approximately 150 ksi $\sqrt{\text{in.}}$, with resultant scatter amounting to a maximum of ± 20 percent. Still another way of analyzing the data of Figures 5 and 6 would be to consider only thicknesses in the range of 0.060 to 0.125 in. Justification for so doing would be based on yet another boundary condition imposed on the determination of the K_{c3} parameter; namely, that the W/B ratio lie within the range 16 to 45. (3). If this procedure were followed (thicknesses of 0.060 to 0.120 in. falling within this range), horizontal straight line curves could be drawn and the data summarized:

Figure Number	Test Temperature ($^\circ$ F)	K_{c3} (ksi $\sqrt{\text{in.}}$)	Maximum Scatter (Percent)
5	-100	120	± 15
5	-200	69	± 16
5	-300	50	-10
6	-100	150	± 12
6	-200	68	± 15
6	-300	40	± 15

Even though the curves of Figures 5 and 6 are shown as other than horizontal straight line curves, the preceding argument (in-

volving the concept of the W/B boundary condition) is taken to support the contention that, for this work, the K_{c3} parameter is at least substantially independent of nominal sheet thicknesses 0.060 to 0.125 in.

K_{c3} vs. TEST TEMPERATURE

Inspection of Figures 7 through 12 reveals that, within the temperature range -300 to -100° F, the K_{c3} parameter is rather strongly dependent upon test temperature. With the single exception of the Group 1 curve of Figure 7, the magnitude of the para-

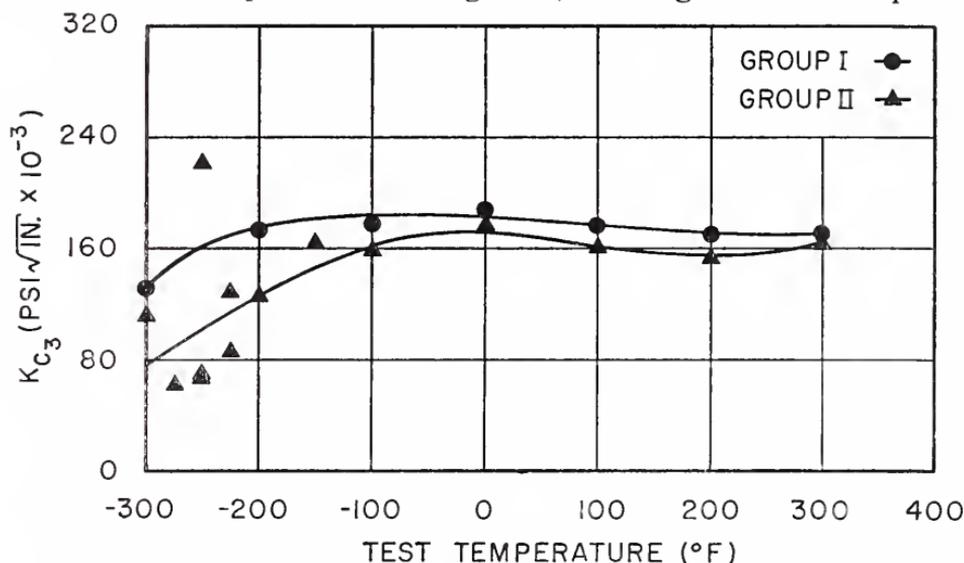


FIG. 7. Critical Fracture Toughness (K_{c3} , 0.020 in.) as a Function of Test Temperature

meter increases by as much as a factor of four, but not less than a factor of two, as the test temperature is increased from -300 to -100° F. Even though curves are shown for test temperatures in excess of -100° F it is probable, as explained previously, that such portions represent data which lie beyond the stipulated boundary conditions upon which valid K_{c3} determinations are dependent. Actually, curve extensions were included simply to illustrate, graphically, the relative insensitivity of the parameter to test temperature under conditions for which the steel possessed a modicum of ductility, that is, contained a relatively large plastic zone in the vicinity of the crack tip and, as a consequence, did not reflect the existence of conditions conducive to the occurrence of brittle fracture. It follows that, under such circumstances, one of the boundary conditions necessary for the occurrence and assessment of resistance to brittle fracture would have been violated.

What has been said regarding the restriction placed on W/B ratios also applies here; however, since, as before, thicknesses of 0.020 and 0.040 in. had been included, for reasons indicated, K_{c3} data pertaining to them is necessarily included here. It would appear that the effect of test temperature on K_{c3} , for the thicknesses

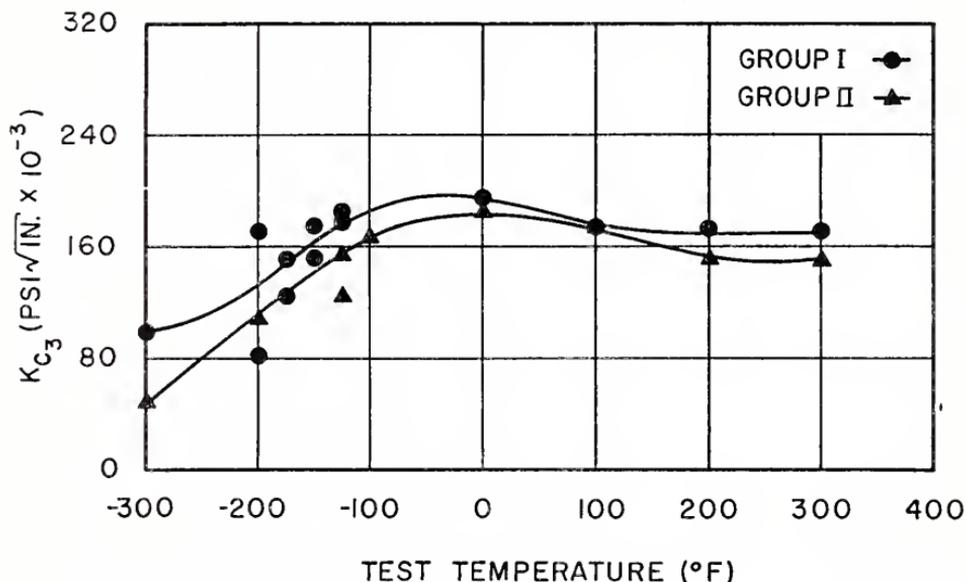


FIG. 8. Critical Fracture Toughness (K_{c3} , 0.040 in.) as a Function of Test Temperature

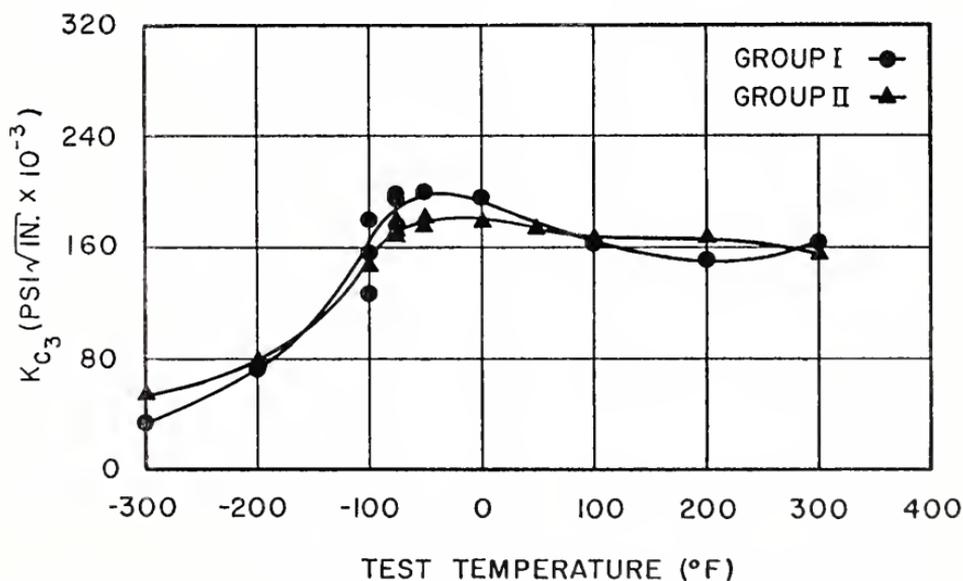


FIG. 9. Critical Fracture Toughness (K_{c3} , 0.060 in.) as a Function of Test Temperature

0.020 and 0.040 in., might be somewhat less pronounced than is the case for the other thicknesses. In any event, there is reason to believe that the parameter definitely is a function of test temperature.

K_{c3} vs. Tempering Temperature

The curves included in Figures 7 through 12 also will be relied upon, in part, to indicate the effect of tempering temperature on K_{c3} . Exclusive of Figures 7 and 8 (thicknesses of 0.020 and 0.040 in., respectively), the greatest displacement of these curves occurs, logically, at the test temperature of -100° F. This is so because the σ_N/σ_{YS} ratio is greater, though not necessarily in excess of 0.8, for this temperature than that of -200 or -300° F. Over the test temperature range -200 to -300° F, the two curves (Group 1 tempered at 1075° F and Group 2 tempered at 475° F) were essentially coincident. Only in terms of differences in the magnitude of K_{c3} at -100° F did the higher tempering temperature (200 ksi yield strength at -100° F) contribute more toward increasing K_{c3} than did the lower tempering temperature (245 ksi yield strength at -100° F). If, however, the tabulated data on page 9 be considered as the basis for ascertaining the effect of tempering temperature on K_{c3} , a somewhat different impression is conveyed. In this case, for which the effect of sheet thickness is constant (the average of thicknesses 0.060 through 0.125 in.), the maximum average deviation (identical in the instances of Figures 5 and 6 for -100° F, and Figures 5 and 6 for -300° F) was 11 percent as regards the difference in K_{c3} when influenced by the use of the two different tempering temperatures.

Relatively minor discrepancies in the two different means of considering the K_{c3} vs. test-temperature relationship may have resulted from the fact that thickness, which has been shown to have an effect on K_{c3} in isolated instances (Figures 10 and 11 at -100° F), is not reflected as a constant average effect in Figures 7 through 12, whereas the reverse is true for the tabulated data. Since, desirably, thickness should be constant for all tempering temperatures (in order to ascertain the effect of the single variable of tempering temperature), and the use of a constant average thickness value more nearly provides this condition, it is concluded that a reasonable basis exists for considering the K_{c3} parameter to be substantially independent of tempering temperature.

Comparison of Present Work with that of Other Investigators

The observed nature of the dependency of FATT on sheet speci-

men thickness and tempering temperature is in agreement with the literature pertaining to AMS 6434 steel (6, 7) and other similar materials.

The observed lack of dependency of K_{c3} (not necessarily just for

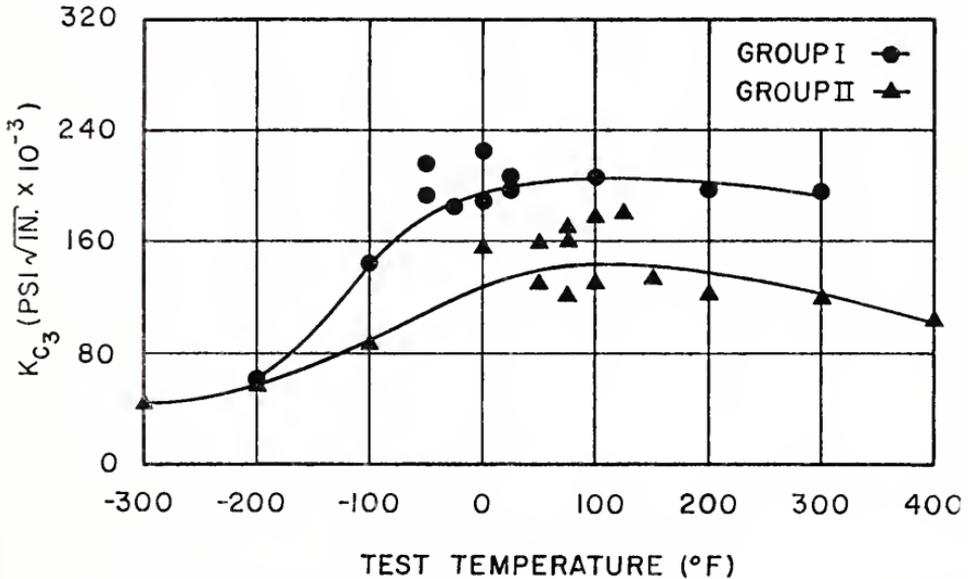


FIG. 10. Critical Fracture Toughness (K_{c3} , 0.080 in.) as a Function of Test Temperature

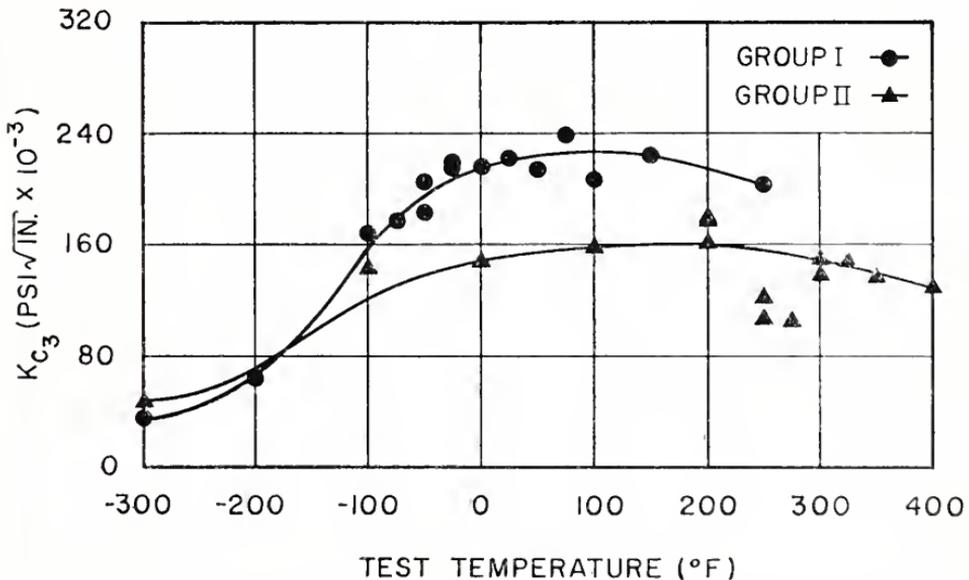


FIG. 11. Critical Fracture Toughness (K_{c3} , 0.100 in.) as a Function of Test Temperature

AMS 6434) on sheet specimen thickness appears to be in disagreement, generally, with the literature, since only K_{IC} supposedly is independent of sheet specimen thickness (3, 6, 8). The reason for this difference is not readily apparent. The observation that K_{c3} is independent of tempering temperature, in the instance of AISI 4340, is supported in at least one case (3). In another instance K_{IC} , of AMS 6434, was observed to undergo a continuous decrease with decreasing tempering temperature (6). With respect to the latter, a statement was made to the effect that "... some part of the mechanism of the effect of tempering temperature on toughness is independent of that on yield strength." The observed dependency of K_{c3} (and K_{IC}) on test temperature has been well established. Srawley and others (6) have shown this for K_{IC} and AMS 6434, and Maynor and others for K_{c3} and X-200 and H-11 (4).

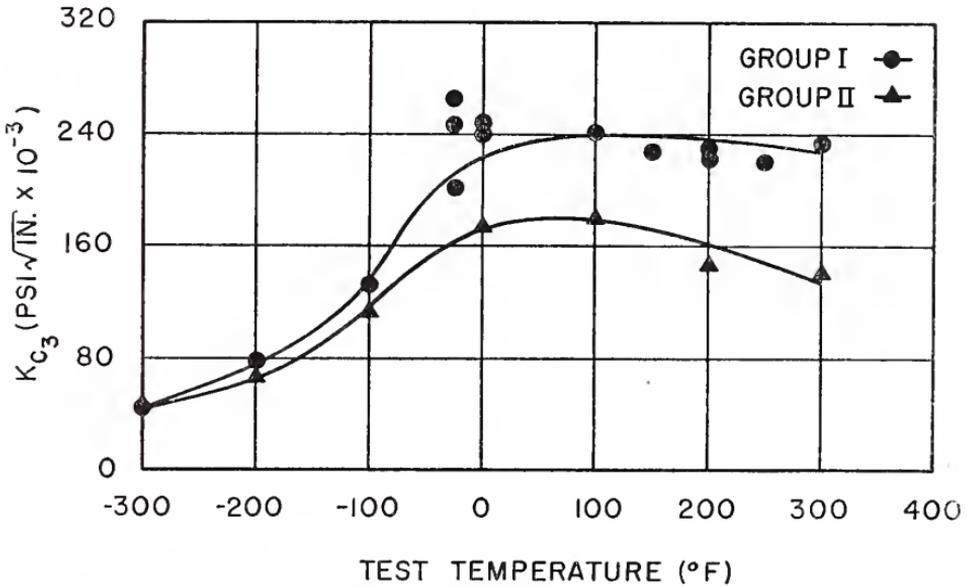


FIG. 12. Critical Fracture Toughness (K_{c3} , 0.125 in.) as a Function of Test Temperature

IV. CONCLUSIONS

1. AMS-6434 steel of yield strength 236 ksi (Group 2) was susceptible, continuously, to elevation of FATT with increasing sheet thickness (0.020 to 0.125 in.), whereas the same steel of yield strength 191.5 ksi (Group 1) was essentially independent of thickness 0.060 to 0.120 in.
2. The effect of tempering temperature on FATT was clearly evident only for thicknesses 0.060 to 0.125 in. Over this range,

however, FATT of Group 2 specimens increased to an extrapolated value of 525° F, while FATT of Group 1 specimens remained essentially constant at approximately -50° F.

3. The minimum value of FATT was observed for Group 1, 0.020 in. specimens, in which instance FATT was below -300° F. The maximum value of FATT was observed for Group 2, 0.120 in. specimens, in which instance FATT was above the tempering temperature (475° F) utilized to produce the corresponding yield strength, $\sigma_{YS} = 236$ ksi. In all instances, lowest FATT values corresponded to the minimum thickness of 0.020 in.
4. The critical fracture toughness parameter, K_{c3} , was considered essentially independent of sheet specimen thicknesses 0.060 to 0.125 in. when evaluated in terms of any constant test temperature, within the range -300 to -100° F, and corresponding yield strength.
5. The critical fracture toughness parameter was considered essentially independent of tempering temperature when evaluated in terms of any indicated sheet specimen thickness and constant test temperature.
6. The critical fracture toughness parameter was considered dependent upon test temperature when evaluated in terms of indicated sheet specimen thicknesses and yield strengths.

TERMINOLOGY

- a_0 = Initial crack length from center line (in.).
- W = Specimen width (in.).
- B = Specimen thickness (in.).
- σ_{YS} = Yield strength (ksi).
- σ_M = Maximum gross section stress at onset of unstable crack propagation (ksi).
- P_M = Maximum tensile load at onset of unstable crack propagation (lb.).
- q_{c3} = Critical stress distribution factor associated with the fracture appearance method.
- K_{c3} = Critical fracture toughness parameter associated with the fracture appearance method; that is, critical stress intensity at onset of unstable crack propagation as determined under conditions of plane stress (ksi $\sqrt{\text{in.}}$).
- K_{1C} = Critical fracture toughness parameter associated with compliance gage, electrical resistance or acoustical methods; that is, critical stress intensity at onset of unstable crack propagation as determined under conditions plane strain (ksi $\sqrt{\text{in.}}$).
- FATT = Fracture appearance transition temperature, that is, the lowest temperature at which the mode of fracture is 100 percent shear (° F.).
- $\frac{\sigma_N}{\sigma_{YS}}$ = Ratio of net section stress (at onset of unstable crack propagation) to yield strength.

REFERENCES

1. E. T. WESSEL and L. E. HAYS. "Fracture Characteristics of Some High-Strength, Weldable, Structural Steels." Welding Research Supplement. November, 1963.
2. R. W. BOYLE, A. M. SULLIVAN and J. M. KRAFT. "Determination of Plane Strain Fracture Toughness with Sharply Notched Sheets." Welding Research Supplement. September, 1962.
3. "Fracture Testing of High-Strength Sheet Materials: A Report of a Special ASTM Committee." ASTM Bulletin No. 243. January, 1960.
4. H. W. MAYNOR, JR., R. E. MUELLER and E. O. JONES, JR. "Investigations of the Fracture Toughness of Two High-Strength Sheet Steels." Proceedings ASTM. Vol. 62, 1962.
5. "Progress in the Measurement of Fracture Toughness and the Application of Fracture Mechanics to Engineering Problems": Fifth Report of a Special ASTM Committee (to be published, ASTM).
6. J. E. SRAWLEY, T. C. LUPTON and W. S. KENTON, SR. "Crack Toughness of Two High-Strength Sheet Steels." Naval Research Laboratory Report 5895. February 13, 1963.
7. H. E. ROMINE. "Critical Crack Extension Force in AMS 6434 Steel Sheets from Stock at the Aerojet-General Corporation Intended for Large Solid Propellant Rocket Casing Thickness Of 0.063, 0.125 and 0.188 inch Heat Treated to Yield Strengths of 170,000, 190,000 and 210,000 psi." Technical Memorandum No. T-27/59. Warhead and Ballistics Laboratory, U.S. Naval Proving Ground. July, 1959.
8. A. M. SULLIVAN. "New Specimen Design for Plane Strain Fracture Toughness Tests" (to be published, ASTM).

The Formation of an Extensive Maze Cave in Alabama

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I. Topography

The area under consideration is defined by a hill containing Anvil Cave (Alabama Geological Survey Cave No. 279) and lying in a meander loop of Flint Creek in Morgan County, Alabama, in Section 32, Township 6 South, Range 4 West.

Flint Creek flows northward, has reached grade, and lies essentially at 560 feet above sea level which is the local elevation of the Tennessee River into which it drains. This creek is entrenched into the Mississippian age sedimentary rocks of the region. These rocks are flatbedded and dip very gently to the south-southwest. The uppermost formation is the Hartselle Sandstone. The Hartselle is about 40 feet thick and overlies the Gasper Limestone which extends below the lowest exposures in the area.

Figure 1 shows that Anvil Cave Hill lies in a meander loop of Flint Creek, which terminates three sides of the hill. The hill is bounded by a shallow streamless valley on the fourth side, separating it from the plateau-like upland to the northeast. The hill reaches 650 feet in elevation, about the same as the nearby upland, while the floor of the shallow valley lies just a few feet above the Hartselle Gasper contact.

There are five sinks in the valley. One sink on the hillside, opens into Anvil Cave; another in the center of the valley collects some surface runoff but is too small to enter. Two sinks are blocked by collapse and the fifth was filled in by the owner before it could be examined. There are three additional sinks along the north-west-southeast axis of the hill itself. Two of these sinks near the northwestern slope opened into the cave, although the owner has now blocked one of them; the other sink on the southeastern slope is closed by fill.

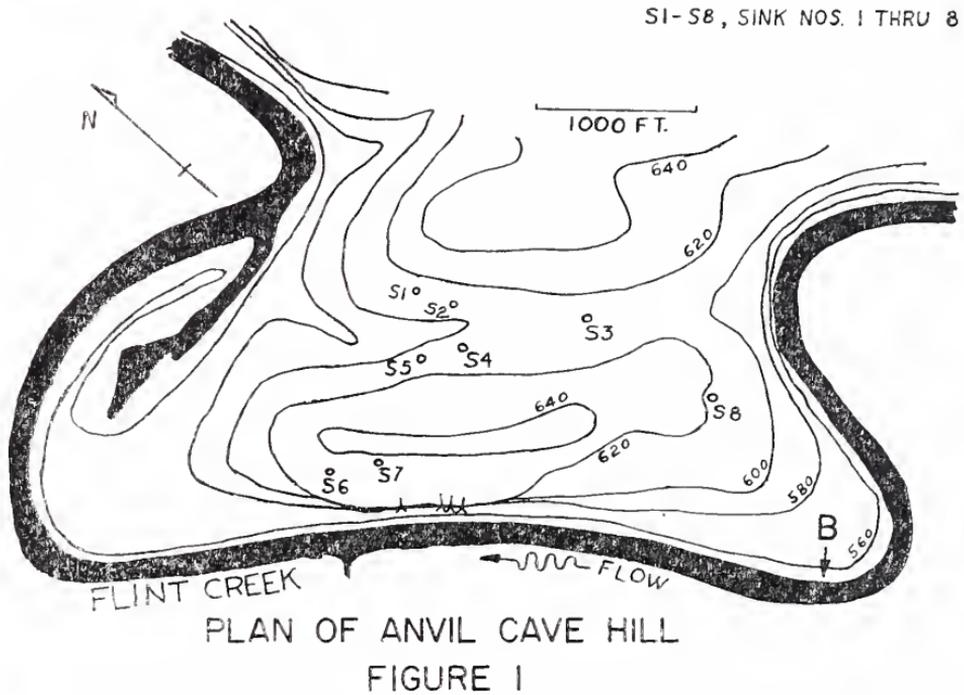
Along the southwestern face of the hill there is a sheer bluff for a length of about 1500 feet. This cliff contains four more entrances to the cave and one small crack through which daylight can be seen from inside.

II. Anvil Cave Description

Anvil Cave outlines a well-defined and extensive joint pattern

with its passages. The map of the cave, shown as Figure 2, clearly shows the joints. The pattern tends to be rectangular, with intersections averaging about 20 feet apart, but many joints strike at irregular directions. The cave underlies almost the entire hill and is calculated to contain 12 miles of passage based on the survey and map of the cave.

Most of the cave passages are large enough to walk through, averaging 8 feet high and 2 to 4 feet wide. Great variety exists, however; there are numerous crawls and some passages are 15 to 20 feet wide and 25 feet high. In these large rooms or passages



the sandstone cap usually forms the ceiling. There are only isolated places where the passage floor dips below the present water table.

Passages in Anvil Cave are terminated to the southwest and northwest by breakdown, but passages to the southeast become impassable because of fill choking off access where the ceilings become low. Few passages seem to have developed heading northeast and those that have quickly become too small to traverse.

Speleothems are scattered throughout the cave and there is one area that cannot be entered because all passages are blocked by flowstone.

In many places, bears have left claw marks in the mud fill; also,

bones of smaller animals have been found in several locations, but no paleontological or biological study has been undertaken to date.

The major portion of the exploration of Anvil Cave was accomplished and the tedious survey and map were prepared by the Huntsville Grotto of the National Speleological Society.

III. The Origin of Maze Caves

Caves, whether their major enlargement was vadose or phreatic, that develop at or near the top of an unconfined water table, develop in an essentially pressureless medium. Under these conditions, the same dynamic principles that govern surface streams control the basic pattern of the cave.

The larger passages get larger at the expense of nearby smaller ones, which are in turn inhibited by the flow being concentrated in the big ones. The resultant pattern resembles either a conduit from sink to resurgence or a stream with tributaries. This pattern serves as the model for most published accounts of cave formation. Explanations for joint pattern caves, however, must supply some means of negating the inhibiting action on the smaller initial paths.

Davies has speculated that solution at depth in the water table would supply pressure which would equalize the solvent action. Unfortunately, one runs into the difficult objection of accounting for solution under the conditions of the very slow flow rates of water at depth and of the single layer nature of most maze caves, since a three-dimensional maze would be expected. It has been postulated, therefore, that if artesian flow were to exist through limestone, that is, the surface of the water table could be confined so that it could build up pressure yet possess essentially the same flow rate as the surface of an unconfined water table, then the conditions would be ripe for a maze pattern to be dissolved from the limestone.

R. O. Ewers has shown, in experiments with block salt, that confined flow through a rectangular crack pattern will, indeed, develop a grid of passages.

There is now, therefore, under discussion a theory that the necessary condition for the formation of maze caves is a layer of impermeable rock confining the fast-flowing level of the water table. This generalized condition holds for most Alabama caves. Very few Alabama caves lie under capped terrain, but where they do, they tend to be developed along joint patterns.

IV. The Development of Anvil Cave

Mr. Ewers' experiment in jointed blocks of salt showed that passages at right angles, as well as parallel, to the flow developed

equally. No consistent preferential direction is discernible today, either in the pattern of Anvil Cave as seen in Figure 2 or in Anvil Cave itself, from rock surface features. There is, thus, no direct evidence to show the direction of movement of the solvent.

Two ground water flow patterns were considered for the Anvil Cave area and rejected.

The most obvious thought was that drainage from the shallow valley flowed by way of the sinks under the hill into Flint Creek. This idea was dropped because all surface drainage is funnelled into specific spots where the sandstone is breached, marked by the five sinks. There is, therefore, no general influx of water on a broad enough front to account for the great extent of Anvil Cave.

This theory was then modified to use the general movement of water southwestward into Flint Creek from the entire upland to the northeast.

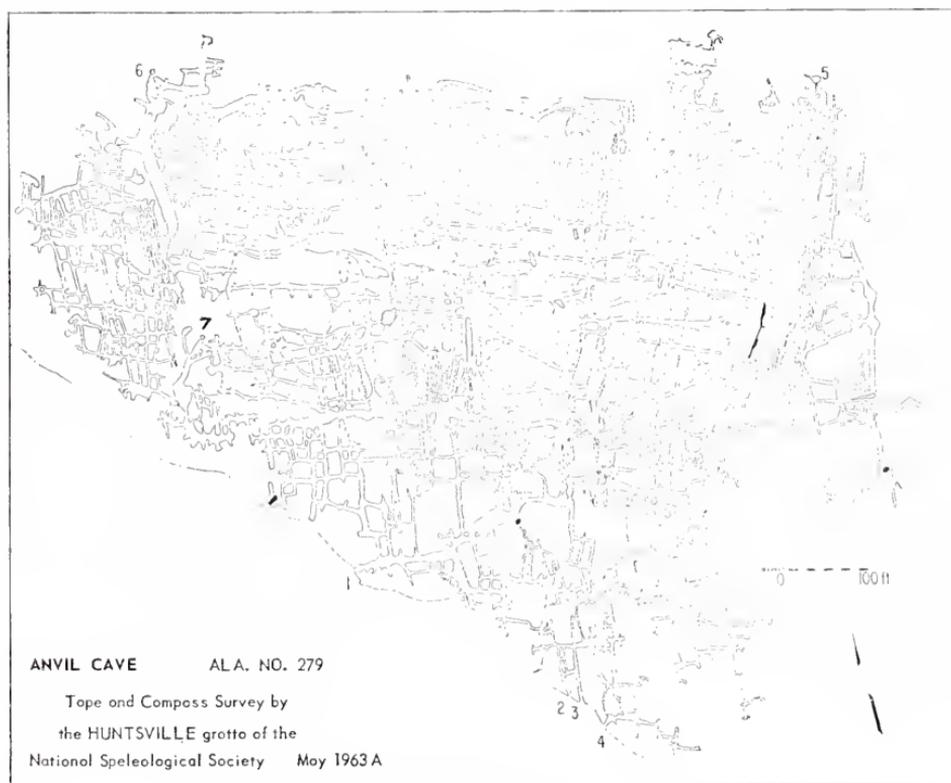


FIGURE 2

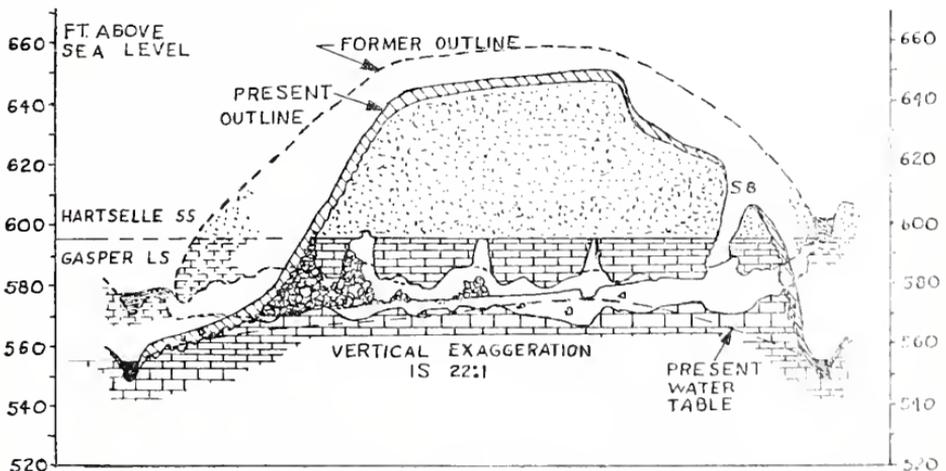
If this flow pattern created Anvil Cave, one would expect even more extensive maze caves all along the east bank of Flint Creek. While joint caves do exist along this bank, they are much

less extensive than Anvil Cave. Also, with both of these theories it is difficult to account for the lack of passages to the northeast in Anvil Cave.

If, however, it is assumed that in the history of Flint Creek a small gradient of some sort, like rapids or a low waterfall, existed at the southwestern corner of Anvil Cave Hill (point "B" of Figure 1) then a rapid artesian flow of some of the Flint Creek water could take place through the Gasper Limestone. This, in effect, would be a partial bypass of the meander loop through the limestone of the hill. It is only necessary to assume, logically, that Flint Creek was at a slightly higher elevation than at present, so that the water table was at, or above, the bottom of the Hartselle Sandstone. A sectional view of this condition is superimposed on the present situation in Figure 3. Under these conditions the flow would have been confined as required by the general discussion on maze cave formation.

Assuming the artesian flow existed, after the passages were dissolved, the hypothetical obstruction in Flint Creek wore away or migrated upstream, allowing the surface stream to offer the least resistant path and recapture its water from the cave. General downcutting to the present grade drained the cave and silted up the upstream conduits to the underground path.

This sequence is consistent with the fill in the southeastern (or upstream) parts of the cave, the breakdown in the northwestern (or downstream) parts of the cave, and the general degeneracy



SECTION ALONG NW/SE AXIS
OF ANVIL CAVE HILL
FIGURE 3

of passages to the northeast in Anvil Cave. The section of the present cave in Figure 3 shows this breakdown and fill.

V. Summary

This hypothetical pattern for the genesis of Anvil Cave strongly supports the artesian flow theory for the formation of maze caves.

LITERATURE CITED

- BARR, T. C., JR. Regional Development of Limestone Caves in Middle Tennessee. Bull. of the NSS. Vol. 16, pp. 83-90. 1954.
- BRETZ, J. H. Vadose and Phreatic Features of Limestone Caverns. Jour. Geology. Vol. 50. pp. 475-811. 1942.
- DAVIES, W. M. Origin of Limestone Caverns. Geology Soc. American Bull. Vol. 41. pp. 475-628. 1930.
- DEIKE, G. H. Origin and Geologic Relations of Breathing Cave, Virginia. Bull. of the NSS. 22:1. 1960.
- EWERS, R. O. Applications of Experimental Geology to Problems of Cavern Development. Paper and Timelapse Movie at the 19th Annual NSS Convention. 1962.
- HOWARD, ALAN D. A Model for Cavern Development Under Artesian Ground Water Flow, with Special Reference to the Black Hills. Bull. of the NSS. Vol. 26. pp. 7-16. 1964.
- KAYE, C. A. The Effect of Solvent Motion on Limestone. Jour. Geology. Vol. 65. pp. 35-46. 1957.
- WHITE, W. B. Terminations of Passages in Appalachian Caves as Evidence for a Shallow Phreatic Origin. Bull. of the NSS. Vol. 22. Part 1. pp. 43-53. 1960.
- WHITE, W. B. and J. LONGYEAR. Some Limitations on Speleo-Genetic Speculation Imposed by the Hydraulics of Groundwater Flow in Limestone. Nittany Grotto Newsletter. Vol. 10. pp. 155-167. 1962.

Prospects for a Southern Pine Plywood Industry in Alabama

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INTRODUCTION

In the past, the softwood plywood industry has been concentrated in the western parts of the United States. At present, however, there is every indication that a substantial development of the southern pine plywood industry will take place in the South. A plant is already operating at Fordyce, Arkansas, and two plants are under construction in East Texas. Although there have been no public announcements, it is rumored that plans are being made for at least two plants in Louisiana. While at present there are no plants being constructed east of the Mississippi, it seems only a matter of time until such plants are built.

When for years it has been assumed that the South could not compete with the Pacific Northwest in the manufacture of softwood plywood, it is interesting to note the reasons for the current activity. One of the biggest developments is the tremendous use of plywood for sheathing, roofing, sub-flooring, concrete forms, and similar structural uses. In the early days of plywood, there was a large production in the finish grades with practically clear faces. This material was usually produced from large peeler logs of douglas-fir four or five feet in diameter or larger. In today's market, however, the structural grades make up approximately 50 per cent of the plywood market and these grades are often made from smaller, knottier logs. Since the percentage of large, clear logs will be small in the South, it is all important to be able to merchandise the structural grades as an outlet for knotty material. In order to produce veneer economically from these small logs, it is necessary to leave only a small core on a rotary lathe and to load the lathe with as little lost time as possible. The advent of automatic lathe loading equipment has largely solved this problem of efficient handling of small logs. The use of two-level chucks allows the logs or bolts to be turned to a small core. The chuck bites into the center of the log and turns it against the knife during rotary cutting of veneer. When the log is large it is necessary to have a fairly large chuck to turn it against the knife. As the log is reduced in diameter during turning, the outer ring of a two-level chuck re-

tracks, leaving a small center chuck, three and one-half to four inches in diameter, which continues to turn the block down to a core size only slightly larger than this inner chuck. Since these small cores may bend from the end pressure of the chucks and the side pressure of the nose bar and knife, it is usually necessary to provide a pressure roll or so-called back roll on the opposite side of the block from the lathe knife to prevent such deflection. A lathe which is properly designed to use all these modern features can cut veneer economically from bolts as small as 12" in diameter, perhaps even smaller. Another development that will help the competitive position of southern pine plywood is a marked lowering of the cost of phenolic resin glue. This material is now down to less than seven cents a pound and will allow the production of completely waterproof southern pine plywood at a reasonable cost.

TECHNICAL PROPERTIES

Southern pine seems especially well adapted to making structural grades of plywood (such as CD sheathing, underlayment, concrete forms), plugged and touch sanded grades, hardwood faced finish grades, and overlaid plywood. In the structural grades it seems that southern pine will produce a product superior to douglas fir plywood. Although the knot and knothole size limitations are the same, southern pine will have fewer knots and fewer knotholes in a C or D grade than does douglas fir or any one of the other western softwoods. Southern pine plywood will have about the same stiffness as douglas fir but will be a little bit heavier and stronger and will have better nail holding ability and less splintering. Unfortunately, it will probably have a somewhat coarser grain on the average than douglas fir and a few more face checks. The current cost studies have assumed a completely waterproof phenolic glue on southern pine. This, together with the other technical advantages, should make southern pine definitely superior to douglas fir as a structural plywood. The proper sales effort should hence insure an equal or even higher price than douglas fir, particularly if one-day truck haul delivery could also be offered as an added service.

PLANT SIZE

Estimates vary as to the minimum sized plant required for efficient production. Some studies indicate that a 1½ million dollar plant producing three million square feet (3/8-inch basis) per month is practical. Others point to a 2½ million dollar plant producing six million feet or more per month as a minimum sized operation. If a straight line, ten year depreciation is assumed in

each case, this gives depreciation charges of \$4.17 per M and \$3.47 per M, respectively. The volume of logs to supply such plants would be from 15 million to 30 million board feet per year if a conservative yield ratio of 2.4 is assumed. A more likely yield ratio seems to be 2.7 feet of 3/8-inch plywood per board foot of log (Doyle scale), which would give annual log requirements of 13.3 million and 26.7 million feet respectively.

COST OF PRODUCTION

It is difficult to compare western costs with potential southern costs; but, if a modern plant is assumed, the southern costs should be slightly lower for raw materials, somewhat higher for drying and gluing, lower for patching, lower for labor, but there would be an additional cost for log steaming. If preliminary cost estimates can be trusted, it seems that these differences will just about balance each other. Most cost studies on southern pine plywood indicate direct costs between \$42 and \$46 per M, 3/8-inch basis. If \$4 per M is assumed for depreciation, this gives a total cost (excluding interest) of from \$46 to \$50 per M, 3/8-inch basis. These figures are approximately the same as production costs for 3/8-inch CD sheathing on the west coast. If pine can be sold at the same price as douglas fir in the southeastern markets, this means that the freight rate differential would be all profit. This freight is about \$16 per M, 3/8-inch basis, into Alabama from Portland, Oregon.

MARKETS

Alabama uses enough softwood plywood to keep one large plywood plant operating. The neighboring states of Tennessee and Georgia use enough to keep three more mills in operation. Kentucky, North Carolina, South Carolina, and Florida use enough softwood plywood to keep six more large plants operating. Moving out one more tier of states, but still within practical truck haul distance, Indiana, Ohio, West Virginia, and Virginia use enough softwood plywood to take the output of seven more large plants. All these states are within practical truck haul and, with the exception of western Tennessee, are closer to a well located Alabama mill than they are to Georgia Pacific's mill at Fordyce, Arkansas. At present market levels, these 12 states could easily take the output of 17 large plywood plants.

PLANT LOCATION

Of the 12 states mentioned in the previous section, only a few have the size and volume of pine timber to support a vigorous

plywood industry. When size, quality, and rate of growth are considered as well as volume, Alabama seems uniquely qualified, among the states east of the Mississippi River, to support a pine plywood industry. Despite constant heavy logging for sawlogs, poles and piling, pulpwood, and various other products, the softwood forests of Alabama increased in total volume 28 per cent and in saw timber volume 30 per cent in the 10 years between 1953 and 1963. If lumber production remains at its present level, this increase of growth over cut will be even more rapid in the future. This means that the state of Alabama has the resources available to support additional forest industry. There are a number of locations in the state which have a sufficient volume of timber to support a plywood mill. As the profitability of this industry becomes more and more obvious, Alabama will undoubtedly support a number of southern pine plywood mills.

ABSTRACTS

Chemistry

Determination of the Niobate Species in Strongly Basic Solutions by Light-Scattering Techniques

R. W. Conrad and James E. Land
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By means of light-scattering techniques it has been demonstrated that $K_8Nb_6O_{19} \cdot 4H_2O$ in a strongly basic solution, containing added supporting electrolyte, was an anisotropic species with a weight-average degree of polymerization of about six. A structure for this species has been proposed.

Preparation and Pyrolyses of Xanthates of *Cis*- and *Trans*-4-*t*-Butylcyclohexylcarbinol and *Cis*- and *Trans*-1-Methyl-4-*t*-Butylcyclohexanol

Glenn Esslinger
University of Alabama

Xanthates of *cis*- and *trans*-4-*t*-butylcyclohexylcarbinol and *cis*- and *trans*-1-methyl-4-*t*-butylcyclohexanol are being prepared in order to study the behavior of these compounds when subjected to pyrolytic decomposition. Comparison of the results with pyrolysis of similar acetates will be of interest, particularly with respect to question of whether conformational effects exert a greater influence on xanthate pyrolyses than acetate pyrolyses. The preparation of the xanthate of *trans*-4-*t*-butylcyclohexylcarbinol has been accomplished, but the *cis* alcohol apparently undergoes isomerization to the *trans* form under the conditions of the xanthate preparation. Experiments related to this isomerization will be discussed. Initial studies on the decomposition of these xanthates by differential thermal analysis will be reported. Finally, problems in the preparation of *cis*- and *trans*-1-methyl-4-*t*-butylcyclohexanol and the corresponding xanthates will be discussed, with particular attention being given to the stereochemistry of nucleophilic addition to 4-*t*-butylcyclohexanone.

Niobium Bromo Complexes in Hydrobromic Acid Solutions

Margaret Jackson and James E. Land
Department of Chemistry, Auburn University

By means of ultraviolet spectra the niobium bromo complex species formed when diniobium pentoxide is dissolved in 13 M hydrobromic acid solutions have been determined and their stability measured as a function of the hydronium and bromide ion concentrations.

The Ultra-Violet Spectra of Some Quinoline Derivatives

Tak Jin Moon
Auburn University

The ultraviolet spectra of some of quinoline derivatives have been determined in 40 per cent ethyl alcohol. The orders of basic strength of the compounds are computed from the differences in intensities of the absorption maxima of solutions having different pH but constant ionic strength.

Based on electron densities at the nitrogen atom as influenced by the various substituents, the shifts in absorption maxima have been correlated with the basic strength in terms of pK_b values.

Transference Numbers in Aqueous NaCl and KCl at Elevated Temperatures

J. E. Smith, Jr., and E. B. Dismukes
Southern Research Institute

A moving-boundary method suitable for determining transference numbers in aqueous salt solutions at elevated temperatures and pressures is described. In this method, electrical-resistance effects are used to follow the displacement of a boundary between two salt solutions.

Cation transference numbers for 0.1N solutions of NaCl and KCl are presented in the range of temperatures from 15° to 125°C. For both salts, plots of the logarithm of the ratio of anion

transference number to cation transference number versus the reciprocal of the absolute temperature are linear. However, the slopes of the relationships are of opposite signs since the sodium ion transference number increases and the potassium ion transference number decreases as the temperature rises. Transference numbers at 100°C, obtained by interpolations of the experimental data, confirm previous estimates of transference numbers that were obtained by extrapolations of earlier data through a wide temperature range.

Evaluation of Factor V Activity and Absorption to Thrombocytes

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Studies were performed with the plasma of 40 patients with a prolonged prothrombin time for the evaluation of the labile factor and of its absorption to platelets. One-stage prothrombin time was chosen as being the diagnostic test in cases of bleeding tendency because of defects in step three of the clotting process or step of thrombin generation. Since one-stage prothrombin time is prolonged by a deficiency of any of the four factors, prothrombin, factor V (labile), factor VII (stable), and factor X, in all cases a deficiency of factor VII and of factor X was ruled out using routine procedure. A moderate prothrombin deficiency was found in 33 cases. A one-stage prothrombin time repeated after incubation of the plasmas for 12 hours and for 24 hours at 37° C. resulted in definite information about lability and titer of factor five which can be expressed in percentage of normal values using standard curves of dilution. This procedure did not require separations, filtrations, precipitations, or any additions to the usual clotting system of the one-stage prothrombin time determinations.

Experiments of incubation with and without platelets indicated that the residual labile factor at the end of 24-hour incubation is almost entirely absorbed to the thrombocytes so that uncontrolled partial removal of them may constitute a source of variable error when determining the prothrombin time after incubation. It was concluded that under these experimental conditions the one-stage prothrombin time resulted to be a useful procedure for the evaluation of minor and not easily detectable defects of the labile factor.

Biology

A Reason for Eventual Failure of Antileukemic Agents Against Experimental Mouse Leukemia

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A quantitative bioassay for L1210 leukemia cells in mouse tissues and fluids has been developed in our laboratories [Cancer Research 21 (9) pp 1154-64, 1961]. There is a direct relationship between the number of leukemic cells inoculated into appropriate inbred mice and their respective life spans.

The usual experimental inoculum of L1210 leukemic cells (1×10^5 to 1×10^6) given intraperitoneally in mice will uniformly kill the animals in six to eight days. Leukemic cells have been shown to be remarkably stable when held *in vitro* at body temperature if suspended in cell-free ascites fluid. After an initial lag period of about two days, intraperitoneally inoculated leukemic cells are detectable by bioassay methods in various tissues of the host, including the brain. The rate of appearance in the brain appears to be associated with the size of inoculum employed.

If treatment is began 24 hours after leukemic implantation, Amethopterin (an antimetabolite of folic acid) will effectively increase average life span of these animals to greater than 100 per cent above untreated controls. If, however, treatment is delayed until intracerebral infiltration has occurred, only slight life span increases are observed. In addition, if as few as 100-1,000 cells are inoculated intracerebrally and intraperitoneal therapy is begun 24 hours later, Amethopterin (and other agents which uniformly markedly increase life span if the leukemic cells are inoculated intraperitoneally or intravenously) fail to show significant life span increase in the mice so inoculated. The ultimate failure of presently known antileukemic agents to cure may be related to the inability of these agents to cross the so-called "blood brain barrier," thereby leaving growing (enlarging) foci of leukemic cells in the brain which are unaffected by antileukemic drugs and which ultimately are the cause of death (menigeal leukemia) even if the peripheral blood picture does not show leukemic cells.

"Blotched Leaf" Gene on Chromosome 2 in *Zea mays*

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A recessive gene causing a yellowish blotching effect on the leaves of some lines of *Zea mays* was located on the short arm of chromosome 2 by linkage tests with a series of chromosomal interchanges. The blotched leaf gene showed linkage with $21.3 \pm 2.64\%$ recombination with T 2-9c (break point 2S.49 and 9S.33). It also showed linkage with the B factor in the short arm of chromosome 2 with $22.9 \pm 4.89\%$ recombination. The expression of the blotching gene was variable, ranging from a few very small spots on some plants to large areas that cover most of the leaves on other plants. The spots usually developed in the later stages of growth of the corn plant, attaining maximum development shortly before maturity. Although the yellowish areas eventually became necrotic, the spots were different from those produced by leaf-spot fungi.

Effects of Adrenalectomy and Adrenergic Blockade Upon the Cold-Stressed Rat

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This investigation was devised to clarify the degree of protection against cold-stress provided by the cortical steroids on one hand and the sympathetic division of the autonomic nervous system of the other. After certain preliminary studies were conducted, 124 thirty- to forty-day-old male rats of the Holtzman strain were used in three main investigations: (1) adrenalectomy plus cortisone acetate, (2) adrenalectomy plus adrenergic blockage, and (3) adrenalectomy plus adrenergic blockade and cortisone acetate. The parameters studied were survival time and colonic cooling rate post cold-stress.

The experimental design called for one adrenalectomized control, one sham, and five adrenalectomized, treated rats to comprise such experimental group. Twenty-four hours after surgery the rats were treated, colonic temperatures were taken, and the rats were placed under cold-stress of zero to 10° C. Temperatures of the rats were then taken at half-hour intervals until death occurred.

The rats receiving $10 \mu\text{g}$. cortisone acetate showed an average increase in survival time above the controls of 0.4 hour which in-

licated this dosage had only a slight effect on temperature homeostasis. However, there was a noticeable decrease in the colonic cooling rate because of the hormonal supplement. In animals in which the sympathetic nervous system was blocked by 5 mg. promazine hydrochloride per 100 grams body weight, a greatly increased colonic cooling rate ensued, resulting in a decrease of 1.6 hours in the survival time of these animals as compared with the untreated controls. All control of temperature regulation seemed to be lost. The animals which received both the adrenergic blockade and the cortisone acetate demonstrated a slight decrease in their colonic cooling rates as compared with the adrenergic blockade group. The cortisone-supplemented animals also showed an increase in survival time beyond that demonstrated by the adrenergic blockade group; however, the supplement was not sufficient to completely nullify the effect of the sympathetic blockade on the survival time.

A Comparison of Various Methods of Delaying the Onset of Maturity in Domestic Fowls

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It is generally accepted that it is undesirable to incubate small eggs which are produced immediately after the bird matures under normal conditions. Little information is available concerning reducing the numbers of small eggs by delaying the onset of maturity in meat-type breeders which predominate in Alabama. An experiment was, therefore, designed to investigate the effects upon meat-type breeders of the more successful methods of delaying maturity with layers (declining light, gross feed, and protein restriction).

Five treatments, each with two replicates of 25 females and two male Pilch strain White Rock broiler breeders, were used in this study. The fall-hatched chicks were raised to eight weeks of age in one group and then allocated at random within sex to each replicate. The five following treatments designed to delay maturity were applied when the birds were 8-26 weeks of age: (1) 12 hours of light, 77% feed intake; (2) declining light, 77% feed intake; (3) 12 hours of light, *ad lib.* feed, water restriction from 8 a.m. to 4 p.m.; (4) 12 hours of light, *ad lib.* feed, protein restriction; (5) declining light, *ad lib.* feed, protein restriction. After 26 weeks of age all birds received the same management. Data for egg production, mortality, body weight, age of maturity, and fertility and hatchability were collected.

No cannibalism because of gross feed restriction was detected. Water restriction was compensated by more drinking at night. Birds receiving low protein diets compensated by eating more feed. There were no significant differences between treatments for mortality, fertility, and hatchability. Birds receiving declining light and protein restriction had significantly lower body weights at the end of the experiment. Feed efficiency (lb. feed/doz. eggs) was best for treatments 1 and 5 and poorest for treatment 4.

Gross feed restriction was the best overall method of delaying maturity in meat-type breeders. Light restriction was also successful, but protein restriction was the least desirable. It is possible that water restriction would be more effective during the summer or during the winter if it were more prolonged.

Evapo-Transpiration of Pot Mums

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This experiment was conducted to determine the influence of several environmental factors on the evapo-transpiration of pot mums, variety Bonnaffon Deluxe. The factors studied were light intensity, duration, and humidity.

The data showed that both light energy and humidity were very important in determining the amount of water lost by a plant, pot, and soil system. Light energy was directly correlated with the average evapo-transpiration and the amount of water lost by black and white atmometers. The amount of water lost by evapo-transpiration was also correlated with the water lost by white and black atmometers. There was no increase in precision in determining the amount of evapo-transpiration by the use of both light and humidity measurements.

The Effects of Hybridization on the Histogenesis of Gonads in Hyloid Treefrogs

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An attempt was made to show the effects of hybridization on the histogenesis of gonads in varying stages of development between closely and distantly related species of treefrogs of the genus *Hyla*. Special emphasis was placed on the occurrence and degree of gametogenesis.

Crosses were made artificially by stripping ripe ova directly into sperm suspensions. Thin sections (10 microns) of gonadal tissue of the F₁ generation were stained with Harris hematoxylin and eosin for histological study.

Secondary sex characters confirmed by histological sections of gonads of the more distantly related hybrids showed a definite imbalance toward the male in the sex ratio. The same information from more closely related species of hylid treefrogs followed the expected 1:1 sex ratio. A decrease, or more commonly, the absence of gametogenesis in the distantly related hybrids was the rule. Gametogenesis in hybrids between the more closely related species appeared to be normal.

Studies of Radiation Effects on Plant Communities

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Over the past seven years a series of studies of the effects of radiation on plant communities at the Georgia Nuclear Laboratory and the Emory University radiation facilities has revealed the following observations: (1) Elimination of some species and increase in the significance of others because of differential sensitivity to radiation; (2) Changes in the physiological tolerances of irradiated plants to environmental extremes; (3) Extreme sensitivity of loblolly pine to radiation. (4) Physiological stimulation of some plants by low levels of radiation; (5) Upsets in some successional patterns with pioneer species elimination, but change in old field succession primarily limited to shifts in dominance to more radiation resistant species; (6) Early leaf fall by deciduous trees. (7) Delay in breaking winter dormancy; (8) Elimination of the overstory canopy in a mixed pine-hardwood stand with attending changes in the environment of the forbe community, and invasion into the area by different species; (9) Changes in the growth patterns of tree because of death of terminal buds and release of lateral buds which were dormant for many years.; (10) Recovery of woody communities by sprouting at the base of dead boles.

The Effects of Monoamine Oxidase Inhibition and Serotonin Blockade Upon Duodenal Motility

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Two studies have been made in the quest for new knowledge of the role that 5-hydroxytryptamine may play in normal intestinal function. In the physiological assay phase of the investigation, the amine oxidase inhibitor, *Marplan** (Isocarboxazid) and the tranquilizer, *Serpacil* (reserpine) were administered. The motility of the perfused duodenum was then studied under controlled conditions. In nine experiments with 134 male and female Holtzman albino rats, motility records were made and the data analyzed with a polar planimeter. Considerable variability and differences in activity between the sexes were evident following drug administration. When *Marplan* was given without reserpine, there was a contractility increase that was significantly greater in the male rat. When both drugs were given, contractility was greater in the female rat. Consistently high mean planimeter readings were obtained when *Marplan* alone was administered to the animals, indicating this drug to be very efficient as an amine oxidase inhibitor. The increased contractility, per se, was postulated to result from 5-HT, which upon being released by reserpine and protected by *Marplan*, then exerted its effect on the smooth muscle of the intestine. Fluorometric and chromatographic studies, now under way, will test this postulate.

The pharmacological, or drug blockade phase of this investigation was devoted to assays using atropine and dibenzylamine. This was an attempt to separate and clarify 5-HT receptors thought to exist in the gut. These were considered as perhaps similar to the α -constrictor and β -dilator receptors which have been verified in the splenic arterioles. The duodenums from 95 female rats were perfused after *Marplan* and the blocking drug had been administered. Results showed decreased intestinal motility with both drugs. Dibenzylamine caused a pronounced decrease in contractility as well as a definite vaso-dilation of duodenal arterioles. Atropine, though showing a much wider range of activity, gave indications of a cholinergic-like blockade.

However presumptuous it might seem at present, to pin-point 5-HT receptor sites in the gut, the results in support of the postulate

**Marplan* (Isocarboxazid) supplied through the courtesy of Dr. Donald B. Clark of Roche Laboratories, Nutley, N. J.

that there are certain drug-specific receptors in the gut wall musculature are encouraging.

Effect of Gibberellic Acid on Flowering of *Camellia japonica*

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This study was conducted during the fall of 1963 on the influence of method of application of Gibberellic Acid on the time of flowering of twelve varieties of *Camellia japonica*. The plants, growing outdoors in partial shade at Auburn, Alabama, were four- to ten-year-old grafts. The varieties selected were: Alba Plena, Lady Claire, Purple Dawn, Duchess of Sutherland, Pink Star, H. A. Downing, Dr. Tinsley, Adm. Nimitz, Victor Emmanuel, Donkelarii, Betty Sheffield, and Marjorie Magnificent. All treatments were applied on the same plant.

Flowering of *Camellia japonica* was hastened by the use of a 1% Gibberellic Acid solution. This was more effective than a paste formulation of 1% Gibberellic Acid in lanolin. Only the treatments containing GA₃ induced early flowering. Treated flower buds produced larger flowers than non-treated buds. Treated flowers remained on the branch longer than non-treated buds.

Effectiveness of Erythrocyte Antigens in Certain Wild Aves

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Howard College

A preliminary study of the blood in wild avian populations revealed the presence of an ABO-like Blood Group in some species but not in others (Norris, R. A. Bull. Tall. Timbers. Res. Station 4: 1-71. 1963). Inasmuch as that initial research represented an exploratory survey of several blood groupings, the number of individuals tested for some species was small. Thus more analyses were needed to delineate the distribution of blood types and to provide as complete an account as possible for all species. This report adds further evidence of both intraspecific and interspecific

variations in blood types. An attempt was also made to determine the potency of red cell antigens and to relate their appearance with age and with sex.

Tests for agglutination involved mixing centrifuged red cells with commercial human antisera A and B or with inactivated normal O-type human sera. When reactions occurred, each was assigned to a specific index (0.5-5.0) ranging from weak to complete based on the degree of clumping.

Results in the present study for AB-typing were evaluated from four nonpasserine and 24 passerine species. Comparison of data obtained in the present study and that of the aforementioned study showed several differences. For nonpasserines, the Yellow-billed Cuckoo previously considered only as O-type was typed as AB. For passerines, heretofore undetermined antigenic diversity occurred in the White-breasted Nuthatch, type A, and the Northern Waterthrush, type AB. A lack of agglutinability (O-type) was found for the Carolina Wren, the Starling, the Brown-headed Cowbird, the Rufous-sided Towhee, and the Field Sparrow. These data provided evidence of geographic variation in these species.

In certain species, age proved to be an important factor in the designation of blood types and also strength of agglutination. Extensive tests on House Sparrows showed that antigen-A appears with enough potency to react by 31-49 days posthatching while antigen-B appears by 80 days. Reactive strength for this species increased as the birds aged to 181-221 days. Evidence for immature agglutinability in Mourning Dove, Hooded Warbler, Rufous-sided Towhee, Indigo Bunting, American Goldfinch, Field Sparrow and Swamp Sparrow was also found. Thus, before a specific blood type is considered typical for a species, chronological age must be determined.

Serological tests with O-type sera showed that variability occurs in the strength of antigens in certain species. Forty-nine female and 95 male House Sparrows typed in 246 tests showed sexual dimorphism; females had higher antigen loads than males. Such data negated the belief that males possessed higher loads than females and suggest that sexual differences result from interindividual dissimilarities since all specimens typed herein are approximately the same age.

Mortality of the Little Blue Heron

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Mortality of the Little Blue Heron, *Florida caerulea*, as portrayed in this paper was based on the analysis of the records of recoveries of nestlings banded by the writer and others in Alabama, Mississippi, Oklahoma, South Carolina, Texas, Florida, New Jersey, Louisiana and Delaware.

The analysis of the 282 recoveries showed the greatest age category to be 12-13 years. The greatest mortality occurred during the first year when 70 per cent of the banded young died.

Response of Six Shrub Species to Contrasting Light Regimes in Two Controlled-environment Rooms

Donald W. Davidson

University of Alabama

The order of the six dominant shrub species (*Lindera benzoin*, *Hamamelis virginiana*, *Viburnum acerifolium*, *Kalmia latifolia*, *Vaccinium vacillans*, and *Gaylussacia baccata*) which was used in the construction of a vegetational continuum from the forests of northern New Jersey served as a basis for studies to determine the relative response of these species under two contrasting light regimes (one representative of an open pine forest, the other of a closed oak forest). Two walk-in growth chambers were programmed to simulate the conditions in these two forest types. Replicates of the six species were placed in the two chambers with light intensity as the variable, and length of day, temperature, and relative humidity as constant factors. Based on leaf area measurements (through weight), terminal elongation of leader shoots, and overall responses of the plants, the growth of these six species under the specified conditions in general supported the order in which they had been placed for construction of the shrub continuum.

Overwintering Depth Distribution of Root-Knot Nematodes in the Soil

Ralph E. Motsinger
Auburn University

Field studies of root-knot nematode depth distribution around individual okra plants (*Hibiscus esculentus* L.) were conducted to aid in establishing better sampling procedures. The studies were conducted in concrete bins, 9 by 15 ft., containing a sandy-loam soil previously inoculated with *Meloidogyne incognita* (Kofoid and White, 1919) Chitwood, 1949.

Monthly sampling for depth distribution of root-knot nematodes began in October, 1962 and continued through April, 1963. Initially 10 plants were randomly selected for sampling, and the number was increased to 16 beginning in February. Cores of soil were taken within a six-inch radius of each plant at successive three-inch depth-increments to 18 inches. One sample, a composite of four cores of soil, was taken for each three-inch depth-increment. The sampling procedure used allowed samples to be taken equidistant from the same individual plant sites each month of the test. The root-knot population of each sample was determined by bio-assay procedures using tomato (*Lycopersicon esculentum* Mill.) as the indicator plant.

Samples taken to a depth of nine inches included the region of maximum root-knot nematode infestation in all months of the study. The severe winter of 1962-63 eliminated root-knot nematodes in the top three inches and reduced them to a very low number in the three- to six-inch depth. Below six inches, low temperatures seemed to have little effect on the total root-knot nematode population. It was concluded that soil samples should be taken to at least a depth of nine inches for determining the root-knot nematode population.

A Comparison of the Drug Response of Some Experimental Animal Tumors and Certain Classes of Human Cancer

Jack H. Moore
Southern Research Institute

Certain classes of drugs are useful, temporarily, in the treatment of some chronic and acute leukemias and a small number of other

types of human cancer. There is evidence (Part I, Cancer Chemotherapy Reports 17: 1-143, 1962) that some experimental animal tumor screening systems will select classes of these drugs. A comparison of the drug sensitivity of certain "human" and "animal" neoplasms will be presented.

Differences in Levels of Volatile Fatty Acids in Rumen Fluid from Cows Grazing Coastal Bermudagrass and Millet

James W. Huff
Auburn University

A study was made to determine (a) the effect of treatment on rumen metabolism (b) changes in rumen metabolism during the day, and (c) changes in rumen metabolism from week to week.

Each experimental treatment, millet clipped at twelve inches and Coastal bermudagrass clipped at four and eight inches, was grazed by six lactating dairy cows. Rumen fluid was collected at 5 a.m. and 1 p.m. on the fourth day and at 9 a.m. and 5 p.m. on the fifth day of each of the three experimental weeks. The molar percentages of acetic, propionic and butyric acids in the rumen fluid were determined by column chromatography.

The mean molar percent of propionic acid in rumen fluid by pastures was millet 24.3, 4" Coastal 25.1, and 8" Coastal 21.9, and the least significant range ($P < 0.05$) was 3.2. Molar percentages of acetic and butyric acids were not affected ($P > 0.05$) by pasture grazed. Samples collected at 1 p.m. had a higher molar percent of acetic acid, and lower molar percentages of propionic and butyric acids than samples collected at one of the other three collections ($P < 0.05$). Acetic acid was higher and propionic acid was lower ($P < 0.05$) during the first week than during subsequent weeks, thus indicating a change in pasture quality.

Influence of a Strontium Replacement for Calcium on the Development of Gametophytes of *Woodsia obtusa* (Spreng.) Torr.

Abbie Lou Bryan and Joseph C. O'Kelley
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Spores of *Woodsia obtusa* were sown on nutrient solutions with differing levels of Ca as CaCl_2 . Three solution series were used:

one with 25 mg/liter CaCl_2 replaced stepwise with a molar equivalent of SrCl_2 ; a second with the CaCl_2 replaced similarly with an equivalent of NaCl ; the third with no CaCl_2 and a molar equivalent of SrCl_2 replaced stepwise with NaCl .

There was evidence of vegetative growth impairment in low Ca solutions at 29 days; width of gametophyte was more affected than length.

Antheridia and archegonia developed later on gametophytes at nutrient CaCl_2 levels from 25 down to 20 mg/liter in the absence of Sr but not at lower levels; in the presence of Sr, they developed at Ca levels of 25 down to 2.5 mg/liter CaCl_2 . Both sex organs failed to develop in nutrient solutions without Ca, except in a Sr-containing solution with Sr equivalent to 12.5 mg/liter CaCl_2 .

Fertilization, as evidenced by development of sporophytes on 109-day-old gametophytes, occurred only in solutions with high levels of Ca, 25 and 20 mg/liter CaCl_2 , in the absence of Sr. When Sr replaced the missing Ca, sporophytes developed in all solutions at CaCl_2 levels from 25 to 2.5 mg/liter. No sporophytes developed when no Ca was supplied, regardless of the Sr concentration.

This research was supported in part by Grant AM-03680-04 NTN from the National Institute of Arthritis and Metabolic Diseases.

Thermogenesis of Adrenal Hormones in the White Rat

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The purpose of this investigation thus far has been to determine the protective action of adrenal hormones, particularly the adrenal corticoids, on adrenalectomized animals subjected to cold-stress. This initial phase was prerequisite to further investigation which will involve the interrelation of the thyroid and adrenal glands in thermogenesis, and finally the mechanism of action of the hormonal involvement in thermogenesis. Thus far, two hundred thirteen 25- to 35-day-old male rats of the Holtzman strain have been used.

These experiments consisted of the administration of each of six hormones following adrenalectomy. These were: Cortisone, Epinephrine, Cortisol, Corticosterone, Deoxycorticosterone, and Aldosterone.

The experimental groups contained one non-operated control,

one sham adrenalectomized, one non-injected adrenalectomized, and four to five injected adrenalectomized rats. Twenty-six hours after adrenalectomy, initial colonic temperatures were taken. Thereafter, the rats were injected intraperitoneally with one of the above hormones, placed under cold-stress of -4 degrees to $+3$ degrees C. and colonic temperatures taken at half-hour intervals until death of the non-injected control.

The results of this study, so far, are as follows: 10 ug. of Cortisone decreased the cooling rate over the non-injected adrenalectomized rat. Cortisol in 1 mg. doses also decreased the cooling rate of the adrenalectomized animal. Corticosterone is protective only when doses approach 1.5 mg. Doses of deoxycorticosterone as high as 4 mg. were ineffective in protecting the adrenalectomized rat against cold-stress.

Of the Adreno-medullary hormones, Epinehprine, so far, has given negative results.

The results on Aldosterone are not yet complete.

Preliminary Studies on the Electrophysiology of Taste in the Honeybee

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Medical College of the University of Alabama

Histological examination of the proboscis of the honeybee was performed to determine the optimum areas for placement of recording microelectrodes for the study of the mechanism of taste reception in the honeybee. The structures observed are discussed in terms of possible approaches to separating electrical signals generated by mechanical stimulation from those of taste. Although brain potentials have been observed, no electrical activity associated with taste has yet been recorded.

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