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RESEARCH IN PROGRESS  
JULY, 1927—JULY, 1928

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# RESEARCH IN PROGRESS

JULY, 1927—JULY, 1928

The interest with which the earlier numbers of RESEARCH IN PROGRESS have been received makes it a pleasure to present the eighth annual issue of this publication to those scholars and investigators who desire to follow the progress of research among the members of the faculty and graduate students of the University of North Carolina in the year ending July 1, 1928.

Credit for bringing together and editing the material in this pamphlet is due Dr. A. C. Howell, Assistant Dean of the Graduate School.

JAMES F. ROYSTER, *Dean.*

APPROPRIATIONS FROM THE ROCKEFELLER GRANT FOR PROMOTING  
SCIENTIFIC RESEARCH

PROJECT NUMBER	APPLICANT	SUBJECT	AMOUNT
28	Wilson, H. V.....	For the employment of a research assistant and technician for the advancement of his researches on sponges.....	\$1500.00
29	Wheeler, A. S.....	For the purchase of the following: 2 kilos of 2-bromocymene.....\$ 90.00 1 kilo of 2-aminocymene..... 110.00 To prepare juglone..... 100.00 Total.....	300.00
30	Stuhlman, Otto.....	For the following: (1) To employ an assistant to take the routine spectrograms in order to determine the calorescent spectrum of hiddenite during the period of June 15 to September 1, 1928.....\$250.00 (2) A general and systematic study of the emissions induced by x-radiation, heat and attrition of all available spodumens to determine if possible what impurities produce what type of luminescent emission bands. Crystals to be supplied by Dr. J. H. Pratt at cost.....25.00 1 Coolidge x-ray tube.....125.00 Total.....	400.00
		The above investigation is contingent upon the purchase of x-ray transformer and accessories by the Department of Physics to the extent of \$1500.	
31	Swartz, J. H.....	For a continuation of the studies of the Chattanooga shale and the Devonian and Mississippian of Tennessee and Virginia—travel, assistance, etc.....	345.00
32	Plyler, E. K.....	For the blowing of quartz tubes in order to study the effect of electron bombardment on the absorption bands in different gases.....\$100.00 For the purchase and preparation of crystals to continue the work on the infra-red absorption bands in crystals and the combination of their frequencies...\$150.00 Total.....	250.00
33	Beers, C. Dale.....	For the purchase of buffer solutions, colorimetric standards and pyrex glassware for use in the continuation of his work on the relation of the environment to various life processes in the ciliate infusoria.....	125.00
34	MacNider, W. deB.....	For material and technical assistance in the study of the kidney in the lower animals, marsupials and fish. This is a continuation of the investigation for which \$145 was appropriated to him last January 20th.	105.00

APPROPRIATIONS FROM THE ROCKEFELLER GRANT FOR PROMOTING  
SCIENTIFIC RESEARCH (Continued)

PROJECT NUMBER	APPLICANT	SUBJECT	AMOUNT
35	Couch, J. N.....	For the employment of an assistant to carry out experiments on Septobasidium diseases of trees during the latter half of the summer school session of 1928..	\$ 50.00
36	Coker, W. C.....	For the employment of an assistant during the academic year 1928-29 (nine months) to carry out systematic studies on the lower and higher fungi....	600.00
37	Dashiell, J. F.....	For the continuation of earlier researches on direction-orientation by the white rat: For housing animals.....\$180.00 Materials for maze..... 100.00 Observation post..... 10.00 Total.....	290.00
38	Brooks, F. P.....	To secure material for the preparation of cholesterol or cholesterol itself for the purpose of establishing its constitution and reactions. Recent studies of the vitamins have emphasized the presence of cholesterol in all tissues and have shown it and its isomers as probable sources of vitamin D, if not the vitamin itself.....	100.00
39	Crane, Harry W.....	For organizing and analyzing data already collected on free association reactions in human beings. This is a continuation of the work for which two preceding grants have been given Professor Crane.....	235.00
40	Coker, R. E.....	For the continuation of his work on the systematic and environmental relations of freshwater copepods: Equipment, including special glassware and calibrated thermometers.....\$ 75.00 Literature—special papers on copepods and environmental relations, not practicable to borrow..... 50.00 Assistance in preparation of material and drawing..... 125.00 Research associate for breeding copepods..... 250.00 Total.....	500.00
41	Prouty, W. F.....	For a continuation of his work in the investigation of the structure and stratigraphy of the Triassic sediments of the Triassic basins in North Carolina.....	200.00
		Grand total.....	\$5000.00

APPROPRIATIONS GRANTED FROM THE SMITH RESEARCH FUND AND THE  
FACULTY RESEARCH FUND

PROJECT NUMBER	APPLICANT	SUBJECT	AMOUNT
78	MacNider.....	Traveling expenses for research work in the Library of the Surgeon-General, Washington, D. C.....	\$ 35.00
79	Royster.....	Photostating Thos. Morell's edition of Chaucer, in part; Lansdowne MSS. 771 and 772, and 677, British Museum.....	165.00
80	MacMillan and Jones..	Photostat copies of the first editions of certain eighteenth century plays.....	100.00
81	Plyler.....	Traveling expenses to the University of Michigan to complete studies concerning some new bands in the infra-red spectra of calcium carbonate.....	130.00
82	Willard.....	Photostating certain documents in connection with doctoral dissertation on the political views of Seneca.	8.00
83	Holmes.....	Traveling expenses to Cambridge to consult books on Du Bartas necessary to his edition of the text.....	75.00
84	Totten and Kyser....	For continuation of their work on <i>Mentha citrata</i> .....	50.00
85	Griffin.....	Traveling expenses to the Linguistic Institute at Yale and to Princeton for research work in connection with doctoral dissertation on the administration of the Roman Province of Cappadocia.....	100.00
86	Howell, E. V.....	For traveling expenses and photostatic work in connection with his projected life of Henry Harrisse....	125.00
87	Jones.....	Traveling expenses to and from Charleston in connection with his research in French influences in America.	50.00
88	Horner.....	Traveling expenses to and from Washington, D. C., for research work in the Library of Congress.....	35.00
89	Robson.....	To purchase rare books needful to him in preparation of doctoral dissertation on the influence of Germany on American political thought.....	50.00
90	Taylor.....	For investigations undertaken at the British Museum..	250.00
91	Barker.....	Photostating and purchase of rare books relating to life and works of Henri Beyle.....	75.00
92	Harland.....	To illustrate a monograph on "Aegean Influence in Sicily in the Bronze Age.".....	40.00
93	Hickerson.....	To cover necessary expenses in connection with derivation, calculation, and tabulation of moments and shears at all critical sections in continuous beam construction.....	75.00
94	Couch.....	Traveling expenses for collecting trip for fungi parasitic on trees and shrubs.....	60.00

## DEPARTMENT OF ANATOMY

W. C. GEORGE is continuing his comparative study of the blood of the lower chordates. In addition, the following studies are to be reported:

An Exhibit of Human Embryology, consisting of whole embryos, serial sections, figures and models illustrating the early stages in human development. Presented before the North Carolina Academy of Science, Chapel Hill, N. C., April 27-29, 1928.

The Somatic Chromosomes of the Opossum (in collaboration with DR. W. E. HOY, JR., of the Presbyterian College of South Carolina). In press.

There are eleven pairs of chromosomes in the somatic cells of the opossum.

The chromosomal complex of the male opossum is made up of six macrochromosomes, fourteen mesochromosomes, one x- and one y-chromosome, which are the smallest.

The chromosomal complex of the female opossum is made up of six macrochromosomes, fourteen mesochromosomes, and two x-chromosomes, which are the smallest.

One pair of macrochromosomes in both the male and the female complex is larger than the other two pairs. The mesochromosome pairs show a gradual decrease in size down to the seventh pair.

The number and type of the chromosomes is constant in all the somatic cells studied, which include glomerular, connective tissue, and epithelial cells of the kidney, cells in the tunica fibrosa of the kidney, epithelial cells of the adrenal, cells in the cerebrum, connective tissue cells of the intestine, epithelial cells of the intestinal glands, epithelial cells of the lung, hepatic cells, pancreatic cells, connective tissue cells of the pancreas, splenic cells, cells of the thymus, and cells from the tunica externa of the arteries.

In equatorial plates of all somatic cells the invariable arrangement of the chromosomes is that of an autosomal ring surrounding the two x-chromosomes or the x- and y-chromosomes. Thus the sex of the individual from which the preparation was made can be determined at a glance.

One dividing giant cell of the spleen showed an 8n number of chromosomes.

Evidence seems to suggest the possibility of a daily or diurnal rhythm of mitosis.

## DEPARTMENT OF BOTANY

W. C. COKER has completed during the year the following:

New or Noteworthy Basidiomycetes. *Journal of the Elisha Mitchell Scientific Society*, XLIII: 129. 1927.

This paper continues the work on miscellaneous Basidiomycetes and describes five new species, *Cyphella spiralis*, *Cyphella Tsugae*, *Craterellus albo-*

*marginatus*, *Amanita Gwyniana*, and *Amanita Roanokensis*. *Aleurodiscus apiculatus* is reported for the first time from the American continent, the only other records being from the West Indies. A sclerotium of *Poria Cocos* is shown, of record size (22¾ pounds) and from a new host, the roots of red cedar. *Polyporus umbellatus* is reported for the first time in America south of Ohio. *Polyporus holocyaneus* and *Hygrophorus minutulus* are reported, each for the first time since the type collections.

Variation in our Native Ornamental Flowering Trees. Presented before the North Carolina Academy of Science, Chapel Hill, N. C., April 28, 1928.

Attention was called to the great variation in both color and size in flowers of native dogwood (*Cornus florida*) in Chapel Hill. Forms occur from pure white to deep reddish pink. River plum (*Prunus americana*) has individuals here that are far more showy in flower than the type. One of these has flowers in large dense clusters reminding one of a delicate snowball; others may be light pink and very floriferous, giving an effect equal to that of the finest Japanese cherries. Many variations occur in the leaves of the evergreens, *Magnolia grandiflora* and the common holly, and the latter may have yellow berries instead of red.

W. C. COKER and JOHN N. COUCH. The Gasteromycetes of the Eastern United States and Canada.

A systematic and morphological study of all known species of Gasteromycetes of Eastern North America. Photographs and microscopic details are given for nearly all species, and in the majority of cases the studies were made from living material. A number of new species are described, mostly from the subterranean group.

Volume 8" x 11", with 197 pages, 73 photogelatine plates, 29 half tones and 18 zinc line drawings.

H. R. TOTTEN has carried on the following experiments:

Cultivation of Mushrooms.

A series of experiments is in progress on the cultivation of mushrooms. Three of the most commonly planted American spawn mushrooms have been tested with manure from stables littered with pine straw and from stables littered with wheat straw and with different methods of composting the manure. It is also contemplated to cultivate some of the choice wild mushrooms.

H. R. TOTTEN and E. V. KYSER. The Cultivation of *Mentha arvensis* (Japanese Mint) at Chapel Hill, and a Study of the Oil.

A very small plot of the mint was set last year with plants obtained from the Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C. The area was not sufficient to determine the yield of oil

on an acreage basis. The dried herb yielded 0.82 per cent of oil. The analysis of the oil showed 4.46 per cent total menthol. The quantity of the oil was too small to obtain the data on the physical constants. The survey which is made possible by a grant from the research fund administered by the Graduate School of the University will be continued over a three-year period.

H. R. TOTTEN and E. V. KYSER. The Cultivation of *Mentha citrata* (Bergamot Mint) in North Carolina. Presented before the North Carolina Academy of Science, April 28, 1928.

A three-year survey has been made of the cultivation of bergamot mint at Chapel Hill. The problem has been considered with the idea of determining the advisability of planting bergamot mint as an agricultural crop. A wild form of escaped mint has been cultivated along with the cultivated variety under the same conditions. The results have been as follows: the wild herb yields 0.1 per cent oil, the cultivated form 0.148 per cent oil. The distilled oils from three forms are comparatively the same in chemical composition. A typical analysis of the oil is as follows: color, water white; acid number, 0.35; saponification number, 141.17; acetalization number, 188.30; free linalool, 16.89 per cent; combined linalool, 43.42 per cent; total linalool, 60.31 per cent; specific gravity at 20° C, 0.9033; index of refraction at 20° C, 1.4580; angle of rotation, -8.50°; soluble in 70 per cent alcohol, 1 in 2 volumes of alcohol.

The acreage under cultivation has not been sufficiently large to determine satisfactorily the amount of oil which may be obtainable; however, experiments which are being carried on this year on larger plots should give somewhat conclusive information relative to the yield of herb and oil per acre.

This project is made possible by a grant from the research fund administered by the Graduate School of the University. The complete paper will be published in an early number of the *Journal of the Elisha Mitchell Scientific Society*.

J. N. COUCH has made the following investigation:

In a paper soon to be published detailed results are reported of descriptive and physiological studies on *Septobasidium*, a cosmopolitan genus of fungi living on woody plants, many of which are of economic importance. A number of species which have not previously been observed are described. The development of several forms has been worked out in considerable detail, bringing out several facts which lend support to the theory that *Septobasidium* is related on the one hand to the rust fungi and on the other to the *Hymenomyces*.

Of much greater interest and importance are the results obtained from physiological studies and observations. It has been found by previous observers since 1907 that nearly all species of *Septobasidium* are associated with scale insects which are found in considerable abundance underneath the fungus. It has been claimed by other observers: (1) that the fungus lives on colonies of

scale insects overgrowing them and finally destroying them; (2) that the fungus generally inflicts no injury on the host plant.

The writer has found in the species investigated by him that both of these statements are wrong. As a result of studies in Jamaica and of a series of observations carried on from January of this year to the present time on several species which are abundant around Chapel Hill, it has been found that the scale insects and fungus live a mutual existence at the expense of the host plant. The fungus furnishes a home and protection for the scale insects. In some species this "fungus house" is specialized to a remarkably high degree of perfection and beauty. The scale insects, protected by the stroma of the fungus, suck the juice from the tree, grow, and finally reproduce their young, which crawl out toward the margin of the fungus, settle down in the little fungus houses which are already prepared for them, and repeat the cycle. The fungus-insect relationship is perennial, depending only upon the life of the tree.

In return for the home and protection furnished the insect by the fungus, the latter obtains a great part, if not all, of its nourishment from the excretions of the insects. The fungus forms a specialized pad, the "ceiling" of the fungus house which, as development proceeds, adheres closely to the very thin scale. This pad also extends underneath the scale and almost certainly serves as an absorbing apparatus for taking up the excretions of the insect.

Extensive observations have shown that the branches of trees badly infected with *Septobasidium* are unhealthy and usually die. Infected places usually become cracked, the cracks extending into the wood regions.

PAUL M. PATTERSON has published the following: Oogenesis in *Pythium torulosum*. *Journal of the Elisha Mitchell Scientific Society*, XLIII: 124. 1927.

This species recently described by Coker and Patterson in the same *Journal* is shown to have at maturity uninucleate eggs which are fertilized by a single male nucleus. There is very little periplasm.

## DEPARTMENT OF CHEMISTRY

R. W. BOST (Doctoral Dissertation, June, 1928). Para-Cymene Studies X. Para-Cymylene-2, 5-Diamine. (Under the direction of ALVIN S. WHEELER.)

Diazotized sulfanilic acid was coupled with 2-amino-p-cymene and the resulting dye reduced with stannous chloride. The amine was extracted with ether and hydrogen chloride passed into the ether solution, whereupon the dihydrochloride was obtained. The free base was isolated in a specially constructed apparatus in an atmosphere of nitrogen under reduced pressure. The amine is a light yellow solid, soluble in ether and alcohol. It can be precipi-

tated from ether solution by the addition of petroleum ether. It is very sensitive to air and light. The amine is very stable in the form of the dihydrochloride. It may be kept for months in this form without any apparent change.

The amino groups were proved to be in positions 2 and 5. First, coupling took place at position 5 according to analogous reactions. Second, the diacetyl compound agrees in melting point with that obtained from thymoquinonedioxime which melts at 260°. Third, the amine was converted into thymoquinone melting at 45°, thymoquinonemonoxime melting at 154-156°, and finally thymohydroquinone melting at 139°.

The amine is very reactive chemically. Oxidizing agents readily convert it into thymoquinone. Ferric chloride in the cold gives a quantitative yield of the quinone within fifteen minutes. Its reaction with inorganic and organic acids is almost instantaneous. It reacts with benzoic acid immediately to form a salt while neither aniline nor 2-amino-p-cymene gives any apparent reaction under the same conditions. Its picrate consists of golden yellow needles, melting at 207° with decomposition. Salts of para-cymylene-2, 5-diamine were made with the following acids: hydrochloric, hydrobromic, nitric, chloracetic, dichloroacetic, trichloroacetic, bromoacetic, benzene-sulfonic, benzoic, o-chlorbenzoic, 3, 5-dinitrobenzoic, and 2, 4, 6-trinitrobenzoic. The benzoyl derivative consists of fine white needles which melt at 280°.

Condensation products were made with the following substances: potassium sulfocyanate, potassium cyanate, carbon disulfide, formaldehyde and oxalic acid.

Three dyes of the Azine group belonging to the Euhrocin class were prepared by condensing the amine with the following compounds: p-nitroso-dimethyl aniline, p-nitroso-diethyl aniline and p-nitroso-phenol. These dyes were applied to cotton, wool and silk. They gave colors ranging from dark gray to purple.

A number of disazo dyes were prepared by adding the tetrazotized amine to the following phenols and amino sulfonic acids; resorcinol, 2-naphthol, 1-amino-4-benzene-sulfonic acid, 2-naphthol-3, 6-disulfonic acid, 1-naphthylamine-4-sulfonic acid, 2-thio-naphthol and thio-salicylic acid. These dyes gave very good shades of reds, browns, blues and yellows when applied to cotton, wool and silk. The substitution of sulfur for oxygen in the phenol has a hypsochromic effect.

CLAUDE ELLIS ANDING, JR. (Master's Thesis, 1928). Reduction of Dinitro-p-cymene and the Action of Aldehydes on Metadiamines, particularly Cymylene-2, 6-Diamine. (Under the direction of ALVIN S. WHEELER.)

The reduction of dinitro-cymene was first carried out by Alfthan and improved by Wheeler and Jennings. Attempts to duplicate the method of Wheeler and Jennings failed and a different method of reduction was worked out. The dinitro compound was reduced with tin and hydrochloric acid, and the diamine was recovered as the hydrochloride by precipitating the tin with hydrogen sulfide and evaporating the liquor to a small volume, or by making

the acid mixture alkaline and extracting the diamine with ether. Yield: 93 per cent of the theoretical by the latter method of extraction.

It was discovered upon investigation of the literature that very little is definitely known about the action of aldehydes on diamines, and there is evidence of conflicting views. Cymylene-diamine was treated with benzaldehyde, acetaldehyde, and chloral. In the first two cases resinous products were obtained; in the latter a white solid of microscopic crystals, m.p. 103-105° C. The benzaldehyde compound was not investigated; the acetaldehyde product agreed in properties and analysis with a typical condensation product; the compound formed by chloral was not identified, although there is evidence of one mol of chloral having condensed with two mols of diamine, with the elimination of water.

The following conclusions were reached:

1. An improved method is given for the reduction of dinitro-cymene.
2. Need is shown for further investigation of the action of aldehydes on diamines.
3. Three types of reactions are suggested: addition, condensation of one mol of aldehyde with two mols of diamine, or condensation of two mols of aldehyde with one mol of diamine.

DAVID RAMSAY ERGLE (Master's Thesis, June, 1928). Juglone Studies. (Under the direction of ALVIN S. WHEELER.)

This investigation was undertaken to establish the constitution of tetrahydroxy-naphthalene, a derivative of tribromojuglone. The tetrahydroxy-naphthalene was prepared by Wheeler and Andrews, who called it 1, 4, 5, 8-tetrahydroxy-naphthalene. Dimroth and Ruck afterwards proved this formula to be incorrect relative to the position of the hydroxyl group at 8. Although the tetrahydroxy-naphthalene could not be prepared by the method of Wheeler and Andrews or by others, its constitution was established by the preparation of a pyridine salt of hydroxy-dibromojuglone, which possesses the hydroxyl group whose position in the phenol ring was unestablished. Pyridine possesses the peculiar and specific chemical property of reacting only with such hydroxyl groups in hydroxyquinones as stand para to one of both carbonyl groups. The formation of the pyridine salt showed the hydroxyl group in question to be in the 7th position; hence, the new and correct formula of the compound is 1, 4, 5, 7-tetrahydroxy-naphthalene.

Ammonium salts of tribromojuglone, hydroxy-dibromojuglone and tetrahydroxy-dibromo-naphthalene were prepared by the ammonolysis of their ether solutions with anhydrous ammonia gas. The method of preparation was easy and gave quantitative yields. Tribromojuglone gave a monoammonium salt while the other two compounds gave diammonium salts. The former salt is very unstable under normal atmospheric conditions, decomposing and reverting to tribromojuglone. The two latter salts are characterized by their stability; they do not melt below 300°. A disodium salt of hydroxy-dibromojuglone was prepared by the ether-sodium carbonate method. In chemical and most physical properties it is similar to the diammonium salts. The ammonium salts are

important because of the light which they shed upon the constitution of tri-bromojuglone. A tin salt of hydroxy-dibromojuglone was prepared by boiling under reflux for eight hours a sodium dried, benzene solution of the compound with the requisite amount of tin tetrachloride. All the compounds, whose preparation is mentioned herein, are new.

R. D. NORTON (Rockefeller Research Assistant). The Reaction between Acetylacetone and 4-Phenylsemicarbazide. (Under the direction of ALVIN S. WHEELER.)

When acetylacetone reacts with 4-phenylsemicarbazide in a cold alcoholic solution a pyrazole compound is formed. The product is 1-phenylcarbamyl-3, 5-dimethylpyrazole, a new compound, and its structure was proved by its action with hot absolute ethyl alcohol. When boiled with alcohol under reflux it hydrolyzes into 3, 5-dimethylpyrazole and phenyl urethane, which were identified by preparing known derivatives. The new product will react also with hot water, giving 3, 5-dimethylpyrazole, carbanilide, and carbon dioxide.

1-phenylcarbamyl-3, 5-dimethyl-4-bromopyrazole was prepared by brominating the pyrazole product in the cold with absolute methyl alcohol as a solvent. The bromo compound was hydrolyzed with hot water and a qualitative test made to determine which ring the bromine entered. It was found to be in the pyrazole ring.

R. E. THOMAS (Master's Thesis, 1928). Behavior of 5-Bromo-Meta-4-Xylidine. (Under the direction of ALVIN S. WHEELER.)

A convenient method for preparing 5-bromo-m-4-xylidine by bromination of m-4-xylidine in acetic acid was developed. The benzoyl derivative formed prismatic needles melting at 186°.

By means of the diazo reaction the corresponding xlenol was made, from which were gotten by synthesis with methyl and ethyl iodides the methyl and ethyl ethers, respectively.

From the diazonium chloride of the base the 4-chloro-5-bromo-m-xylene was gotten by the Gattermann reaction as a liquid b. 247-254°. The diazonium hydrogen sulfate with potassium cuprous cyanide yielded the nitrile, 5-bromo-1, 3-dimethylbenzonitrile-4, m. 86-87.°

Four azo compounds were prepared from the diazonium hydrogen sulfate of the base. Beta-naphthol formed bright red crystals, m. 136°; alpha-naphthol a dark red compound, m. 150°; resorcinol formed red crystals, m. 133°; phenol gave dark orange crystals, m. 166°. Many compounds of this type can probably be formed.

FRANK C. VILBRANDT. The Status of Chemical Industries in North Carolina in 1926. III. *Journal of the Elisha Mitchell Scientific Society*, XLIII: 55. 1927.

A statistical review of the development and progress in the chemical industries in North Carolina ending with 1926, showing the number of establish-

ments, capital investment, value of plants, value of products, wage earners, and wages earned. Each class of industries was discussed to show progress or retrogression that occurred in the biennial period since the last survey.

FRANK C. VILBRANDT. Process Piping for Chemical Laboratories. *Journal of Chemical Education*, June, 1928.

A description and some views are given of the installation of the process piping in Venable Laboratories, University of North Carolina, Chapel Hill, N. C. At no point is the piping below a point eight inches above the desk-top level, nor below the service outlets on each system. The main feed lines are carried at a seventeen foot level, supported on the cross-members of the bays, from which level risers drop to the service levels. The overhead piping system as outlined in the paper eliminates floor piping with resultant cleanliness of laboratory floors, permits ready detection of leaks and easy repair, eliminates loss of cupboard space, is easy to install, and is low in first cost.

FRANK C. VILBRANDT and W. C. HAMMOND, JR. Insulation for Refrigerators. *Journal of the Elisha Mitchell Scientific Society*, XLIII: 63. 1927.

A study of several types of insulating materials was made on a controllable refrigerator unit. The influence of the thickness of wall, condition of material, grade of material, and outside temperatures on the consumption of ice were studied, and the insulators ranked according to resultant efficiencies.

FRANK C. VILBRANDT and J. T. DOBBINS. New Chemical Fume Elimination System. *Journal of Chemical Education*, May, 1928.

A presentation of plans, views, calculation, installations and resultant success with the individual student desk canopy fume elimination system. Novelty of design and installation details permit easy, accessible, ready elimination of fumes, with no obstruction to light, ease in cleaning and repair, low initial cost and upkeep, and efficient service.

WILLIAM MILFORD LOFTON, JR. (Doctoral Dissertation, June, 1928). Emulsification of Tars and Asphalts. (Under the direction of FRANK C. VILBRANDT.)

The object of the present investigation is to make a study of the factors influencing the emulsification of bituminous materials in water with the water acting as the external phase, giving special study to the possibility of using the resulting emulsion as a road binding material. In carrying out the investigation, a preliminary study of typical methods proposed in the literature for the production of bituminous materials was made. The methods selected as being representative of the different theoretical principles involved and those which offered possibilities of being utilized in a practical way were those that had been proposed by Wallbaum, Kirschbraun, Van Westrum, Morrell, and

Reeve. The runs were made by using agitation speeds of 1000 R.P.M. and 1500 R.P.M., and running each of these speeds at 180° F and 212° F. After this study was completed, further attempts were made to ascertain the effect of changing the concentrations of the different ingredients, the effect of temperature, and the effect of the rate of agitation on the properties of the emulsions produced. These tests were made on seven samples of tars and asphalts whose consistencies ranged from that of very mobile tars to samples which were quite viscous. From the results of the experimental data obtained it is concluded:

1. That very unsatisfactory emulsions are produced by the use of the methods that have been proposed in the literature by some of the investigators in this field of colloidal chemistry.

2. The viscosity of the resulting emulsions produced by such methods is generally much greater than that of the original materials.

3. That the effect of temperature on the type of these emulsions is extraordinarily small.

4. That practically no change in the type of emulsion is made evident by changing the rate of agitation by the motor when using the formulas proposed in the literature.

5. That a method of preparing homogeneous emulsions of bituminous materials in water has been worked out, and such emulsions may be produced by use of sodium soap in conjunction with a definite ratio of oleic acid.

6. That this method may be applied to emulsify the more viscous tars, but it is not at all applicable to the very mobile samples.

7. That the presence of finely divided clay or similar material is essential to the existence of one-phase emulsions as produced by this method.

8. That better results on the penetration tests are obtained when using emulsions formed by the improved method than when using the original material.

9. That one-phase emulsions are not produced by this method when insoluble soaps are substituted for the soluble soaps.

HOWELL GRADY PICKETT (Doctoral Dissertation, June, 1928).  
The Sulfur Factor in the Synthetic Methanol Reaction. (Under the direction of FRANK C. VILBRANDT.)

The study of the sulfur factor in the synthetic methanol reaction was undertaken to determine what effect sulfur and sulfur-bearing compounds present in the water gas have upon the formation of methanol by hydrogenation.

Water gas consists chiefly of carbon monoxide and hydrogen and is made from bituminous coal. The coal carries varying amounts of sulfur, thus the commercial water gas is contaminated in a greater or lesser degree by sulfurized compounds. The hydrogen used in this work was prepared by the electrolytic process and was free from sulfur. The carbon monoxide was generated in the laboratory by two methods: viz., by dropping formic acid into hot orthophosphoric acid and passing the gas through a series of purifications, and

by an internal generating process, consisting of decomposing formic acid in a sealed vessel by heating.

The success of synthetic methanol production depends largely upon the presence of a catalyst. It has been found that a mixture of zinc oxide and chromium oxide is a select activating agent for the methanol synthesis. Such a catalyst was prepared and used in the hydrogenation experiments.

It is intimated in the literature on the subject that sulfur in the reacting gases hampers the formation of methanol. No quantitative proof was available.

Several experiments on the hydrogenation of carbon monoxide in the presence of zinc oxide and chromium oxide were carried out. The temperature of the hydrogenation was  $250^{\circ}$  C and the pressure within the reaction chamber four hundred and fifty pounds per square inch. The time of the reaction in each case was one hour and a half. The sulfur content of the reacting gases varied from no sulfur to five per cent sulfur. Analyses were made of the products in the reaction chamber after hydrogenation, and the effect of sulfur upon the reaction was noted.

It was concluded that:

1. Carbon monoxide can be readily generated by the thermal decomposition of formic acid, the decomposition products being equal volumes of carbon monoxide and water vapor.
2. Sulfur present in the reacting gases up to five per cent of the total volume does not act as a poison.
3. Sulfur in the reacting gases tends to accelerate the formation of oxygenated products of hydrocarbons of the methane series if the per cent of sulfur in the reaction chamber does not exceed five per cent of the total volume of the reacting gases.

FRED WEYMOUTH DAVIS (Master's Thesis, June, 1928). The Winning of Caesium from its Ore. (Under the direction of FRANK C. VILBRANDT.)

This investigation was carried out with the purpose of finding some method of obtaining caesium from its ore that would be more efficient than the prevailing methods.

The chloride and nitrate of caesium were first prepared from the silicate ore, pollucite, by the methods of H. L. Wells and O. D. Allen. Then an attempt was made to decompose the ore by the following methods: (1) fusing with sodium carbonate at  $800^{\circ}$  and  $1200^{\circ}$  C; (2) fusing with borax at  $900^{\circ}$  and  $1200^{\circ}$  C; (3) treating with magnesium powder as in the Goldschmidt Thermit process; (4) treating with sodium hydroxide; and (5) a new method of fusing with lead oxide at  $900^{\circ}$  C. Of these only the last mentioned method gave satisfactory results. After the decomposition of the silicate the caesium was precipitated by lead tetrachloride and chlorine. This method gave better results than either the method of Wells or that of Allen, the respective yields being: from the Wells method 10.52 gms. of  $\text{CsNO}_3$ ; from the Allen method 10.00 gms. of  $\text{CsCl}$ ; and from the new method 15.80 gms. of  $\text{CsCl}$ .

JAMES OLIVER DUNSTON (Master's Thesis, June, 1928). Color and Odor Constituents in Menhaden Oil. (Under the direction of FRANK C. VILBRANDT.)

Samples of fish oil were treated with the following reagents: sulfuric acid, benzenesulfonic acid, stearic acid, boric acid, hydrochloric acid, alum, alcohol, sodium carbonate, sodium bicarbonate, calcium hydroxide, filtrol, clay, sawdust, hydrogen, oxygen, and air. The temperatures used were 20° C, 100° C, 200° C under atmospheric pressure and vacuums of 25 and 15 inches mercury for periods of 4 and 8 hours. Samples of both raw and centrifuged oil were used in these tests.

The following conclusions were drawn:

*Hydrogen-ion concentration.* The intensity of the color varies directly as the hydrogen-ion concentration. The hydrogen-ion concentration has practically no effect on the odor. Sulfuric acid in small quantities tends to decrease the color.

*Absorbing agents.* Most absorbing agents slightly decrease the color and tend to decrease the odor but not in proportion to the amount of reagent used.

*Alkali.* Bicarbonate of soda seems to be the best decolorant, but saponification is produced on heating.

*Vacuum.* The odor is not affected by vacuum treatment. Therefore it must be somewhat fixed and has a great affinity for the oil.

*Centrifuging.* Centrifuging threw down the solid particles and slightly decreased the odor, the odoriferous substance tending to remain in solution in the oil.

*Gases.* Hydrogen, oxygen, and air, as applied here, had practically no effect on either the color or the odor.

*Heat.* The color varies directly as the intensity of the heat applied to it. Heat also changes the odor, which is not necessarily desirable.

*Semi-commercial Basis.* The same results were obtained on a semi-commercial basis as with the similar experiment on a small scale. Therefore the best reagent used is bicarbonate of soda and the temperature should not exceed 100° C. Vacuum need not be used. The oil may also be treated with sulfuric acid separately from the soda to assist in removing the odor.

ANDREW MURPHY (Master's Thesis, June, 1928). North Carolina Oil Shale Investigation. (Under the direction of FRANK C. VILBRANDT.)

Past investigations relative to the study of North Carolina shales have been confined to samples taken from the Deep River valley formation. The present investigation was undertaken for the purpose of continuing the study of North Carolina shales by examining samples from deposits other than Deep River valley. The examination of these samples included a study of the oil content and the determination of the nitrogen, phosphorus, and potassium content in order to evaluate them as fertilizers. Samples from the Deep River

valley were included in the fertilizer evaluation. The same samples used in the above investigations were used in the study of the effect of exposure to weather conditions on the oil, phosphorus, nitrogen, and potassium content.

The standard methods and apparatus devised by the Bureau of Mines were used in the determination of the oil content. In the fertilizer evaluation nitrogen was determined by the Kjeldahl method, phosphorus by the official volumetric A.O.A.C. method, and potassium gravimetrically by the perchloric acid method. The following results were obtained:

1. No yield of oil was obtained in the examination of the Dan River shales.
2. Exposure to weather conditions of some Deep River oil-bearing shales that were investigated showed no appreciable effect on the oil, nitrogen, phosphorus, or potassium content.
3. The amounts of ammonia and phosphorus that were found to be present were sufficiently large to make the samples useful as fertilizers. Only a trace of potassium was found in each sample.

GLADYS MORGAN (Master's Thesis, June, 1928). Two studies. (Under the direction of F. C. VILBRANDT.)

#### I. The Esterification of 3-5-Bibrom Anthranilic Acid.

The 3-5-bibrom anthranilic acid used in this investigation was prepared by direct bromination of anthranilic acid. The yield on this compound was increased to 95 per cent theoretical by the use of iodine as a bromine carrier, and previous solution of bromine in the reaction solvent. The silver salt of 3-5-bibrom anthranilic acid was treated with methyl iodide, ethyl iodide, and isobutyl iodide for the purpose of producing esters of the above. The ethyl iodide and methyl iodide produced esters. Isobutyl iodide did not produce an ester under the conditions studied. The ethyl ester was also prepared from the dibrom acid and ethyl alcohol.

#### II. The Diazotization of 2-Amino-5-Chloro-p-Cymene Hydrochloride and its Coupling with Other Primary Amines.

2-amino-5-chloro-p-cymene hydrochloride was prepared by acetylation of amino cymene; chlorination of the acetylated product; then by boiling with this acid. A more direct and simple method was found by direct chlorination of amino cymene, thus reducing the process from days to hours, with much less trouble and a better product. Chlorine was passed into the amino-cymene dissolved in ethyl ether, at the rate of 2 bubbles per second for 12 minutes, at a low temperature.

Diazotization of 2-amino-5-chloro-p-cymene hydrochloride was effected, but attempts to couple this compound with several complex primary amines, namely, p-chloro aniline, sulfanilic acid, anthranilic acid, naphthionic acid, aniline, toluidine, phenylhydrazine, 2-amino-cymene hydrochloride, and 2-amino-toluene-5-sulfonic acid proved unsuccessful.

WALTER BAILEY SELLARS (Master's Thesis, June, 1928). The Acid Mercerization of Cotton. (Under the direction of FRANK C. VILBRANDT.)

The literature upon the mercerization of cotton by acids, with particular reference to sulfuric acid, was investigated. The use of nitric acid and hydrochloric acid has been studied in detail, but little work has been done heretofore with sulfuric acid. For this reason the action of sulfuric acid has been studied in detail.

A series of experiments to determine the effect of varying the concentration of acid, its temperature, the time of immersion of cotton in the acid, and the use of tension has been made. The changes produced have been measured by the change in tensile strength, extensibility, affinity for dye, lustre and shrinkage in length.

Preliminary to this a series of experiments was made to determine the proper conditions and methods of carrying out the mercerizing treatment. The effects of oil used for wetting out the cotton, alkalies used for neutralizing the excess acid and tension in the mercerizing and drying processes were studied. A method was developed for calculating the tensile strength of untreated yarn at any ordinary value of relative humidity, with corrections for the effect of the washing agents. This was necessary to determine the absolute change in strength, extensibility and shrinkage due to the sulfuric acid.

Following this, samples of cotton yarn were treated both with and without tension in sulfuric acid of concentrations of 30 to 70 per cent at temperatures of 0 to 80° C and with times of immersion of eight seconds to five minutes.

It was found that sulfuric acid of concentrations below 60 per cent cannot be used to obtain a mercerized effect. A mercerized product is obtained by using 60-65 per cent acid at temperatures of 0-30° C with application of tension; no improvement in lustre is obtained without the use of tension. The product obtained has increased lustre, strength and affinity for dyes. The time of immersion may be from one-quarter minute to two minutes, longer times giving a stiff, parchmented product.

Increasing concentrations above 65 per cent show less mercerizing capacity; concentrations of 70 per cent and above disintegrate the cotton. An increase in strength and dye affinity, without an increase in lustre is obtained by treating without tension in 60-70 per cent acid at temperatures of 0-30° C.

Sulfuric acid of 62.5 per cent concentration shows a maximum activity with cotton, affecting all its properties to a much greater degree, especially at low temperatures, than any other concentration of acid.

PROFESSOR VILBRANDT presented the following papers:

Sulfur-dioxide—Potassium Permanganate Reactions. North Carolina Section of the American Chemical Society, Chapel Hill, N. C., April 28, 1928.

Chemistry and Physics of Plumbing. Institute of North Carolina Association of Plumbing and Heating Contractors, Chapel Hill, N. C., Jan. 4, 1928.

PROFESSOR VILBRANDT has the following investigations under way :

1. Acid Mercerization. W. B. Sellars.
2. Alkali Mercerization. R. M. Byrd.
3. North Carolina Brick Clays. R. E. Lineberry.
4. Factors in Oleo-resinous Mixtures. J. H. Mourane.
5. Hydrogenation of North Carolina Coal.
6. Lubricating Principles in Oils.
7. Unsaturation of Mineral Oils.
8. Pollucite Extraction. F. W. Davis.
9. Methanol Synthesis. H. G. Pickett.
10. Composition of Volatile Matter in Coal. J. Addlestone.
11. Refining of Menhaden Oil. E. V. Kyser.

FRANK K. CAMERON. A Survey and Discussion of the Technical and Economic Factors Determining the Growth and Development of Chemical Production and Consumption in the Area Contiguous to Salt Lake City, Utah. *Plant Location* (published by Chemical and Metallurgical Engineering, New York City, 1928).

FRANK K. CAMERON and others. The System: Lime, Phosphoric Acid, Sulphur Dioxide, Water.

The four-component system of lime, phosphoric acid, sulphur dioxide and water is of theoretical interest. According to the literature, but one solid is formed, a double sulphate-phosphate. This cannot be true. It is of commercial importance as offering a possible way of separating lime and phosphoric acid, thereby making the dilute sulphur dioxide in our western smelter stack fumes an asset instead of a liability and eliminating the costly step of oxidizing sulphur dioxide in the manufacture of acid phosphates. Dr. S. C. Collins is collaborating at the University of Tennessee, Martin, Tenn., in making vapor tension measurements. At Chapel Hill, Dr. J. T. Dobbins and Mr. Gilreath have made solubility determinations. Mr. W. M. Mebane is now working on the concentrations of the liquid solutions for isotherms at 25° C under standard vapor tensions, and the nature and composition of the corresponding solid phases. Definite results have been obtained. Further work, however, will be required to find their significance.

FRANK K. CAMERON and H. D. CROCKFORD. The System: Cupric Sulphate, Ferrous Sulphate, Water.

The system cupric sulphate, ferrous sulphate, and water is of theoretical interest because of the isomorphism of the salts, and of commercial importance in the precipitation of cement copper. On account of the marked hydrolysis of both salts there is more than the usual difficulty in obtaining concordant results; hence the system has not hitherto attracted investigation in spite of

its importance. Several isotherms have been plotted. Others are in course of investigation and methods are under trial for the complex problem of interpreting the solid phases in contact with liquid solutions of determined composition.

S. C. COLLINS (Doctoral Dissertation, August, 1927). Complexes of Lithium Chloride and Ammonia. (Under the direction of FRANK K. CAMERON.)

An experimental investigation showed that at 25° ammonia forms complexes with lithium chloride corresponding to the formulas:  $\text{LiCl} \cdot 4 \text{NH}_3$ ,  $\text{LiCl} \cdot 3 \text{NH}_3$ , and  $\text{LiCl} \cdot \text{NH}_3$ . When water is added to the system the complexes which may exist correspond to the formulas  $\text{LiCl} \cdot 3 \text{NH}_3$ ,  $\text{LiCl} \cdot \text{NH}_3$ , and  $\text{LiCl} \cdot \text{H}_2\text{O}$ . Isotherms were plotted and limiting conditions of solubility and vapor tension determined. It was not found possible to obtain the complex with the formula  $\text{LiCl} \cdot 2 \text{NH}_3$  previously described by Bonnefoi. Description of this work will shortly appear in the *Journal of Physical Chemistry*.

A. T. CLIFFORD (Master's Thesis, June, 1928). The System: Lime-Arsenic Oxide-Water at 25° C. (Under the direction of FRANK K. CAMERON.)

An investigation has been made of the chemical nature of the precipitates obtained in dilute solutions. Products so obtained have commercial importance as insecticides particularly for combating weevil infections. It is commonly assumed that they are mechanical mixtures of a hypothetical tricalcium arsenate and calcium hydrate, and there has been no scientific basis for a factory control of the product. This investigation has shown that these products are, in fact, members of a series of solid solutions strictly analogous to the series of phosphates as previously shown by Cameron and Bell. The isotherm for 25° C has been plotted, and solubilities and hydrogen ion concentrations of the corresponding liquid solutions have been determined. A description will shortly appear in a technical journal.

W. M. MEBANE (Progress on Doctoral Dissertation). (Under the direction of J. T. DOBBINS.)

The equilibrium conditions of the system  $\text{P}_2\text{O}_5\text{-CaO-SO}_2\text{-H}_2\text{O}$  at 20° C are being studied in connection with the use of sulphur dioxide in the manufacture of superphosphates.

HARVEY ALBERT LJUNG (Master's Thesis, June, 1928). Reduction of Nitro-Compounds. (Under the direction of J. T. DOBBINS.)

The work on this problem has been done in order to determine whether titanium trichloride could be used as a reducing agent for nitro-compounds on a commercial scale, and to determine what conditions as regards concentration

of titanium trichloride, hydrogen ion concentration would give the best results and the greatest reaction efficiency, and to determine whether titanium trichloride could be used to effect the partial reduction of a poly-nitro-compound.

The following experiments have been designed and carried out: 1. To determine the influence of any variation in the concentration of titanium trichloride, hydrogen ion concentration, and the time of reaction upon the reaction efficiency. 2. To effect the reduction of one nitro-group in a dinitro-compound. 3. To prove that the oxidation-reduction potential of the second nitro-group is different from that of the first.

From the experimentation it is concluded: 1. That an increase in the titanous ion concentration results in a decrease in the reaction efficiency. 2. That a decrease in the hydrogen ion concentration results in an increase in the reaction efficiency. 3. That an increase in the time of reaction results in an increase in the reaction efficiency. 4. That this method is not altogether a good method for the quantitative determination of nitro-groups due to the unaccountable losses which occur. 5. That titanium trichloride is an efficient reducing agent for nitro-groups. 6. That preferential reduction of a poly-nitro-compound does take place when the theoretical amount of titanium trichloride required by one nitro-group is used. 7. That the oxidation-reduction potential of the second nitro-group is less than that of the first nitro-group.

J. B. GALLENT (Master's Thesis, June, 1928). The Potentiometric Titration of Fluorine. (Under the direction of H. D. CROCKFORD.)

The object of this work was to develop a rapid and accurate electrometric method for the determination of fluorine. The reaction employed was the formation of the complex salt,  $M_3FeF_6$ , produced when a soluble fluoride is titrated with ferric chloride. A polarized system of platinum and tungsten electrodes was used. The results seem to show that this method possesses great possibilities.

O. B. HAGER (Master's Thesis, June, 1928). Electrometric Studies of the System Indigo—Indigo White. (Under the direction of H. D. CROCKFORD.)

Indigo dyeing is economical only with standing baths in which the concentrations of the constituents must be maintained very close to predetermined values found to give optimum results. An electrometric method was studied as a possible means of keeping control of the concentrations of the baths. Unexpected breaks in the titration curves were found and some probable reasons for them are advanced. It is concluded that an electrometric method for control of the concentrations of an indigo bath is possible only with intricate apparatus in the hands of a skilled laboratory technician.

F. W. ZURBURG (Master's Thesis, June, 1928). Studies of the Binary Systems of Some Nitrotoluenes with Calculations for the Heats of Fusion of the Components. (Under the direction of H. D. CROCKFORD.)

The binary systems, para-nitrotoluene-salicylic acid, 2-4-dinitrotoluene-salicylic acid, 2-4-6-trinitrotoluene-salicylic acid have been established from the cooling curves of mixtures of the components. The latent heat of fusion of each of the components has been calculated. No compounds were found in either system. The eutectics were as follows: P.N.T. 95 per cent, acid 5 per cent at 49° C, D.N.T. 90 per cent, acid 10 per cent at 65° C, T.N.T. 90 per cent, acid 10 per cent at 76° C.

### DEPARTMENT OF CIVIL ENGINEERING

T. F. HICKERSON has published :

A Proposed Column Formula. *Proceedings of the American Society of Civil Engineers*, May, 1928.

This one basic column formula is proposed as a substitute for the fifty or more formulas that have gained admittance into engineering literature during the past one hundred and fifty years. The following advantages of this formula are claimed:

(1) It is theoretically correct for any initial condition of curvature or loading; (2) it possesses all the advantages incorporated in the Rankine Formula with none of its incorrect features; (3) it is superior to the so-called secant formula for two reasons: (a) it is directly solvable, and (b) it is more correct, since the secant formula assumes the effects of initial curvature and eccentricity of loading as identical; (4) by means of either tables or the simplified approximate formulas, it is simple of application to the conditions of practice.

The Pound as Compared with the "Slug" as a Unit of Mass. *Journal of Engineering Education*, April, 1928.

A system of units is proposed whereby the *pound* will be the unit of *mass* as well as the unit of *force*. This tends to simplify the subject of dynamics in substituting the familiar *pound-foot-second* units in the place of the unfamiliar *slug-foot-second* units. Every problem in dynamics, whether one of translation or rotation, can be solved just as accurately according to the proposed system as in terms of the "slug" system now in vogue. This proposition has already provoked much discussion among engineers and physicists.

PROFESSOR HICKERSON is now occupied with studies concerning the derivation, computation, and tabulation of moments and shears at critical sections in three-span continuous beam construction.

Various ratios of the equal end spans to the middle span are considered, covering all ranges of conditions that may occur in practice. The following cases are being considered:

(1) Ends hinged and intermediate points merely supported; (2) ends fixed and intermediate points merely supported; (3) ends restrained 50 per cent and 75 per cent while merely supported at intermediate points; (4) beams and columns considered as a monolithic frame with all terminals (a) hinged and (b) fixed.

Two-span continuous beams of unequal spans are being treated in a similar way.

Investigations have been made to show that the above methods of dealing with three-span construction are equally applicable to four or more spans.

This work when completed will therefore cover every case and condition of beam and column construction such as occurs so widely in buildings, bridges, culverts, and monolithic frames of various types.

THORNDIKE SAVILLE has published during the year:

Las Aguas Potables y los Diversos Methodos de Purificacion. *Boletin De La Oficina Sanitaria Panamericana*. Octubre De 1927.

The Power Situation in the Southern Appalachian States. *Manufacturers' Record*, April 21 and 28, 1927. Reprinted as separate by Southern Appalachian Power Conference.

A detailed and analytical study of power distribution and growth in the region.

The Sewage System of Caracas, Venezuela. *Engineering News Record*.

Describes the writer's investigations in that city in 1926-1927.

Investigations in Coast Protection in North Carolina. *Proceedings of the American Shore and Beach Preservation Association*.

Contains statement of studies in coastal erosion pursued under the writer's direction in 1927 and outline of detailed investigation proposed for comprehensive study of entire coast and inland waters of North Carolina.

Corrosion and the Plumber. Publication of the North Carolina Association of Plumbing and Heating Contractors.

This paper describes briefly the chemical and physical factors influencing the corrosion in piping systems and methods which may be undertaken to alleviate the trouble.

THORNDIKE SAVILLE and G. WALLACE SMITH prepared a map showing all power stations and transmission lines in the Southern

Appalachian States from funds contributed by the Southern Appalachian Power Conference. Published by U. S. Geological Survey, 1925.

THORNDIKE SAVILLE and G. WALLACE SMITH. Discharge Records of North Carolina Streams, 1896-1923. Bulletin 34, N. C. Department of Conservation and Development. Tables, Diagrams, and Maps, 402 pp.

Weekly and monthly records of stream flow at all stations ever operated in North Carolina. Duration curves of weekly flow at the long term stations. Map of North Carolina and adjacent states showing location of all gaging stations and water power developments. The most comprehensive publication on stream flow ever issued by any state east of the Rocky Mountains.

The following master's theses were accepted by the Department during the year:

FRANCIS MURDOCH BELL. Distribution of Annual Rainfall in North Carolina. (Under the direction of THORNDIKE SAVILLE.)

This is a comprehensive investigation of annual rainfall and its distribution in North Carolina. The records of all rainfall stations in the state have been assembled, corrected and tabulated, and the mean annual rainfall computed for each station. A rainfall map of North Carolina has been prepared, which illustrates the distribution of precipitation over the state for the 40-year period 1888-1927, inclusive. This map indicates that annual rainfall is well distributed over the state, varying from 49 inches to 55 inches in the coastal plain section, 43 to 50 inches in the piedmont section, and 38 to 83 inches in the mountain region. The lowest annual rainfall in the state occurs at Asheville in the French Broad valley, and the highest occurs at Highlands in Macon County. The rainfall varies more or less in amount from year to year, but a study of the records of many stations indicates that extreme variations from the mean are uncommon. A preliminary study of monthly rainfall shows that the month of maximum rainfall is July and the minimum amount occurs in November, and that there is heavy spring rainfall in the western section of the state.

ALBERT MACON WORTH. The Treatment of Combined Textile Wastes and Domestic Sewage. (Under the direction of H. G. BAITY.)

These studies were made on the wastes from a portion of the city of Durham, N. C., which consist of domestic sewage mixed with textile wastes.

The objects of these studies were the determinations of the character and concentrations of the textile wastes, their effect on the usual methods of sewage treatment, and suitable methods of treatment of the combined wastes.

The character and concentrations of the textile wastes were found to vary widely, but average values were determined. The average daily discharge of total wastes was found to be 23.5 per cent of the mean daily dry-weather flow of domestic sewage. The combined textile wastes were found to possess a biochemical oxygen demand of about seven times that of normal domestic sewage.

A continuous small portion of the flow of the combined wastes was treated in actual experimental sewage treatment units for about nine months. The combined wastes can be successfully treated at reduced rates by the usual methods of sewage treatment. Preliminary treatment in the concentrated state at the source of production and equalization of the rate of discharge are recommended for several of the textile wastes.

HARRY ANDREW SCHMITT and EARL GEORGE DOBBINS A Comparison of Laboratory and Field Data Relative to Pressure on Culvert Pipe. (Under the direction of H. F. JANDA.)

This report deals with a comparison of field and laboratory data on culvert pipe. It is the fourth of a series of reports written on culvert pipe experiments conducted at the University of North Carolina during recent years.

The object of the laboratory tests was to provide data which would make possible a method of rational design for culvert pipe.

An attempt was first made in the laboratory to produce field pressures on the pipe by means of a box-and-sand apparatus. The test pipe was placed in the box and pressure was transmitted to it through a filling material of sand.

The second series of laboratory experiments was conducted on the assumption that field deflections could be produced on the pipe in the laboratory. Attempts were made to produce the desired deflections by using radial restraints on the pipe.

The laboratory study indicates that deflections are the controlling factor in culvert pipe design.

## DEPARTMENT OF CLASSICAL LANGUAGES AND LITERATURE

GEORGE HOWE is engaged on a continuation of the study of Vergil's ideas of war and peace, reported in *Research in Progress* for 1927. With G. A. HARRER he is preparing a Dictionary of Classical Mythology. He is also directing dissertations of students in the field of Latin literature.

G. A. HARRER has published during the year:

Some Verses of Cicero. *Studies in Philology*, XXV: 70-91. 1928.

The paper gives a résumé of Cicero's reputation as a poet in Roman times, and then discusses in detail the history of two of his verses, *O fortunatam*

*natam me consule Romam, and Cedant arma togae, concedat laurea laudi.* Among other matters it is shown that the jingles in Cicero's verse are due to his liking for the sounds, which was probably based on his fondness for the verse of Ennius who used internal and end rhyme a great deal. Some suggestions are made about the Pseudo-Sallustian *Invective*, which was apparently the source of some of Quintilian's criticism of Cicero's verses. Cicero's verse was evidently little read, and as a poet in after times of the Roman Empire he was known by his notoriously bad lines and condemned for them.

PROFESSOR HARRER is continuing his work on the *Fasti Consulares*, and is writing a review of Huelsen's *The Forum and the Palatine*, English edition. He is also directing graduate students' dissertations in the Latin field.

J. PENROSE HARLAND has published (*The American Journal of Archaeology*, 1928, p. 63) a preliminary report on the general results of the Excavations of Tsoungiza, conducted by him near Nemea, Greece, in 1927-1928.

PROFESSOR HARLAND is working on a detailed and fully illustrated work, *The Excavations of Tsoungiza, the Prehistoric Site at Nemea*. This site was excavated while he was a Fellow of the John Simon Guggenheim Memorial Foundation, June, 1926—September, 1927.

PROFESSOR HARLAND is also collecting and assembling material for a comprehensive work on *The Helladic Civilization (Prehistoric Greece)*. Material for this work was gathered while he was on the Guggenheim Fellowship engaged in carrying on investigations in the civilizations that developed in the Aegean Basin during the Bronze Age (ca. 3000-1100 B. C.).

The first part of the proposed work deals with the archaeological evidence; in the second part the evidence from traditions and dialects will be presented; in the last part an attempt will be made to reconstruct the history of Hellas in the Bronze Age.

The following master's theses were accepted by the Department during the year:

EVA GENTRY. *Ovid's Correspondence with his Wife.* (Under the direction of GEORGE HOWE.)

In the thesis an effort has been made to study anew the material containing the correspondence between Ovid and his wife, with a view to determining as clearly as possible the exact relations existing between the two. Chapter I presents all material available in the original sources. There follows

in Chapter II a discussion of its chronological arrangement in order that the historical sequence of incidents may be kept in view. Chapter III is concerned with the problem of the wife's identity, and her family and social relationships. In Chapter IV appears a discussion of the incidents, attitudes, and feelings shown to be characteristic of Ovid's wife from his correspondence with her. Chapter V deals with the character of the poet's wife and attempts to ascertain as nearly as possible the extent of her loyalty to her husband and her efforts to secure his recall.

LAURINE HAYNES. *The Literary Works of Servius Sulpicius Rufus.* (Under the direction of G. A. HARRER.)

This work consists of a biography of Servius Sulpicius Rufus; a collection of his literary works; titles, quotations, and letters; a study of his vocabulary and syntax in comparison with Ciceronian usage; and an estimate of the man such as might be drawn from Cicero. An attempt has been made to list all titles to literary works attributed to Sulpicius. His extant writings, two letters to Cicero, and a passage from his book, *De Dotibus*, have been quoted. There follows a study of the vocabulary and syntax of Sulpicius as compared with the vocabulary and syntax of Cicero. Finally certain passages from Cicero's work, the *Brutus* and *IX Philippic*, have been quoted to give something of Cicero's opinion of Sulpicius.

MRS. M. A. HONEYCUTT. *Panegyricus Mamertini Maximiano Augusto Dictus.* (Under the direction of G. A. HARRER.)

This work consists of a detailed study of the *Panegyricus Mamertini Maximiano Augusto Dictus*, of which an English translation forms an important part. In order that this particular type of speech might be better understood, a brief historical account of the panegyric in general is given, and a short sketch of the twelve extant panegyrics, known as the *Panegyrici Veteres*, to which group the *Panegyricus Mamertini* belongs. This, with a discussion of the time, place, occasion, and author, and a study of the language, syntax, and structure of this panegyric form the first chapter. This is followed by the Latin text, which is an exact copy of the oration according to the Baehrens Edition. The third chapter is a fairly literal English translation of this panegyric. The last chapter is devoted to an explanation of all geographical, historical, mythological, or other references that occur, and that may not be clear.

EDGAR B. JENKINS. *The Rôle of Ascanius in the Aeneid.* (Under the direction of GEORGE HOWE.)

The purpose of this thesis is to show the importance of the son of Aeneas as an individual clearly portrayed in Vergil's epic. A summary of all the passages in which Ascanius appears is given first. With this list as a basis, his presence throughout the story is shown both by actual appearance and by

presence in spirit. A more detailed study is made of these passages which are grouped for unity of impression. Special consideration is given those sections of outstanding importance in the career of the young Trojan, and their value as episodic material in portraying his personality or as motivating forces in the progress of the action is pointed out. Finally, by tracing the indications of his physical, mental, and social activities, the significance of the continuity of his presence is shown in the development of a distinct personality from early boyhood to the dawn of manhood, when he is practically ready to enter upon the management of national affairs.

MARGUERITTE WERTZ. *The Juno of the Aeneid.* (Under the direction of GEORGE HOWE.)

Juno's many and varied activities in *The Aeneid* make of her one of the most important personages in the story. Yet, by no means is her behavior simple throughout. Many interesting questions therefore arise as to the exact nature of her role and as to the poet's conception of her character. Chapter I tabulates and analyzes all the passages of any importance dealing with Juno and her activities. In Chapter II follows a discussion of Juno as the opposing force in the piece, dealing especially with the nature of this force and the variety in its presentation. Chapter III is concerned with Juno's outstanding traits of character. The final chapter presents her as a combination of the Greek conception of Hera and the Roman conception of Juno.

The following studies have been undertaken by candidates for an advanced degree:

M. H. GRIFFIN. *A History of the Roman Province of Cappadocia* (for the doctor's degree).

E. P. WILLARD, JR. *Seneca's Estimate of the Caesars* (for the doctor's degree).

KATE DEROSSET MEARES. *Literary Patronage in the Post Augustan Period* (for the doctor's degree).

P. M. CHEEK. *The Arrangement of Material in Tacitus' Historical Works* (for the master's degree).

MRS. F. E. UNDERHILL. *Horace and the Latin Poets of the Early Republic* (for the master's degree).

IVA BARDEN. *The Literary Work of Caelius Rufus* (for the master's degree).

F. B. NIMS. *Vergil's Use of Objects of Art in the Aeneid* (for the master's degree).

## DEPARTMENT OF ECONOMICS AND COMMERCE

C. T. MURCHISON is engaged in the following studies:

Business Cycles and Individual Industries.

A study of selected major industries in their relationship to fluctuations in the general volume of business. The industries studied are the automobile industry, the construction industry, the iron and steel industry, the power industry, and the textile industry. In the analysis of each industry an attempt is made to distinguish between the behavior which is primarily conformative or passive in type, and that which arises from conditions peculiar to the industry and therefore to be regarded as dynamic in character. (To be published in book form during the winter, 1928-1929.)

The Cotton Textile Industry, An Economic Analysis.

A study of the factors which seem to account for the failure of the industry to share in the great general prosperity of the period from 1922 to 1928. Also an examination and appraisal of current movements in the industry that seem directed toward an eventual solution of its problems. (To be published as a monograph in the spring of 1929.)

JOHN B. WOOSLEY is engaged with a study of the Taxation of Banks in North Carolina for the State Tax Commission.

The study includes an analysis of the present method of taxing banks in this state and the results obtained therefrom, together with a survey of the possible methods of taxing such institutions and the estimated revenues to be derived from the employment of each method.

ERICH WALTER ZIMMERMANN is engaged in bringing his work in Resources and Industries to a close.

At the same time, PROFESSOR ZIMMERMANN continues his work in international commodity price control and in major trends of world economic changes.

HERSCHEL L. MACON is engaged upon the following studies:

The Relative Tax Burden on Textile Industries in North Carolina and Competing States.

A statistical study of the variations in the total tax bill—federal, state, and local—of a hypothetical textile mill located in specified towns and cities.

Assessment Ratios for Urban Real Estate in North Carolina. (In collaboration with members of the research staff of the North Carolina State Tax Commission.)

The following doctoral dissertation was accepted by the Department during the year :

C. K. BROWN. A State Movement in Railroad Development. (Under the direction of Professors KIBLER and HEATH.)

Almost exactly a century ago agitation began in North Carolina for a purely North Carolina trunk line railroad to be based upon a North Carolina port and to run east and west through the state. A long political contest was waged over the proposal and no such railroad came into existence until 1848. Thereafter three separate companies, in each of which the state was a majority stockholder, constructed a line of railroad extending from Morehead City on the coast to the vicinity of Asheville in the mountains. At the time the trunk line railroad undertaking was abandoned by the state in 1880 some 450 miles of the line were completed and in operation. For half a century this undertaking was so closely tied up with the various phases of the political and social life of the state that its successes and failures may fairly be said to form an integral part of North Carolina's growth and development.

The project has been studied as a state movement; that is, from the standpoint of the state as a political unit. The political and economic factors out of which the idea grew have been analyzed. Likewise, those forces which operated to cause the final overthrow of the plans have been analyzed and set forth in detail. Political and economic forces seem at many points to have been at work side by side. The effects of the construction of these railroads upon the finances of the state government are dealt with at various points as the story proceeds, but more especially in a chapter set aside for that particular purpose.

The first North Carolina trunk line railroad failed of its objective. As a state undertaking it was never pushed across the mountains, and the east to west trend of traffic which it aimed to establish never materialized. At the present time the trend of railroad traffic in North Carolina is predominantly north and south. But the trunk line idea is not dead. In recent years it has come up in connection with proposals for state ports and terminal facilities. It may come up again. This story of the state's first effort to build up a great home port and an east and west traffic route may have some bearing upon North Carolina traffic problems of the present or immediate future.

The following master's thesis was accepted by the Department during the year :

BERTIE MELVEL MCGEE. Production Risks in the Peach Industry (with special reference to the Southern States). (Under the direction of E. W. ZIMMERMANN.)

Although this thesis treats of production risks alone, the term risk is analyzed at the outset and the kinds of risks are defined. To understand the whole situation clearly, however, market risks should also be considered.

The next section of the thesis discusses (1) the history of the peach; (2) the characteristics of the plant with special reference to its perennial nature, the difficulties which this causes the grower, and the extent to which he is able to control output per tree; and (3) the product itself as to the general characteristics of the class and of special varieties. These explanations show clearly the peculiar risks to which this industry is subjected in the production process.

Although all production risks are classed as economic, they may be subdivided into (1) those arising largely from physical causes, such as weather, insect pests, and disease; and (2) those arising largely as a result of social causes, such as competition resulting from the large number of growers, and the lack of adjustability to changing demand arising from the nature of the plant.

The grower is primarily interested in the spread between the costs of production and the price he receives. It was found that this price fluctuates widely from year to year in a very close correlation with the amount of fruit produced. This depends far more upon climatic factors than on anything else, although it is influenced to a lesser extent by the number of bearing trees. The perennial nature of the tree does not appear to affect yearly prices.

## DEPARTMENT OF EDUCATION

EDGAR W. KNIGHT has published during the year:

State Control of Education. *South Atlantic Quarterly*, January, 1928.

The Story of Teacher Training. *High School Journal*, October, November, December, 1927.

Teachers and Teaching. *High School Journal*, February and March, 1928.

PROFESSOR KNIGHT has continued the collection of documents illustrating American educational history, to be published later, and has directed the studies of several students in educational history.

PROFESSOR KNIGHT has also prepared for the *Dictionary of American Biography* articles on Charles B. Aycock, Joseph Caldwell, and Calvin H. Wiley.

A. M. JORDAN is continuing his studies of the environmental influence of differing vocations of parents on the mental growth of children.

J. MINOR GWYNN has completed the following study:

The Status of Latin in the High Schools of North Carolina. *The High School Journal*, XI, No. 3. March, 1928.

A statistical investigation, based in part on annual reports of the state supervisor of North Carolina high schools and in part on replies received from high school teachers. The body of the study presents the following: (1) the status of Latin in the secondary schools of North Carolina; (2) the training and experience of teachers of Latin in secondary schools; (3) a digest of opinions of school officials and Latin teachers on the status of Latin, including their suggestions as to means of improving the teaching of Latin and making the subject more attractive.

PROFESSOR GWYNN is engaged at present in the examination and compilation of a comprehensive bibliography for teachers of high school Latin.

The following master's theses were accepted by the Department during the year:

GRAHAM B. DIMMICK (Master's Thesis, August, 1927). A Comparative Study of the Growth in Mental and Physical Abilities of the Mill and the Non-Mill Children over a Period of Six Months. (Under the direction of A. M. JORDAN.)

The purpose of this investigation was to determine the rate of growth in mental and physical abilities of two groups of individuals—mill and non-mill—over a period of six months, as compared with the growth of the same traits in the average child during a similar period of time.

In order to do this, four tests of mental ability were given each group of subjects in October, 1926 (The National Intelligence Tests, Form A and Form B, the Pintner-Cunningham Primary Mental Test, and the Dearborn Intelligence Test). In April, 1928, different forms of these same tests were given again. From the first series of tests the mental status of the subjects of each group was determined, and by subtracting the scores made by each individual in the two sets of tests the mental growth of the individuals comprising each group was established.

Measurements of the individuals of each group in respect to the following physical traits were made in October, 1926, and in April, 1927: (1) height, (2) weight, (3) circumference of chest, (4) vital capacity, (5) strength of grip—right hand, (6) strength of grip—left hand, (7) muscular coordination. The difference between the first series of measurements and the second was a measure of the physical growth of the subjects during a period of six months.

*Results.* In physical traits, no reliable difference between the children of mill workers and those of others appeared. This statement holds whether reference is made to younger or older children, to boys or girls, or to status or growth. Physically, then, the children of mill workers are as fully developed for their age as are those children on which the norms of Baldwin were so laboriously made. In mental traits the results are not so definite, since the results vary with the type of test used. When a test not dependent on written language was employed the mill children accomplished quite as much as those

on which the norms were established. On the contrary, when tests depending on efficiency in written language were administered the mill children were from 11 to 30 points behind the norms at every age. Another significant trend was the gradual increase of the amount of differences between the scores of mill children and those of the norms with increasing age. For example, at year eight the difference is 11 points; at year 14, 30 points. The mental growth of children of mill workers during the six months' period studied was appreciably less than that of other groups. In all cases conclusions are only tentative because of the limitations of the samples.

JOSEPH ORLANDO BOWMAN. *The History of Academies and Private Schools of Wayne County.* (Under the direction of E. W. KNIGHT.)

The purpose of this study was to show the educational development of Wayne County during the period of its private schools and academies, 1790-1800, through a historical and biographical treatment of the subject. The historical background of the field studied is first given, and then the thesis develops the subsequent history of education of the county around the outstanding individuals who promoted the various important educational movements and institutions which have become the county's leading educational centers.

The period studied falls into three natural and logical divisions: first, the pioneer period from 1790 to 1840; second, the antebellum period from 1840 to 1860; and third, the post-bellum, or reconstruction period, from 1860 to 1880 when the academies and private schools were forced to yield to the rapidly developing public graded schools.

The plan of treatment has been as follows: First, a chapter giving a brief historical sketch of the county as a background for the study, after which a chapter has been devoted to each of the above-named historical periods of educational development; and, finally, a concluding chapter giving a résumé of the period studied, and analyzing the effect of the academy and private school movement upon the development of the public school system, which was eventually to supplant and supercede the former educational regime in the county.

GROVER CLEVELAND BUSH. *The Growth and Development of Public Education in Lenoir County.* (Under the direction of E. W. KNIGHT.)

The purpose of this study is to show the growth and development of public education in Lenoir County, North Carolina, from its formation out of Dobbs and Craven counties in 1791 to the present. The physical, political, historical, and social conditions of Lenoir County are studied.

Lenoir County, 390 miles square, is one of the smallest counties in the state. Situated in the Tidewater section of the state, it has a rich soil well adapted to agriculture. The population, which is 98½ per cent American, is 55 per cent white and 45 per cent Negro.

Schools were few and poorly supported in Lenoir County before the Revolutionary War, but after that period more interest was taken in the subject. The establishment of the Literary Fund in 1825 marked the development of still wider interest. The statewide public school law, enacted by the Legislature of 1839, gave the county its first public schools. The appointment of a state superintendent in 1835 gave the schools of the county a still better organization.

The schools in the county were seriously interrupted by the Civil War and the period of Reconstruction, and for some time conditions continued backward. By 1900 the time was ripe for great advances in educational development; wealth had increased, race issues in politics were eliminated, there was an awakening of class consciousness among the rural people, and an appearance of a new type of leadership. This educational awakening has influenced the progress of the schools in Lenoir County for the past thirty-five years. With a consolidation program practically completed, Lenoir County is now ready to devote more time to reorganizing the curriculum and studying the best methods of instruction.

ERNEST B. GOODWIN. The High Schools of Orange County.  
(Under the direction of E. W. KNIGHT.)

The schools doing high school work in Orange County were investigated in this study as to the number of pupils enrolled and the average daily attendance in the high schools, the amount and quality of supervision in these schools, the kind of equipment both for the proper teaching of the subjects in curricula and also for the extra-curricular activities, the subjects found in the curricula in the schools, and the attempts the schools are making to bring their work into direct contact with the life of the community.

It was found that practically no supervision was effective in any of the high schools in the county, in all the schools proper equipment for adequate instruction according to the best standards was lacking, the subjects taught in the schools were confined almost entirely to those necessary for college entrance, and no definite program was outlined in any school for contact with the community.

It is suggested that good roads be constructed, supervision be instituted, a thorough-going school survey be made, all the high school work be done in the two high schools located at Chapel Hill and Hillsboro, and that the county should first vote to maintain all its schools eight months and then to abolish the special charter district at Chapel Hill and vote to support all of its schools for nine months. A publicity campaign is suggested to put this program of reform before the people.

NELLIE HAMILTON GRAVES. Rivalry as an Incentive in the Learning of First-Year Mathematics. (Under the direction of A. M. JORDAN.)

This study was carried out for the purpose of determining: (1) whether rivalry is an effective incentive in learning mathematics; (2) whether it stimulates the group as a whole to greater effort in the mastery of the subject; and (3) whether it is a more effective incentive for the dull pupil, the average pupil, or the bright pupil, or motivates equally.

Thirty-six students of the Chapel Hill High School, registered for first-year mathematics, were selected as subjects. These were divided into two equivalent groups of eighteen pairs on the bases of age and of scores made on standard tests. One group was used as a control group; the other was stimulated by the incentive of rivalry. The experiment was carried on in two regular forty-five minute class periods five times a week for twenty-one weeks. Nine tests were given during this time, from the results of which it was sought to measure the influence, if any, of rivalry on learning mathematics.

The results of the experiment seem to justify the following conclusions: (1) that rivalry is an incentive which was effectively used in the learning of mathematics; (2) that rivalry stimulates the group as a whole to greater effort in the mastery of the subject; and (3) that the average pupil was more influenced by rivalry than the dull pupil; that data do not justify a comparison of the bright pupil with the average or dull owing to the fact that the full ability of the bright pupils was not always measured by the tests, and hence no definite conclusion should be drawn.

HOMER HENRY. The Development of Public Education in Madison County. (Under the direction of E. W. KNIGHT.)

The purpose of this study is to trace the development of public education in Madison County, North Carolina, from the formation of the county in 1851 to June 30, 1927.

The study shows that a very creditable system of schools was developed between 1853 and 1858, but this early interest in schools was destroyed by the Civil War before the people came to appreciate thoroughly the benefits to be derived.

From the Civil War to 1900 was a very discouraging period for the cause of public education. The constitution of 1868 made it mandatory on the legislature to provide "by taxation or otherwise" for a four-months' school term in every school district in the state; yet the same constitution contained a conflicting clause limiting the rate of taxes that could be levied for state, county, and school purposes. As a result of this tax limitation there was not sufficient revenue to maintain a system of schools that could command the respect of pupils and patrons. The schools of 1900 were very little better than the schools of 1858.

During the first two decades of the present century Madison County experienced an educational awakening, but between 1920 and 1927 a more substantial type of educational progress was made. Seven consolidation centers were developed; seven school buildings of the more permanent type were erected and equipped at a cost of approximately \$225,000; the number of school

busses increased from one to nineteen; five new high schools were established; the high school enrollment increased from 84 to 457; and the per capita cost of instruction increased from \$12.47 in 1921 to \$19.09 in 1927.

Probably the greatest need at present is a practical plan for further development, including (1) a campaign for a county-wide eight-months' school term; (2) consolidation where it is practical; (3) fitting the school to the needs of the child; and (4) provision for adequate class-room supervision.

The greatest handicap of the school system is a lack of adequate financial support. The taxable wealth back of the education of each school census child is only \$1,516, an amount entirely too small to produce a sufficient income. Therefore the legislature should create a fund for the purpose of equalizing, among the several counties of the state, the tax for school buildings and equipment.

DANIEL P. WHITLEY. A Study of the School Progress and Achievement of Children in High Point, North Carolina. (Under the direction of M. R. TRABUE.)

The purpose of this study was to discover: (1) the progress and achievement of pupils in the High Point public schools; (2) the relation between school progress and achievement of children and certain social and economic factors affecting them.

In order to obtain a cross-section of what is happening to children in school, pupils of a given age were selected; namely, those who were between the ages of 12 years 0 months and 13 years 0 months.

The data consisted of the cumulative records, results of the Standard Achievement Test, and certain information regarding parental vocations and home conditions supplied by the children on forms provided for the purpose.

It was found that fifty per cent of 12-year-old children had repeated one or more grades. Although this is a very high percentage, it is slightly lower than the average of North Carolina cities, as indicated by the state reports of age and grade distribution.

The median achievement of 12-year-old pupils (median age 12 years 6 months), as measured by the Stanford Achievement Test, is 11 years 8 months in terms of the national standards. That is, the median educational age of these pupils is ten months below the national standard.

The results of the study indicate that there is a definite relation between the success of children in school and the economic success of their parents, as evidenced by their vocations, the types of positions they hold, and the kinds of homes they keep.

There is the need for the reorganization of the schools so as to permit the majority of pupils to progress normally through the grades. This can probably be accomplished by introducing greater flexibility in the types of work done in the elementary school; by limiting the elementary course of study to six years; and by establishing a junior high school which would provide, in addition to the work now done in the sixth, seventh, and eighth grades, some

instruction designed to meet the special needs of those pupils who do not succeed in work of a strictly academic nature. By these means retardation would be reduced, and it is believed that a greater number of those pupils who now leave school to enter the occupations as soon as the limit of compulsory attendance is reached would remain in school.

LYLE LYNDON WILLIAMS. A Comparative Study of Types of Rural White Elementary Schools in the One Hundred Counties of North Carolina. (Under the direction of M. R. TRABUE.)

The purpose of this study has been to determine the relative status of nine types of rural white elementary schools (from one-teacher schools up to schools with eleven or more teachers) with respect to: number of schools, enrollment, attendance, length of term, teachers' salaries, cost of instruction per pupil, and scholarship of teachers. This has been done with a view to determining, to a degree, whether North Carolina shall attempt to standardize the size of the rural school, and if so, what type or types shall be selected. This information has been tabulated by counties for each type of school, and for all rural white elementary schools as a group, and presented herein in the form of twenty-five frequency tables, with a summary for the state as a whole.

There are 3,549 rural white elementary schools in the state; 2,203 have one and two teachers and 414 have seven or more teachers. Forty-one per cent of the total enrollment is in schools with seven to eleven teachers. Seven-teacher schools have the highest per cent in attendance, and larger and smaller schools have poorer attendance. The school term is longest in large schools and shortest in small schools and ranges from 125 to 165 days. Teachers' salaries are in proportion to the size of the school and length of term. Per pupil cost of instruction is lowest in small schools, large schools rank second, and the highest cost is found in three- and four-teacher schools. Rural white elementary teachers have an average training equivalent to one year of college work; teachers in small schools are high school graduates and in large schools are college juniors.

On the whole, schools with from seven to ten teachers are more economical and more efficient than either larger or smaller schools. Small schools must be maintained in remote parts of the state (where geographical conditions will not permit consolidation) and should be operated on a higher plane.

## DEPARTMENT OF ELECTRICAL ENGINEERING

The following master's theses were accepted by the Department during the year:

ABRAM ADKINS CORY. Multiplex Radio Communication. (Under the direction of P. H. DAGGETT.)

The conventional methods of sending two or more messages simultaneously from the same transmitter were reviewed, and a study was made of a new method.

A slight shift in frequency of the wave of a continuous-wave transmitter may be detected by filtering the output of a heterodyne or autodyne receiver. If this shifting is controlled by a transmitting key and is made small enough to prevent de-tuning, two messages may be sent simultaneously with the same wave.

Experiments showed that shifts in frequency of a very few cycles could be detected by a regenerative receiver, by a bridge circuit, or by a tuned audio-frequency amplifier. A special type of amplifier was designed that established upper and lower ranges of audibility with respect to volume. This amplifier has a tendency to produce a flat-topped response curve that rapidly falls to zero at the sides. The frequency band may be made as narrow as desired if sufficient amplification is used to overcome the necessary excess grid bias. Since the selectivity of this amplifier is under control, it may be applied to any circuit that requires sharp tuning.

The chief difficulty with this system of multiplex reception is the problem of frequency control. The oscillators at the transmitter and receiver must maintain constant frequency. Crystal control seems to be necessary.

THOMAS BRYAN SMILEY. A Study of Local Interference in Radio Receiving Sets. (Under the direction of P. H. DAGGETT.)

A mathematical derivation is made, giving a set of equations which may be made to represent the voltage induced upon an antenna owing to interfering waves impinging upon it. A set of oscillograms is submitted, each representative of a certain type of disturbance. The mathematical analysis is suggested for each of the oscillograms to which it appears applicable. Possible uses of the oscillographs, errors introduced in oscillograms, and the general theory of oscillographs are discussed briefly.

#### DEPARTMENT OF ENGLISH

JAMES F. ROYSTER has published during the year the following papers:

The First Edition of De la Mothe's *French Alphabet* and of Hollyband's *French Schoolemaister*. *Philological Quarterly*, January, 1928.

Points out the existence in the Library of Congress of a copy of De la Mothe's useful French-English conversation-manual, the first edition (1592) of which no copy has been supposed to be extant, and advances evidence to support Pollard's theory that 1566 as the date of the first edition of the *French Schoolemaister* is an error for 1576.

The Chaucer Concordance. *Studies in Philology*, January, 1928.

A review of Tatlock and Kennedy's *Concordance to the Complete Works of Geoffrey Chaucer*.

E. K.'s Elf <Guelph, Goblin <Ghibelline. *Modern Language Notes*, April, 1928.

An attempt to trace the history of this etymology before and after E. K.'s use of it.

A Review of A. G. Kennedy's *A Bibliography of the Writings on the English Language*. *Modern Philology*, 1928.

Additional Eighteenth Century Chaucer References. *Studies in Philology*, July, 1928.

Before the English Seminar of Johns Hopkins University PROFESSOR ROYSTER read, in November, a paper on the Structure of Chaucer's *Canon's Yeoman's Tale*, which will soon be published, together with a paper on Some Eighteenth Century Chaucer Editors.

NORMAN FOERSTER'S book on American Criticism: A Study in Literary Theory from Poe to the Present was published by the Houghton Mifflin Co. in May, 1928. A book on The Reinterpretation of American Literature: Some Contributions toward the Understanding of its Historical Development, which he has edited for the American Literature Group of the Modern Language Association, will appear in the autumn of 1928. PROFESSOR FOERSTER is at present studying Wordsworth and Coleridge.

HOWARD M. JONES has published during the year:

America and French Culture. The University of North Carolina Press, 1927.

For abstract see previous announcement in *Research in Progress*, July, 1926.

HOWARD M. JONES and PHILIP S. ALLEN. The Romanesque Lyric. The University of North Carolina Press, 1928.

A survey of the development of European lyric poetry in Latin from Petronius to the Cambridge Songs, with illustrative translations.

In the collection edited by NORMAN FOERSTER (to be published by Harcourt, Brace and Company in the fall of 1928) on the subject of new viewpoints in American literature, PROFESSOR JONES has a chapter on the European background, which indicates what is to be gained for an interpretation of American cultural history

by references to the likenesses and differences between American and continental European history, especially in the fields of religion, literature, and politics.

PROFESSOR JONES has in progress research to determine the extent of the American knowledge of, and interest in, French literature in the period 1750-1848.

With PHILIP S. ALLEN of the University of Chicago he is engaged in research in the history of European Latin poetry from the Cambridge Songs to the Renaissance, directed toward a book to be entitled *The Renaissance Lyric*.

With W. D. MACMILLAN III he has under way research in eighteenth century drama to establish texts of certain important plays from 1660 to 1800.

GEORGE C. TAYLOR has completed an investigation of the Influence of the Dialogues of Heraclitus and Democritus on the Dialogue of Act I, sc. I, of *The Merchant of Venice*.

PROFESSOR TAYLOR has in preparation the following studies:

The Title-Pages of Elizabethan Plays.

The investigation seeks to determine mainly the relation of the title-pages of one and the same play to each other and to the play itself.

The Influence of Non-dramatic Types of Renaissance Poetry on the Elizabethan Drama.

Further Evidences of the Vogue of DuBartus in England.

W. D. MACMILLAN has published during the year:

Planche's Early Classical Burlesques. *Studies in Philology*, July, 1928.

A study of the subject-matter, purposes and production of burlesques in the early nineteenth century.

LOUIS B. WRIGHT has published during the year:

Notes on Thomas Heywood's Later Reputation. *Review of English Studies*, IV: 135-144.

Calls attention to the knowledge about Heywood in the late seventeenth, eighteenth, and early nineteenth centuries.

The Male-Friendship Cult in Thomas Heywood's Plays. *Modern Language Notes*, XLII: 510-514.

Shows that Heywood was fond of the male-friendship theme; that it is a dominant theme in *A Woman Killed with Kindness* and other domestic dramas.

Heywood and the Popularizing of History. *Modern Language Notes*, XLIII: 287-293.

Presents evidence to show that Thomas Heywood was keenly interested in making historical and biographical material available to the common people; that he was impressed with the obligation of the author to make his work easily understood by the commonalty of readers.

Variety Show Clownery on the Pre-Restoration Stage. *Anglia, Zeitschrift für Englische Philologie*, LII: 51-68.

Discusses the popularity of detached clownery and slap-stick comedy in the drama of the Tudor and Stuart periods.

Animal Actors on the English Stage before 1642. *Publications of the Modern Language Association*, XLII: 656-669.

Points out the frequent use of trained animals in the staging of Elizabethan plays.

Variety Entertainment by Elizabethan Strolling Players. *Journal of English and Germanic Philology*, XXVI: 294-303.

Shows that the travelling actors, both in the provinces and on the continent, filled their plays with much vaudeville matter; that this dramatic custom is reflected in the popularity of extraneous vaudeville matter in London plays.

Stage Duelling in the Elizabethan Theatre. *Modern Language Review*, XXII: 265-275.

Presents evidence that the love of fencing matches and contests of swordsmanship forced dramatists to furnish realistic stage fights; that one of the appeals of the drama of blood was the sword-play.

A Note on Dramatic Piracy. *Modern Language Notes*, XLIII: 256-258.

Examples of the "traitor-actor" method of play-text compilation from the eighteenth century.

Note on *A Game at Chess*. *Times Literary Supplement*, February 16, 1928, p. 112.

Suggests that Middleton had favor of someone high in authority in launching his bold satire on James' foreign policy.

Review of W. J. Lawrence's, *The Physical Conditions of the Elizabethan Public Playhouse and Pre-Restoration Stage Studies* in *Modern Language Notes*, XLIII: 118-120.

Review of Ola Elizabeth Winslow's *Low Comedy as a Structural Element in English Drama from the Beginnings to 1642* in *Modern Language Notes*, XLIII: 66-67.

MR. WRIGHT has under way certain studies of the reflections of political and social conditions in the drama of the late sixteenth and early seventeenth centuries. Specific studies which he has in preparation are:

The Use of Belated Morality Plays for Economic Propaganda.  
Social Aspects of Middleton's Dramatic Satires.

The Glorification of Middle-Class Ideals in the Plays of Heywood and other Bourgeois Dramatists.

The following doctoral dissertations were accepted by the Department during the year:

RAYMOND WILLIAM ADAMS. Henry Thoreau's Literary Theory and Criticism. (Under the direction of NORMAN FOERSTER.)

The study of Henry Thoreau as a literary figure proceeded upon two premises: (1) that a thorough knowledge of Thoreau's literary, aesthetic, and social experiences before 1845, the year of the writing of *The Week on the Concord and Merrimack Rivers*, was a prerequisite to any adequate comprehension of Thoreau's literary theories; (2) that Thoreau's philosophy was transcendental and akin to Emerson's.

The first four chapters outline the experiences of the young Thoreau that seem to have affected his notions of literature: (a) his boyhood acquaintance with the woods and fields of Concord, which made him a peculiarly parochial writer and a romantic naturalist; (b) his reading of the ancients during a score of years, a discipline that made him at once the best classical scholar in Concord and one of the most careful writers among American romanticists; (c) his assimilation of English poetry from Chaucer to Cowper, a reading program of nearly twenty thousand poems; (d) his reading of Wordsworth, Coleridge, and Carlyle as exponents of English romanticism and interpreters of the French and German romanticists whom he did not read at first hand; (e) his admission into the Transcendental Club and the consequent stimulation of philosophical thought in the young naturalist; and, finally, (f) a consideration of Thoreau's ideas about the classics, nature, labor, and the Indian, four matters of supreme importance for an appreciation of Thoreau's mind. Emerson wielded a great influence over Thoreau. He encouraged Thoreau to read the Greeks and the Oriental scriptures, reënforced Thoreau's native Puritanism, informed him of Kant and Fichte and Carlyle and Coleridge, and offered him a livelihood in his home and a medium of publication in the *Dial*. More than all these, Emerson formulated transcendental philosophy and defined it for Thoreau, a definition analyzed in Chapter V.

Chapter VI shows that Thoreau's definition of poetry was highly romantic, that to him any product of genius through the medium of language was poetry, that true poetry grew out of health.

Chapters VII, VIII, and IX outline Thoreau's theory of composition, the romantic theory of guidance by one's genius in the matter and method of literature, with an insistence that one write only about experiences, that one rework one's material carefully, using simple and indigenous language and recollection as an aid to perspective in the choice of material.

Chapter X outlines Thoreau's method as a critic of literature. The method was (1) to assemble all possible biographical facts about the author under consideration and see if his writing rang true to his life, (2) to compare a piece with some classic piece as a standard, (3) to seek the organic unity of the piece, (4) to base final judgment upon the critic's personal reaction to the writing.

Chapters XI and XII analyze two critical essays by Thoreau—the essay on Carlyle, written in 1846, and the earlier essay on Sir Walter Raleigh—as examples of Thoreau's method in practice.

Some general conclusions may be derived from this study of Thoreau's literary method: (a) Thoreau derived his literary theories from Emerson and Wordsworth, but he drew upon an enormous body of literature for other theories. Certainly he was not an original critic; he invented no theory for himself except as he re-combined and re-emphasized old theories. (b) Thoreau was a classicist in his setting up of a standard of excellence and in his demand that writing be polished and rearranged during a long process of composition. (c) Thoreau was a romanticist in his ideas of genius, inspiration, worth of the common man and the common language, subjective criticism, and search for biographical content in all literature.

JOHN WEST HARRIS, JR. *The Glorification of American Types in American Literature from 1775 to 1825.* (Under the direction of G. L. PAINE.)

With the birth of nationalism in America there developed in the new country a spirit of romanticism which was in line with that of eighteenth-century England and France, but which took on a decidedly primitivistic coloring. Americans were induced into this primitivistic frame of mind by four forces: (1) the primitivistic spirit in England during the eighteenth century as we see it reflected in the speculations of scientific theorists, the purely literary writings of the time, and the popular interest in primitive life; (2) the primitivistic spirit in France, as evidenced by the travel literature of the period, and the writings of such men as Montesquieu, Rousseau, and Chateaubriand; (3) English and French criticisms of America and American life, which provoked defensive reactions among American writers; and (4) conditions in America—the unique history of the country and the grandeur of the terrain of the New World—which, in themselves, made for a nationalistic primitivism.

It is the purpose of this study to ascertain to what extent American writers from 1775 to 1825 attributed to American nature and the human types peculiar to America—the frontiersman, the farmer-soldier, the Indian, and the Negro, particularly—primitivistic qualities which argued for a superiority of things American over the products of the effete civilizations of Europe. In attempting to do this, the writer hoped to establish, partially at least, the native background for (a) later exploitation of America and American nature by such writers as Bryant, Emerson, Whitman, and Burroughs; (b) the romanticization of the frontiersman and the American rustic by Cooper and others of the nineteenth century; (c) the glorification of the Indian by Longfellow, Cooper, and those who sought to elevate him as an innately heroic being; and (d) the sentimentalization of the Negro by Whittier, Mrs. Stowe, Joel Chandler Harris, DuBose Heyward, and the host of writers since 1825 who have used him as a dramatic literary figure. From the evidence here accumulated it appears that there were definite tendencies in these directions during the first fifty years of America's national existence. And the one idea which seems to prevail in most of the writings of the period is that the various forms of American life were uniquely superior because of the primitive state of affairs in the new country.

HENRY A. POCHMANN. The Influence of the German Tale on the Short Stories of Irving, Hawthorne, and Poe. (Under the direction of H. M. JONES.)

This study examines more thoroughly than has hitherto been done the relation between three American authors and the tales of Goethe, Schiller, Zschokke, Tieck, Wackenroder, Hoffmann, Novalis, Hölderlin, Fouqué, Brentano, and Arnim; and collections of German folk-tales by Musaeus, Otmar, Büsching, Grimm, Gottschalck, and Grässe. This influence is either direct or through intermediary channels, such as English periodicals.

In the case of each American author his knowledge of the German language and literature is carefully worked out, together with the influence upon him of literary interests—British, American, and European—which would lead him to study, absorb, and imitate the German tale. Specific relations are established between "Rip Van Winkle" and "Peter Klaus the Goat-herd"; "The Legend of Sleepy Hollow" and the fifth of the *Legenden von Rubezahl* by Musaeus; "The Spectre Bridegroom" and Bürger's "Lenore"; six of the *Tales of a Traveller*, and *Wilhelm Meisters Lehrjahre* and *Die Räuber*; and (in *Wolfert's Roost*) "Guests from Gibbet's Island" and Grimm's *The Gallows' Guests*, "Don Juan: A Spectral Research" and Gottschalck's *Seebürger See*. This much for Irving.

The case for Hawthorne, despite Poe's insistence that this author borrowed from the German, is shown to be negligible. Of the Poe stories seven go back to German tales of mesmerism and metempsychosis, namely, "The Tale of the Ragged Mountains," "William Wilson," "The Imp of the Perverse," "The Tell-Tale Heart," "The Oval Portrait," and "The Spectacles."

Two—"Ligeia" and "Morella"—owe much to Novalis. "The Fall of the House of Usher" is probably indebted to Arnim's "Majoratsherren" and Hoffman's "Das Majorat." Poe's critical theory also owes something to Schlegel's "Einheit der Interesse," in turn based on Aristotle.

The American short story drew valuable material from the German tale, improving on its borrowings. Irving tended to use material as he found it, translating it to a new setting; Hawthorne gave carrying power to certain vague effects; and Poe contributed a definite technique.

GAYNELL CALLAWAY SPIVEY. Elizabethanisms in Victorian Poetic Drama. (Under the direction of J. M. BOOKER.)

The purpose of this study is to discover what conventions of Elizabethan drama are to be found in the chief Victorian poetic dramas—the dramas of Swinburne, Tennyson, Browning, and Bulwer-Lytton—and to show specifically the features of the earlier drama that re-appear in the latter. The term Elizabethanism is applied to those qualities or characteristics that are ordinarily regarded as being peculiar to Elizabethan drama as distinguished from the realistic drama of today.

Of these Elizabethanisms in Victorian drama perhaps the most important are the direct borrowing (Chap. III). Swinburne's *Lochrine* is avowedly a mere re-working of the old anonymous play of the same name, and *Rosamund* follows closely Davenant's play *Albovine, King of the Lombards* (1629). Modeled upon particular scenes in the older drama are the trial scene of *Mary Stuart*, upon Webster's *White Devil*; the prayer scene in *The Queen Mother*, upon Claudius' prayer in *Hamlet*; a second scene in *The Queen Mother*, upon the Portia-Brutus scene of *Julius Caesar*; Mary's reception of the messenger from Bothwell, upon a scene from *Antony and Cleopatra*; and the scene of Darnley's death, upon the last scene of *Doctor Faustus*. Tennyson telescopes the first two scenes of *Julius Caesar* and uses the resulting scene to open *Queen Mary*. The street-fighting scene in *Romeo and Juliet* offers suggestions for *Becket*; the ghost scene from *Richard III* for the last scene of *Harold*; *Twelfth Night* for the meeting of Robin Hood and the disguised Maid Marian. The fairies in *The Foresters* are an imitation of those in *A Midsummer Night's Dream*. Of the characters, Bothwell has characteristics of both Sejanus and Macbeth; Mary, of both Cleopatra and the White Devil. Herries suggests John of Gaunt in *Richard II*; Aldwyth, Lady Macbeth; Elizabetha, Juliet's old nurse; and Luria, Othello.

Merely pointed out (Chap. II) are the Victorian parallels to those Elizabethan dramatic conventions that have been generally adopted by English romantic dramatists since the time of Shakespeare; no claim is made of a direct borrowing in any single case. These conventions are classed under the following headings: (1) Technique—such expository devices as obviously explanatory dialogue, the soliloquy, and the messenger; the arousing of suspense by unnatural weather conditions and ominous sayings; and the regard for the unities. (2) Characters—the inordinately ambitious hero, the weakling king,

clowns, faithful servants, the confidant, and the messenger. This section also examines the means of characterization—the bold self-revealing soliloquy and the episode unconnected with the plot. (3) Subject matter—chronicle plays, the revenge tragedy, the tragedy of pity, madness, jealousy, and stock scenes. (4) Stylistic features—the mingling of prose and verse in a single play, the introduction of the lyric, puns, ambiguous sayings, oaths, parallelisms, and stichomythia.

As an introduction to these two chapters, the first chapter gives a brief résumé of the growth of interest in Elizabethan drama from Lamb to Tennyson, and discusses at more length the enthusiasm of each of the four Victorian playwrights—Swinburne, Tennyson, Browning, and Bulwer—for the Renaissance drama.

The fourth chapter is a statement of the conclusions reached. In view of the esteem in which Shakespeare and his contemporaries were held, after due regard to the great number of general similarities between the plays of the two periods and after consideration of the direct borrowings, there can be no doubt that the Elizabethan influence was a constant, well-recognized, directing—almost a dominating—force in Victorian poetic drama.

#### AGNES STOUT. Reflections of Current Social Conditions in Milton's Major Poetry. (Under the direction of G. C. TAYLOR.)

In this analysis of Milton's major poetry, made with the definite aim of relating it to the panorama of social and intellectual life of the time, two primary problems have arisen. First, did Milton actually concern himself in the later poetry with current social conditions, after he had turned from them as subjects for literary controversy? If so, how does he use such material? In spite of many suggestions to the contrary, no definite allegorical plan of presentation of contemporary conditions has been found for any of the major poems. Nevertheless, Milton does reflect current problems of social life in the illustrative material which he uses. In order to focus the attention, a cross-section, as it were, of some of the leading social and intellectual ideals of the seventeenth century has been presented in its relation to the poetry. Consideration has been given to these problems: educational theories and systems, the development of science and scientific research, the status of women, the social position of the lower classes, the recreation of the people, and war as a social institution. Each problem is an almost independent unit, having its own background of social conditions. The chief purpose of the entire study has been to show Milton's position with regard to these outstanding interests of the time, and to compare it with that of his contemporaries.

The plan of education prepared by Raphael and Michael for Adam and as found in certain passages in *Paradise Regained* is discussed in connection with ideas proposed by Comenius, Bacon, Hartlib, and others. Milton's use of scientific material and his attitude toward scientific research and experimentation are considered. Class distinctions are taken up in the chapters on the status of women and the rise of the common people. The first deals with the

two controversies about women in the literature of the period, the attitude of Church and State, and a refutation of the generally accepted theory that Milton is more bitter in his denunciation of women than his contemporaries. The second reveals Milton's emphasis upon merit as the basis of social and political position. The chapter on social recreation considers sports and aesthetic entertainment of literature and music. Finally, with regard to war, the study has dealt with the use of contemporary technique and the attitude toward the purposes of war.

A survey of the results of this investigation leads to the second problem of Milton's relation to the times. He began as an abstract idealist. As time passed, he became an idealist who looked upon events more concretely. Milton is a follower of two schools: the conservative and the progressive. In his art he was a conservative. He was classical in a time when classicism was gradually fading away. In form, subject matter and purpose his conservatism is revealed. But in each of the social problems analyzed Milton is found to be progressive. In educational theories noted for their applicability to systems of a later day, in aim of research and method, in class distinctions of caste, in attitude toward the position of women, in social recreation, and in attitude toward war he is indeed ahead of his time. Milton completed the full cycle of his career as an artist still classical, and as a social thinker decidedly progressive.

The following master's theses were accepted by the Department during the year:

BLANCHE BRITT ARMFIELD. *The Chivalric Vocabulary in the Middle English Romances of the Latter Half of the Fourteenth Century.* (Under the direction of J. F. ROYSTER.)

This study makes an attempt to compile the words of chivalric significance in the following group of Middle English romances, all of unknown authorship and commonly ascribed to the latter half of the fourteenth century: *Sir Gawain and the Green Knight*, *William of Palerne*, *Alexander and Dindimus*, and *Joseph of Arimathe*.

The list of chivalric words is based upon the texts of these romances, each instance of occurrence being given by line reference to the romance. The meaning and derivation of each word are also included in the list.

The principal topics of discussion are: the origin of the words, conventionality of the use of the chivalric vocabulary in the romances, and the revival of this vocabulary and its conventionality in the writings of Edmund Spenser. In the treatment of this first topic it is shown that the great majority of the words are of Old French origin, a much smaller proportion being of Germanic origin. The second topic consists of a discussion of conventional phrases in the romances, their nature and the extensiveness of their use; following this treatment of conventionality, a specific list of conventional phrases with line occurrence is given. The final discussion, Spenser's use of the chivalric vocabulary, is based upon an examination of *Osgood's Concordance to the Poems of Ed-*

*mund Spenser*. A comparison of the original list of chivalric words with the concordance shows that Spenser employed the greater number of these words with varying frequency in his writings.

WILLIAM RAYMOND BOURNE. The Theatre in the *Gentleman's Magazine*, 1731-1776. (Under the direction of W. D. MACMILLAN.)

The purpose of this study is, by examining the files of the *Gentleman's Magazine* from its beginning in 1731 to Garrick's retirement from the stage in 1776, to determine the popular knowledge of the theatre and the interest in it of a mid-eighteenth century intelligent person likely to read the *Magazine*. It purports to give a summary of the criticism of the stage and the actors, and of the plays popular at the moment. At the end is appended a handlist of the plays referred to or talked about, with the single exception of book announcements not accompanied by appreciable reviews.

The conclusion is reached that a widespread interest existed, so wide, indeed, that many a reader sent in unsolicited reviews of plays and general articles on the stage, the length of the handlist alone offering sufficient evidence to that effect; that such interest was uncritical, the age caring little about the source of its plays or the identity of its writers; and, though the period produced many a moral stricture upon its plays, that it had more artistic sense than is generally conceded.

MARGARET CHREITZBERG. Prevailing Types of Women in English Comedy from its Beginning to 1640. (Under the direction of G. C. TAYLOR.)

The first purpose of this investigation was to make a study of the prevailing types of women used in English comedy before Shakespeare. It was found necessary to include in it a number of plays which were written after Shakespeare and a few of the more important tragedies. Thus the field has been enlarged until it includes a general survey of practically all types of Pre-Restoration comedy.

Although this is a study of woman's part in English comedy, it was thought expedient first to make a general survey of the social conditions of woman during the years covered by the dramas under consideration. It was found that the different characters tend to become stock figures and repeat themselves more than is supposed, but a comparison of some of the women in the drama with the actual conditions of women will show that to a certain extent these plays do reflect the freer life which woman was slowly achieving.

The first chapter discusses the woman of low class used for farce, a type which comes from the Italian *servetta* and which appears all through the drama, exerting some influence on tragedy and also on the woman of higher class, particularly in Marlowe's *Tamburlaine*. The second division is on the shrew. This type appears in the early mystery plays, Noah's wife being the most important, and is a very popular type all through the drama. The nurse is discussed in the third division. This character begins in Latin comedy and

is a stock figure in Italian drama. English comedy follows closely the Italian in the use of the nurse. The fourth division is concerned with the courtesan, a distinctly foreign type. The earliest English plays had Biblical courtesans, a different type from the Roman, Italian, or Spanish. The English bawd is classed with this type. With Marston begins a more sympathetic treatment of the courtesan, a decided change from the earlier treatment. In this division come certain of the great tragedies. The fifth division takes up the clean, wholesome, strong woman, the type most peculiarly English. This is the type developed by Greene and carried on into Restoration comedy. In this last chapter are grouped the patient wife, the noble lady, the sweet, simple girl, the social climber, and the girl in man's clothes, the type so popular in Renaissance literature.

OSSIE MARGUERITE CLAYTON. Contemporary People in Shakespeare's Plays. (Under the direction of G. C. TAYLOR.)

The purpose of this paper has been to assemble all possible theories as to the possibility of Shakespeare's presenting the real people of his day as characters in his plays. This investigation begins as far back as 1708, when the first ingenious guess was made in regard to Sir Thomas Lucy, and continues through 1926.

The material has been presented in the following manner: First, the references and identifications according to plays, arranged in their probable order of production, followed by a chronological tabulation of critics and their respective theories. Thus the growth of this tendency of criticism is shown. After this tendency is traced, the basis, if any, of each theory is presented and compared with the facts of the history of the period.

From this information a conclusion is drawn as to the validity of the bases and the probability of Shakespeare's dramatizing scenes of the day and reproducing his friends and associates on the stage.

LUCY MARIA COBB. Traditional Ballads and Songs of Eastern North Carolina. (Under the direction of ADDISON HIBBARD.)

The purpose of this thesis is to present a varied collection of traditional songs and ballads found in eastern North Carolina—particularly in Lenoir, Franklin, Wayne, Carteret, Hyde, Anson, and Dare counties—and to use these songs and ballads as evidence either for or against the communal theory of authorship. This collection does not give the music, which is only incidentally touched upon.

The divisions under which the study is made are as follows: Introduction. A discussion of the ballads as a whole with regard to their authorship and transmission, and the changes brought about by transmission and influence of locality, with instances cited from particular ballads and songs. I. Versions of old English and Scotch ballads; II. songs and ballads of apparently British origin; III. songs and ballads of apparently American origin; IV. Negro and pseudo-Negro songs; V. dance songs, both white and Negro; VI. nursery songs;

VII. fragments found in various localities which may enable another collector to find the whole song or ballad.

The conclusion reached from study of these traditional songs is that originally nearly all of them were composed by an individual, and that through oral transmission they have become a part of the tradition of the people and have gone through many changes, more degrading than uplifting.

### VINA MOSTELLER FENLEY. Structural and Verbal Repetition in Chaucer. (Under the direction of J. F. ROYSTER.)

In this thesis a detailed study is made of the works of Chaucer in relation to structural and verbal repetitions and parallelisms. The first chapter deals with the repetitions in structure that are to be seen, for the most part, in certain fixed methods for the beginning and ending of a story, together with a series of tangible formulae for the indication of variations within the narrative itself. In Chaucer's early poems, there seems to be a close following of the medieval rhetoricians, who had laid down rigid principles in *l'art de bien dire*. Consequently, in almost all of the poet's early works, there may be seen recurring rhetorical devices which Chaucer either abandons or burlesques in his later productions. For example, Chaucer's undoubted development in technique is evidenced by his methods of beginning a story. The first period of his literary activity shows two chief schemes for the initial motif: first, the formal invocation, seen chiefly in the dream allegories; and second, the apostrophe to the main character in the story. Both of these methods were thoroughly in keeping with rhetorical rules of "fine writing." The later *Canterbury Tales*, however, show a decided change in the introductions, but Chaucer has his formulae here as well as in the earlier poems. The scheme followed in twelve of the later tales in the Chaucer chronology is that of the announcement of the character, his name, and his particular dwelling place, after which the poet goes immediately into his story without further digression. Thus repetitions in structure appear in the earlier poems in the form of elaborate figures of rhetoric, while the later poems are filled with structural repetitions, but these bear evidence of Chaucer's decided development in method. Distinction may also be made between the early and late poems in line structure. Chaucer's first works are in the octosyllabic couplet, while his last poems are in the iambic pentameter couplet, the first use of this verse form in English. While the poet's use of certain rhythm fillers and tags is extensive in both verse forms, the later form allows a greater variation because of its added foot. These tags and fillers, as a result, become less obvious and the monotony of their use in the early verse disappears when Chaucer has at his disposal a series of metrical aids ranging from one to three syllables.

In the second chapter detailed study is made of verbal repetitions and parallelisms throughout Chaucer's works. Although this is a field for unlimited study, an attempt is made here to establish the existence of a distinct and possibly conscious line of echoes between the stories which are near each other in time of writing and which also conform forcibly when tales of the

same nature are compared, as romantic with romantic and realistic with realistic. A striking example of similitude of expression in stories that bear a relative date of composition is to be seen in *Troilus and Criseyde* and the *Knight's Tale*. These two also have a kindred subject matter. Thus, the repetitions of this nature lend themselves to a conclusive and detailed conformity.

ANTOINETTE SMITH JENKINS. The Jealous Husband in the Plays of Chapman, Jonson, Heywood, and Shakespeare from 1597 to 1611. (Under the direction of G. C. TAYLOR.)

The purpose of this thesis is to show what contributions Chapman, Jonson, Heywood, and Shakespeare made to the characterization of the jealous husband in the drama during Shakespeare's dramatic activity.

The introduction deals with the use of the jealous husband theme in the literatures of other countries and England previous to the period studied, in order to show what may have influenced the dramatists under consideration.

Each of the four succeeding chapters deals with one of the dramatists and the fifth with *Eastward Hoe*, a play of joint authorship. Chapman, who supposedly introduced the theme into late Elizabethan drama, used the jealous husband for humorous purposes in his comedies of intrigue and as the basis for revenge in his tragedy. Famous for his development of the so-called humour play, Jonson gives the jealous husband a prominent position in his gallery of humorous characters, although he lays little stress on the probability of the motivation. In the realm of tragedy, on the other hand, Heywood is noteworthy for having portrayed wronged and forgiving husbands. Then, as would be expected on account of his versatility, Shakespeare utilizes methods from the other three dramatists, adding others of his own. His comedy of intrigue is similar to Chapman's; his tragedy portrays the revengeful husband of the same dramatist; his tragi-comedies sometimes show the forgiving husband of Heywood, and at other times reveal the Jonsonian husband whose suspicions arise unaccountably from his own imagination. By far the most sympathetic treatment of the theme by any dramatist occurs in Shakespeare's *Othello*.

Within a period of about fourteen years, the dramatists have exemplified various skilful methods of approaching the subject. In the Jacobean plays the playful element of the humour comedy, as well as the nobility of *Othello* and *A Woman Killed with Kindness*, largely give place to a rather sordid, unfeeling treatment of the subject, illustrated by such decadent dramas as Ford's *The Broken Heart*.

ARTHUR I. LADU. The Conception of the Ego in Emerson and Whitman. (Under the direction of NORMAN FOERSTER.)

Without going into the matter of influences and sources, this study investigates separately the writings of Emerson and Whitman to ascertain the conception of the ego which each held. It is therefore a double study, not primarily a comparison.

The study defines egoism, as both Emerson and Whitman conceived it, to be a cult of the self; it attempts to show that this cult is of unique importance in the thought and writings of both.

It attempts to show that Emerson conceives, first, an oversoul which has unconditioned existence as idea, is essentially good, and of a flowing nature; second, a soul—the ego—which is of the same essence as the oversoul, and communicates with the latter directly by intuition and mediately through nature. The soul in its natural state needs only be passive to receive communication from the oversoul. Hence, the primary practical duty of the soul is to reject obstacles of the intellect and of creed—to be “self-reliant.” Finally, Emerson denies the actuality not only of evil but also of actual people and the concrete world; he reduces the universe to a beautiful idea of the ego in its relation to the oversoul.

In many respects Whitman’s conception of the ego is similar to Emerson’s. He has the same respect for the intuitions, much the same attitude towards evil; he regards personality as the supreme reality of the universe. But Whitman does not reduce the physical world to an idea; the ego is as much body as soul; it exists as the entire man. Life is essentially good and spiritual when it is healthy and normal. Whitman’s ego realizes itself in an attitude of acceptance of the universe, and in the romanticists’ search for the ideal. Emerson denied actual life to promote an idea; Whitman used it to make an idea sensuously poetic.

LOUISE LANHAM. *Hymnic Elements in Milton’s Poetry.* (Under the direction of A. C. HOWELL.)

Begun originally as a study of the hymns in *Paradise Lost*, this thesis includes a study of similar elements throughout Milton’s poetry. The first chapter discusses Milton’s conception of the hymn, which is apparently a compound of religious content and classical form. The second chapter shows that the musical connotation of the hymn has given a certain quality of style to portions of Milton’s poetry. The third section includes a study of the early hymnic poetry, and suggests a new source for the *Nativity Hymn*. A study of Milton’s translations of the Psalms, Milton’s venture into practical hymnology, shows that he was probably influenced by other metrical versions of the Psalms. The hymns of *Paradise Lost* are next shown to have been influenced by certain forms in the classical Greek and Latin literature. The probable influence of Latin Christian hymnology is also indicated.

MAURICE AUGUSTUS MOORE, JR. *Sir Isaac Newton in Early Eighteenth Century Poetry.* (Under the direction of H. M. JONES.)

In Chapter I an attempt has been made to ascertain Newton’s contributions to the development of mathematics; the value of his optical researches, especially his theory of light; and the incalculable importance to science of his verification of the law of universal gravitation, with a suggestion of the amaz-

ing influence it exerted on subsequent philosophical and theological speculation. Also, his interpretation of Scripture is shown to be half-naturalistic, half-mystical. Finally, the vast difference between Newton the scientist and Newton the philosopher is emphasized. In science he was wholly positivistic; but into philosophy he injected a deep, mystical, religious faith. Nevertheless, by virtue of his metaphysical opinions, he unconsciously opened the door to natural religion.

Chapter II is concerned with tracing the gradual acceptance of the Newtonian philosophy in England, in France, and in Holland, showing how his metaphysical beliefs were adopted together with his scientific achievements.

That many poets of the early eighteenth century knew of Newton's reputation, scientific discoveries, theological and metaphysical speculations, is demonstrated in the third chapter by quotations from their poetry.

THOMAS BRADLEY STROUP. *Travel Conventions in Raleigh's Discoverie of Guiana.* (Under the direction of W. F. THRALL.)

Raleigh's *Discoverie of Guiana* has been examined with a view to determining whether the author was "copying from the Book of Nature," as some of his biographers have said, or whether he was, in the main, following the current methods of contemporary travel books in introducing into his narrative certain unusual people, animals, and other natural phenomena. The study has led to the conclusion that the conventional elements dominate throughout, and when Raleigh reports such "marvels" as the headless men who live in the mountains of Guiana, he is following in the well-beaten paths of his predecessors and contemporaries.

In the course of the study the relation of ancient and mediaeval encyclopedias and their subsequent relation to mediaeval travel literature have been briefly considered, and an interrelation between mediaeval encyclopedias and travel literature has been indicated. Furthermore, renaissance travel books have been shown to be dependent upon mediaeval travel accounts for the bulk of phenomena that appear in them. In addition, the spread of travel literature during the Renaissance is shown, by the number of collections and translations, to be very great. The various phenomena employed by Raleigh have been pointed out, together with their relation to similar phenomena in other travel books, both before and during the Elizabethan period.

This work is in no sense exhaustive; it purports merely to point out the possibilities for establishing further interrelationships in travel literature.

EDWARD PINCKNEY VANDIVER, JR. *The Parasite in English Drama From Its Beginnings Up to and Including Ben Jonson.* (Under the direction of G. C. TAYLOR.)

The object of this thesis is to trace the development of the parasite in Elizabethan drama, to compare him with the Latin comic parasite, to show the kinds of plays in which he figures, to analyze his role as a dramatic

character, and to point out his culmination in important dramatic characters of Shakespeare and Jonson.

In Elizabethan drama the parasite is found to be a flatterer, a dependent seeking food or power, sometimes a humorist, sometimes a villain, occasionally a pander, often an adviser. Usually he is much more important as a dramatic figure than is the Latin comic parasite. Although in Plautus and Terence the parasites are always in pure comedy, in Elizabethan drama they are usually found in tragi-comedy and at times in tragedy. As the parasite's importance as a dramatic character increases, so does his tendency to become a villain suitable for tragedy increase. The parasite is sometimes found combined with the braggart soldier as one character. All the traits of the earlier English parasites are found in either Falstaff as a comic figure or in Iago as a tragic figure; also Ben Jonson's Mosca embodies the leading traits of the English parasite as a mischievous scoundrel in a so-called comedy.

LILY WINN. *The Gypsy in English Literature: 1700-1825.*  
(Under direction of G. L. PAINE.)

The purpose of this thesis is to show the different attitudes toward Gypsies as indicated by their treatment in English literature from 1700 to 1825. A brief account of their origin and history is given. Special attention is paid to the important laws passed against them in England and to the gradual change in the general attitude of the people toward Gypsies from one of hostility to one that was predominantly humanitarian.

The treatment of Gypsies in literature indicates widely varying attitudes toward these characters. Two very distinct attitudes exist: the hostile and the romantic. To writers of the former, Gypsies are filthy rogues and wicked rascals who prey upon the people; to writers of the latter, Gypsies are engaging rogues who possess a charming deviltry and a romantic mystery. Between these two extremes are attitudes and interests which find expression in: (1) a representation of Gypsy life as an ideal of freedom, (2) a humanitarian attitude toward Gypsies, (3) the employment of Gypsy characters in literary conventions, (4) the incorporation of Gypsies into Gothic stories and nature scenes.

#### DEPARTMENT OF GERMAN

E. C. METZENTHIN has continued his studies in regard to Goethe and the Lutheran Church in America, to be published in the *Goethe Encyclopedia*. He did research work while in Germany during the summer months of 1928, dividing his time between these Goethe studies and the investigation in the *Monacensis*, the most important MS. of the Old Saxon *Heliand* at Munich, in preparation for the editing of a paleographic reprint of the parallel passages in all four extant MSS., with introduction and notes.

## DEPARTMENT OF GEOLOGY

During the year COLLIER COBB has continued his study of the loessal soils along the Mississippi River. An extensive field trip has been made through the Mississippi delta, and the rewashed loess followed as far north as Memphis. He expects to conclude this study during the coming year and to publish the results. Abstracts of papers presented follow:

Some American Pioneers in Soil Investigation. A paper presented to the Elisha Mitchell Scientific Society, November 8, 1927.

*Gerard Troost (1776-1850)*. Born at Bois-le-Duc, Holland. Traveled widely in France, Italy, Switzerland, and Germany, under commission from the King of the Netherlands. Made large and valuable mineral collection. While working on his geological map of the environs of Philadelphia he made a soil survey of the region.

*Eugene W. Hilgard (1883-1916)*. Born in Rhenish Bavaria. Our earliest direct investigator of soils in connection with their vegetation, and of the influence of climate upon the formation of soils; also one of our earliest students of "alkali lands."

*Joseph Buckner Killibrew (1831-1906)*. Bred plants, wheat (1871), to suit certain exhausted soils in Tennessee, increasing enormously the yield per acre.

*Milton Whitney (1860-1927)*. Was the first to stress the importance of the physical analysis of soils, so early as 1886, including size of soil-grains, structure, and texture of soils. His investigations really mark the formal beginning of a "science of soils," and his work has always been highly esteemed in Europe.

*Collier Cobb (1862- )*. Was the first to point out the value of the mineral analysis of soils and to make such analyses of dune sands and soils (1886) by means of the microscope and the Harada tube.

*Frank K. Cameron (1869- )*. Was the first to realize the importance of the soil solution and an understanding of the phenomena affecting the composition and movement of the soil moisture. He brought to bear upon this problem the most highly finished technique of the physicist, the chemist, and the bio-chemist (1910).

Early Italian Maps of American Shorelines. A paper presented to the North Carolina Academy of Science, April, 1928.

This paper consisted of a study of photostats of sixteen maps engraved by Antonio Francisco Lucini which were exhibited to the Academy. Several of these maps are from the collection of Sir Robert Dudley, the rest obtained in ports around the Mediterranean, dating from the third expedition of Columbus fitted out by Amerigo Vespucci exploring the coast of Venezuela (Guiana) in 1499, and including maps made as late as 1661, extending even to the north-

ward of Newfoundland. These maps show the character of the shoreline in even greater detail than the Portolano maps. In many cases they give soundings and mark the variation of the compass; and they are the earliest wind and current charts of which we have any knowledge.

**Japanese Plants Around Chapel Hill.** A paper presented to the North Carolina Academy of Science, April, 1928.

William A. Graham (A.B. University of North Carolina, 1824), Secretary of the Navy, 1850-1853, sent Commodore Matthew Galbraith Perry to Japan in 1852. James Dobbin (A.B. University of North Carolina, 1832), Secretary of the Navy, 1853-1857, received the report of the returning Perry, who had made a commercial treaty with Japan in 1854. Dr. James Morrow of Charleston, agriculturist of the expedition, made the collection of plants submitted to Asa Gray and described by Professor Gray with the assistance of Mr. Sullivant, Dr. Harvey, and others at Harvard College. The *Narrative of the Expedition* was written by Dr. Francis Lister Hawkes (A.B. University of North Carolina, 1815).

Lieutenant James Iredell Johnston, U. S. N., a North Carolinian, executive officer of the Powhatan, on which the first Japanese Embassy made their voyage as far as Panama in 1860, brought with him a few living plants and the seeds of many more. Nearly all of these found their way to Chapel Hill. They were set out and planted in and around the campus of the University where most of them flourished, producing a dense undergrowth on the campus until cleared out by order of President George T. Winston in 1891 and 1892.

In 1877 Dr. Kemp P. Battle showed Dr. Cobb *shortia* from Japan growing just south of the campus, and toward the end of the same summer Dr. Cobb saw a different variety of *shortia* growing in the mountains of North Carolina. Professor Asa Gray told the author of this paper in 1886 that the plants of Japan were strikingly like those of North Carolina, all the way from the region around Wilmington to the mountains of the western and northwestern parts of the state. A list will follow later.

WILLIAM F. PROUTY has published during the year :

Geological Report and Map of Hardy County, West Virginia, as part of "Report on Hampshire and Hardy Counties, West Virginia." *West Virginia Geological Survey Report*, March, 1928.

The geology of Hardy County covers pp. 202-265 of the report and is descriptive of about 15,000 feet of Paleozoic sediments and their fossils. The geological map is on a scale of an inch to the mile and covers an area of approximately 1000 square miles.

Geological Report and Map of Rocks of Pendleton County, West Virginia, Older than the Clinton. *West Virginia Geological Survey Report*. (In press.)

Abstracts of papers presented follow:

Typical Structures of Central Appalachians and Their Relation to Topography. A paper presented at the North Carolina Academy of Science, April 27, 1928.

In the Central Appalachian area, west of the great belt of outcropping, massive limestones and dolomites, the surface rocks are largely thinner-bedded limestones, shales, and sandstones. These have readily folded under lateral earth pressures and have been little faulted. Under these conditions we have the maximum relationship between erosional topography and geologic structure. In all folds, after erosion has cut through the heavy sandstone arches, the anticlines tend to become depressions and the synclines to become elevations. In some of the larger geanticlines of the area, as Patterson Creek Mountain, Hardy County, West Virginia, this correspondence is so perfect that a longitudinal structural profile of the great fold can be drawn from a study of a distant sky-line photograph. The same tendency of erosion to form anticlinal valleys and synclinal hills applies equally well to longitudinal or to transverse folds.

In many of the larger anticlinal valleys where the folds have been overturned and dips are steep, as in the eastern portions of Hampshire and Hardy Counties, West Virginia, drag folding and fracture cleavage of the less competent beds make it possible to determine readily the direction of the axis of fold from the point of observation.

Structural Relationship of Triassic Basins of Eastern North Carolina to other Triassic Basins of Eastern North America. A paper presented before the North Carolina Academy of Science, April 28, 1928.

If we assume, as others have done, that the Durham Basin of the Deep River Triassic area of North Carolina received its sediments from both the northwest and southeast sides, and that the basin was approximately symmetrical in cross-section, and had an original dip of beds toward the center of approximately five degrees, then, to fit the observed facts of present dips of beds, there must have been a tilting of the whole basin toward the southeast of at least twelve degrees. This could have been accomplished by: (a) a tilting of the whole or a large part of the piedmont area, (b) elevation of west side of Durham basin, (c) a single great fault on east side of Durham basin, or (d) a number of faults in the basin. (a) Cannot be true, else Triassic basins of west central North Carolina and Virginia would be much more highly elevated than Triassic basins of eastern or east central parts of Virginia and North Carolina. If (b) is correct the west side of Durham basin must have been elevated about 22,000 feet above east side. If (c) is true the east side must have been faulted down about 22,000 feet. If (d) is true, there must have been a down faulting on the east of 22,000 feet, probably in numerous small slips, at end of sedimentation or during sedimentation, to be

followed by faulting in the basin, with rise of blocks toward the southeast, or depression toward the northwest, or perhaps both these movements.

If faulting on east side of Durham basin and in basin occurred at close of sedimentation, then Triassic sediments on the southeast side must be very thin, and, unless the strike faults in the basin are numerous and of small throw, erosion would expose strips of basement rock along the eastern border, parallel to the border fault, much more readily than would be the case along the western border, on account of the steeper dip of beds on northwest side of basin. Such strips are known on the west side of basin but not on east. The Durham deep well, about two miles from the western border, reaches a depth of 1800 feet below the level of the border, without encountering the basement rock. In the Connecticut Valley Triassic basin, with east dipping sediments, wells have penetrated to a depth of 4,000 feet within less than two miles of the western border, entirely in the Triassic.

From the above it is concluded that the east border fault occurred in stages during Triassic sedimentation and that much of the interior faulting occurred toward or at the close of sedimentation.

It has long been recognized by geologists that there exists some structural relation between the various eastern Triassic basins. A hypothetical anticlinal axis can be drawn separating the east central North Carolina basins and the Connecticut Valley basin (both with east dipping sediments) from all the rest of the Eastern United States areas (with dipping sediments). If such a great structure, due to lateral compression, existed and controlled the direction of faulting it must have occurred in conformity with original tensional jointing; or, if the latter, in accordance with original compressional jointing.

Perhaps the most logical structural assumption is a great but relatively shallow synclinorium existing to the east of the folded Appalachians. In basins of this structure Triassic sediments began to accumulate under semi-arid conditions, since the highlands to the west cut off much of the rainfall. Later in Triassic time the lifting force of great masses of molten igneous rock beneath the synclinorium caused a general arching of the strata and tensional faulting along planes practically parallel to those of the former compressional joints. During this process the areas of sedimentation tended to sink on the sides away from the axis of arch and to rise on the side toward it. This continued until the molten basic rock reached the surface in the Connecticut Valley Triassic area and injected the Triassic basins to the south, when collapse of the arch began with additional normal faulting, with down throw on the side toward axis of fold. This action was also accompanied by the formation of basic dikes whose strike is in many places different from that of the sediments, usually in a direction to the west of north. The greater and earlier outpourings and injections of lava seem to be toward the north, so that collapse would begin there first and work gradually southwestward along the general Triassic Arch area. This would cause the new tensional lines to have a general strike of west of north in conformity with the observed facts in Virginia and North Carolina.

Triassic Deposits of Durham Basin and Their Structural Relation to other Triassic Areas of Eastern North America. A paper presented before the Geological Society of America, Cleveland, Ohio, December 30, 1927.

The Durham basin represents the northern portion of the Deep River Triassic area of North Carolina; the city of Durham is in the basin and Chapel Hill is on the western border.

Red argillaceous sandstones with interbedded arkosic sandstones and conglomerates frequently cross-bedded and carrying many wind faceted pebbles, prove the sediments to be largely of arid climate and terrestrial character. Torrential conditions prove bordering highlands while small areas of thin-bedded carbonaceous clays with color and texture banding show local lake basins and seasonal changes. Color mottling and false bedding are largely explained by differential staining and leaching. Correlation of divisions with those of Cumnock basin to the south is made possible by the occurrence of fossiliferous shales, carrying numerous *Estheria* and *Cypridas*.

The thickness of the Triassic is estimated as 10,000 feet.

Igneous injection took place toward the end or after the close of Triassic sedimentation. Surface flows during sedimentation and volcanic ash deposits are unknown.

The Durham basin is a monoclinial structure with southeast dip and southeast boundary fault of large displacement, considerable of which is shown to have occurred during later stages and at close of Triassic sedimentation.

The author believes with others that the Triassic basins of Eastern North America are structurally related and, further, that this structure is a partially collapsed complex fold. Triassic sedimentations began in the synclinal basins of this great bed. Many of these basins were depressed and faulted by the weights of accumulating sediments and the loss of underlying molten basic rock.

PROFESSOR PROUTY is continuing his study of the Triassic.

J. H. SWARTZ is continuing his studies of the Chattanooga black shale of the Eastern United States under a grant from the Rockefeller Fund for Research in Pure Science. During the past year he has published and presented the following articles and papers giving his results:

The Chattanooga Age of the Big Stone Gap Shale. *American Journal of Science*, XIV: 485-499. December, 1927.

A series of detailed stratigraphic studies has led to the following conclusions:

1. The Big Stone Gap shale of Ulrich and Stose is shown by direct and continuous tracing to be the northward continuation of the Chattanooga shale

of the type area. Such being the case, the term *Big Stone Gap shale* must be abandoned for the prior term *Chattanooga shale*.

2. Throughout the whole area the Chattanooga shale is divisible into three members: (1) an upper black shale member to which the term *Big Stone Gap* is here restricted; (2) a middle gray shale member, here called the *Olinger member*; and (3) a lower black shale member here designated the *Cumberland Gap member*.

3. The Olinger member is of the same age as the Cumberland Gap member, with which it intertongues to the south, representing merely a different environmental condition.

4. The Big Stone Gap member is separated from the underlying Olinger member by an unconformity which is most marked in southeastern Tennessee and which appears to be absent in northeastern Tennessee and southwestern Virginia.

The Chattanooga Shale of Eastern Tennessee: Its Age and Correlation. American Association for the Advancement of Science, Nashville, Tennessee, December 28, 1927. Abstract in *Pan-American Geologist*, XLIX: 300-301. May, 1928.

The Chattanooga Shale in Eastern Tennessee and Virginia. Geological Society of America. Cleveland, Ohio, December 31, 1927. Abstract in *Bulletin of the Geological Society of America*, March, 1928.

The Chattanooga shale in eastern Tennessee and southwestern Virginia is exposed chiefly in two disconnected areas: (a) along the Cumberland escarpment from Chattanooga, Tennessee, to Big Stone Gap, Virginia, and thence, via Powell Mountain, Newman Ridge, etc., to Sneedville, Tennessee; and (b) along Clinch Mountain from near Knoxville, Tennessee, to north of Saltville, Virginia.

In the Cumberland escarpment area (a) the Chattanooga shale is divided into the three members outlined above: (1) the black Big Stone Gap member; (2) the gray Olinger member; and (3) the black Cumberland Gap member, which becomes quite sandy at Olinger and Big Stone Gap. These are underlain in the north by cream shales and interbedded black shales of Portage age (a4) and these by black shale of Genesee age (a5).

In the Clinch Mountain area (b) there are at least five members in the black shale series: (b1) an upper pure black shale of Mississippian age; (b2) a gray shaly sandstone and sandy shale carrying a Mississippian fauna; (b3) a very sandy black shale to black shaly sandstone of post-Chemung, probably Mississippian age; (b4) gray to buff sandy shale and shaly sandstone of Chemung age; and (b5) interbedded gray and black shales of Portage age. This is underlain by (b6) black shale of Genesee age.

The fauna of bed b2 has been discovered at Sneedville, in the southeastern end of the outcrop (a) above, where beds 1, 2, and 3 are clearly exposed, under-

lain by Portage and Genesee. Similarity in succession and lithology proves that beds a1, a2, and a3 are the equivalents of beds b1, b2, and b3. The Chattanooga shale is thus extended into the Clinch Mountain area, where a Mississippian age is indicated for it.

The Devono-Mississippian Black Shales of Tennessee and Virginia. North Carolina Academy of Science, April 28, 1928.

The Devono-Mississippian boundary is concealed throughout most of the eastern United States by a series of black shales whose relationships to each other and to the Devonian and Mississippian systems have been in doubt for almost a century. Two of the most interesting of these are the Chattanooga shale of Tennessee and its correlative, the Big Stone Gap shale of Virginia. Recent studies by the writer have shown that:

(1) The black shale identified at Mendota by Stose as Big Stone Gap is not Big Stone Gap at all. It is older than the Big Stone Gap (Chattanooga) shale, which it underlies, and from which it is separated by a considerable thickness of Chemung beds.

(2) The Chattanooga shale can be traced to Klondyke, Tennessee, up to which point it displays its characteristic three-fold division. Beyond that point its presence cannot yet be proven.

(3) A characteristic Mississippian fauna, found in the middle member at Sneedville and Rutledge, Tennessee, proves the upper two-thirds of the formation to be Mississippian in age. The lower third is probably Mississippian, although more field work is needed to settle that point.

(4) Some evidence has been found indicating that there is no true break between the Devonian and Mississippian in the southeastern United States, a very important fact if it can be substantiated by further investigation.

PROFESSOR SWARTZ has recently undertaken a series of X-Ray studies of fossils, especially of foraminifera. The results so far obtained were summed up in a recent paper:

Some X-Ray Studies of Fossils. North Carolina Academy of Science, April 28, 1928.

A series of X-ray photographs was made of a considerable number of fossils, especially of foraminifera. It was found that the internal anatomy of the larger foraminifera could be very easily determined in this way. Since several hundred foraminifera can be photographed at one time, with exposures of from 1 to 2 seconds, a very rapid and simple method is thus provided for the investigation of their internal structure.

The method is not yet available for the study of the smaller foraminifera since their internal morphology is blurred and partially concealed by the coarseness of the silver grains in the finished negative. Experiments are being carried on in an attempt to discover some method of taking enlarged X-ray photographs.

A series of photographs of large fossils showed that excellent results could be obtained where the fossil had been replaced by silica or pyrite. The ordinary fossil, however, has a filling too closely allied chemically to the shell to permit the necessary contrast for good photographs. Efforts made to produce an artificial contrast by differential chemical reactions have so far met with little success. The experiments, however, are being continued.

PROFESSOR SWARTZ is studying the very abundant foraminifera which he has found to be present in the marl of the city quarry of Wilmington, North Carolina. A paper embodying his results will be presented later in the year.

PROFESSOR SWARTZ has completed a large series of measurements of *Atrypa reticularis*, *Atrypa spinosa*, and *Spirifer pellaensis*. He is continuing his statistical studies of the Brachiopoda with measurements of *Composita trinucles* and of a more extended series of *Terebratula wilmingttonensis*.

A Simple Proof of the Law that the Only Possible Periods of Crystal Symmetry are 1, 2, 3, 4, and 6. *Zeitschrift für Kristallographie*, LXVI: 2: 309-314. 1927.

Two proofs, one trigonometrical, the other geometrical, were given of this fundamental crystallographic law. In the trigonometrical proof it was shown that faces parallel to the *c*-axis, one of the most common of crystal forms, can intersect in a real edge only when the crystal has a period of 1, 2, 3, 4, or 6. The geometrical proof showed that the raumgitter units of the crystal could form a continuous structure only when they, and therefore the crystal, had symmetry periods of 1, 2, 3, 4, or 6.

GERALD R. MACCARTHY has published during the year:

An Unusual Quartz Crystal from Grassy Creek, N. C. *Zeitschrift für Kristallographie* (Leipsic), LXVII: 1: 29. 1928.

PROFESSOR MACCARTHY has presented the following papers:

Experimental Work on Some of the Processes Involved in the Building of Mountains. Elisha Mitchell Scientific Society, February 14, 1928.

The Origin of Folded Mountains. North Carolina Academy of Science, April 27, 1928.

The following master's theses were accepted by the Department during the year:

IRVING LEE MARTIN. A Petrographic and Micro-Paleontological Study of Some Marls of Eastern North Carolina. (Under the direction of W. F. PROUTY.)

The purpose of this study was to see if some method of correlating our Cenozoic deposits could be worked out by the use of the mineralogical and foraminiferal content of the marls of Eastern North Carolina.

In this work the writer determined the calcium carbonate and mineralogical content and their relative percentages of two samples that were taken about fifteen miles apart. Also the foraminiferal content was studied and as many species identified as time would allow.

The two samples contained identically the same minerals and their percentages were almost alike, both samples having 95 per cent quartz. The following are the minerals that were found: quartz, augite, hornblende, rutile, corundum, apatite, topaz, limonite, garnet, and muscovite. Also all the foraminifera that were identified occurred in both samples and their ratio was approximately the same. The species that were identified are: *Rotalia soldanii*, *Pulvinulina umbonata*, and *crstellaria rotulata*. The percentage of calcium carbonate was 60 in both samples.

The above results show that the two samples must have been deposited under the same conditions and at the same time. This shows that a method of correlating our eastern North Carolina Cenozoic deposits can be worked out by a detailed study of the marls.

MARGARET D. SLAVENS. Clays in Industry in Ohio. (Under the direction of COLLIER COBB.)

In this thesis the clays of Ohio have been discussed in regard to their importance to the industries of the state.

The clays in that state furnish a great amount of industry to the state, as Ohio leads in ceramic production.

The history of the clay industry shows its development and growth from small household industries to the present magnitude of output.

Some of the more important clays of the state have been discussed in detail, especially the Sciotoville clay.

Only the coal formation clays of Ohio—the flint, semi-flint, and plastic—are of great importance industrially. Their origin is directly associated with the formation of the coal in the state.

The present industry has grown to such an extent because the demands of the people have necessitated the improvement of older products and the introduction of new ones. The plants are located along the Ohio river, owing to transportation conditions in early times. The plants are located in Ohio, due to the presence of raw materials and fuel; and now a ready market is of importance. They have continued in this state because of raw material, fuel, labor, transportation, ready market, and capital. Due to these things the industry will expand in the future.

H. T. THOMPSON. A Study of the Physiographic History of Swamp Lands in Relation to the Problem of their Drainage. (Under the direction of COLLIER COBB.)

Swamp lands now undergoing reclamation, both successful and unsuccessful, have been studied, especial interest being taken in the Zuider Zee project in Holland and Lake Mattamusket in Hyde County in this state.

It has been found that drainage is inadvisable where the water table can not be lowered to a depth of three feet below the surface of the ground.

Swamps formed by heavy cypress growth may be more valuable for production of cypress lumber and shingles than as agricultural land, particularly if there would be difficulty in lowering the water table.

The conditions under which peat may be taken from peat swamps profitably are these: extensive deposit of high quality peat, absence of logs and roots within the beds, few growing trees, and an easily accessible market.

No drainage project is justified for agriculture in the United States if the swamp has been formed in an area sufficiently low to necessitate pumping equipment and levees. In no case is drainage practicable when there is dry land available.

## DEPARTMENT OF HISTORY AND GOVERNMENT

H. M. WAGSTAFF is editing Vol. XX, No. 2, of the *James Sprunt Historical Studies* (in press), which contains the *Letters of James Augustus Graham*, and *A Descriptive Book of the Orange Guards* (by James A. Graham).

The *Letters* are Civil War materials containing sidelights upon some of the dramatic incidents of the period of 1861-1865. The *Descriptive Book* is a manuscript history of a unique sort recently come to light, written by Graham as Captain of the Orange Guards (Company G, 27th N. C. Infantry).

C. C. CRITTENDEN has published during the year:

North Carolina Newspapers before 1790. *James Sprunt Historical Studies*, XX: No. 1.

The following doctoral dissertations were accepted by the Department during the year:

ALBERT LINCOLN BRAMLETT. North Carolina's Western Lands. (Under the direction of R. D. W. CONNOR.)

The term "western lands" included all of the present state of Tennessee. This territory was originally a part of North Carolina; after independence was declared it became public land, subject to the control and disposition of the new state government.

It is the object of this study to explain the purposes and means employed for the distribution of the lands and the efficiency with which these objects were accomplished. The period of time covered in this investigation extends from the establishment of the state government in 1777 to 1846.

The land policy adopted by North Carolina was based on its colonial landholding system. During and immediately following the Revolutionary War

objections were made to North Carolina's exclusive ownership and control of this territory, but these objections did not affect her land policy.

Land offices were first opened in this territory to dispose of the land to the settlers and other claimants. Arrangements were then made to sell it to pay the debts of the state, to redeem its credit, and to reward its Continental soldiers. Officials were appointed and offices were opened to carry these purposes into effect. The officials were inefficient and many frauds were committed. For various reasons the efforts made by the state to punish the criminals were not very effective. Speculators and not the soldiers secured most of the lands.

After the cession of the territory to the United States and its organization into the State of Tennessee, North Carolina, because of her many reservations in the Cession Act, continued to make grants for the vacant lands. This caused many controversies and compromises with Tennessee. The matters of dispute were not settled satisfactorily to either state and Tennessee was especially dissatisfied.

The University of North Carolina had received, through escheats and gifts from the state, a large amount of vacant land in Tennessee, but in order to secure its possession these claims were divided between the University of North Carolina and the colleges of Tennessee.

In 1825 Tennessee, under the leadership of James K. Polk, began a long series of efforts to secure from the United States the remaining ungranted land within her borders. This was finally accomplished in 1846.

**JAMES A. PADGETT.** *The History of the Enactment and Operation of the Federal Election Laws.* (Under the direction of W. W. PIERSON, JR.)

The purpose of this study is threefold—that of examining the history of the suffrage provisions of the federal Constitution, and the fourteenth and fifteenth amendments; and that of tracing the legislative history of the various federal laws bearing on suffrage. An attempt is also made to follow the operation of these laws, to analyze the litigation resultant from them, the popular opinion of them, and subsequent efforts to provide federal control over elections.

The first chapter has as its theme the history of the adoption of the provisions in the federal Constitution providing for the election of President, Senate, House of Representatives, and qualifications for electors. It also gives a history of the suffrage resolutions and proposed amendments of the suffrage sections of the Constitution, as well as the suffrage laws enacted before the close of the Civil War.

The second, third, and fourth chapters give the legislative history of the suffrage provisions of the fourteenth amendment, the reconstruction acts, and the fifteenth amendment, together with some of the leading arguments for and against their adoption. Chapter V is a discussion of the enactment of the enforcement acts and the proposals to extend these laws. Chapter VI is

a history of the minor election laws passed in the seventies, and the proposals before 1880 to extend these statutes.

Chapter VII is a discussion of the contest between Congress and the executive over the repeal of parts or all of the federal election statutes, and of the attempts further to extend federal control over suffrage before 1889. Chapter VIII is an account of the operation of the enforcement acts, showing how they failed, how in other instances they succeeded, how they were misused, the expense of enforcing them, and a detailed study of their operation in various sections of the United States. This chapter also points out some of the more flagrant violations of the enforcement acts, the attempts to evade the laws, the difficulties of holding elections under them, the cost of federal supervision of elections and the effects of these laws on politics, on the South, on the people, and on contested election cases in Congress.

Chapter IX is the congressional history of the force bills of 1889-1891, the reasons why these bills were defeated, and the final repeal in 1894 of most of the sections of the federal election laws. Chapter X gives the opinion of the press for and against federal control over elections in the various parts of the country, together with the opinion of some of the leading editors on the court decisions in some of the more important election cases.

Chapter XI is a history of the federal election laws in the courts, the number and distribution of these cases, and the decisions of the various federal courts bearing on these laws. Chapter XII is an account of the attitude of the two leading political parties towards federal control over elections after 1894. It also gives an account of the various election bills introduced in Congress after that date, the movement for and the passage of corrupt practice acts after 1900, and general conclusions.

The following master's theses were accepted by the Department during the year:

SAMUEL HORTON ASKEW. The Guarantee Clause of the Constitution since 1870. (Under the direction of W. W. PIERSON, JR.)

The purpose of this study is to trace the history, since 1870, of that clause of the Constitution of the United States which says, "The United States shall guarantee to every State in this Union a republican form of government." As an introduction a brief summary is given of the history of the clause before this period. An effort has been made to determine what power is given by the clause, by whom the power is to be exercised, and what is considered a republican form of government. The investigation has been made largely through the records of the cases involving the guarantee clause which have come before the United States Supreme Court and the highest courts of the states.

The leading case during the period was *Pacific States Telephone and Telegraph Company vs Oregon*. The opinion in that case removed any doubts existing as to what power was to enforce the guarantee given by the Constitution. Congress is unquestionably entrusted with that authority, subject

only to the limitations which govern ordinary legislation. Numerous attempts have been made in the state and federal courts to have acts of the state legislatures or constitutional amendments nullified because they were in conflict with principals which were claimed to be essential to the republican form of government. In many cases the courts have assumed jurisdiction but the contentions were not allowed. In the leading case it was held that the question whether or not a state has a republican form of government is a political one and is not subject to the jurisdiction of the courts.

The cases show no uniformity of opinion on the attributes of a republican form of government. It is clearly demonstrated that the ideas on the subject have undergone a change. Congress has the power not only to enforce the guarantee but also to decide what principles are necessary to republican government. It does not appear that the courts would attempt to examine the decision of the legislative branch on this point. This leaves Congress with large discretionary powers. There is no reason to believe that such authority, under ordinary circumstances, will be abused, but the history of the guarantee clause shows that it may become exceedingly important in times of crisis.

MATTIE ERMA EDWARDS. *The Doctrine of the Separation of Powers and the Relations of the Judicial and Legislative Departments in North Carolina.* (Under the direction of E. J. WOODHOUSE.)

The purpose of this study is to trace the history of the doctrine of the separation of governmental powers in North Carolina and to show the influence which the incorporation of this doctrine in the fundamental law of North Carolina has had upon the decisions of the supreme court of the state.

Beginning with the theory as enunciated by Locke and Montesquieu, its practice in England and influence on European political thought are discussed. The practice of the separation of powers as found in the colonial government is then taken up and followed by a discussion of the attitude upon the theory at the time of the American Revolution. The constitutional provisions for separating the three departments are then discussed, showing the increasing importance of the executive and judicial departments. This is followed by a detailed analysis of the supreme court decisions interpreting the provisions of the constitution.

The investigation tends to show:

(1) That the doctrine of judicial review of legislation is definitely established in North Carolina.

(2) That the Legislature cannot interfere with the inherent powers of the courts but can, to some extent, control the manner in which this power is exercised.

(3) That the courts can compel the performance of ministerial duties by the executive department, but cannot interfere in the exercise of discretionary power.

(4) That absolute separation is impossible and undesirable, and the distinction between the three classes of powers is becoming less definite.

KATHERINE MCKEAN WOLFF. *The Conflict between Congress and the Executive over the Control of the Administrative Service, 1789-1837.* (Under the direction of W. W. PIERSON, JR.)

This thesis is an historical sketch of the struggle between Congress and the executive over the control of the administrative service from the establishment of the federal government to the end of Jackson's presidency.

The Revolutionary background presents the precedent of placing administrative control in the hands of the legislative body. The Constitutional Convention of 1787 ignored this precedent to the extent of vesting the appointment of "executive officers" in the President with the advice and consent of the senate. When the great administrative departments were established by the first Congress, the President's control was further increased by giving to him the sole power of removal.

Certain incidents in the administration of the first two Presidents indicate that they interpreted the powers of the President to include the control over the administrative service, although Congress still at times asserted this power. With the growth of the administrative service and the introduction of the spoils system, the conflict between the two departments of the government increased in intensity during the period from 1800 to 1828. The two administrations of Jackson materially increased the validity of the claim of the executive over the administrative service by his winning in most of his contests with Congress.

The whole period, then, from 1789-1837 indicates an evolution in the control of the administrative service from legislative direction only, as under the Articles of Confederation, to predominance of executive control. This study ends, however, with the conflict still unsettled, for neither Congress nor the executive had waived control in theory, nor would they do so in practice if any other course were possible.

## DEPARTMENT OF MATHEMATICS

WILLIAM CAIN has published during the year discussions of the following papers:

"Stresses in Thick Arches of Dams," by B. F. Jakobsen. *Transactions of the American Society of Civil Engineers*, XC: 522. June, 1927.

"Experimental Deformation of a Cylindrical Arched Dam," by B. A. Smith. *Transactions of the American Society of Civil Engineers*, XCI: 712. December, 1927.

"Notes on Arched Gravity Dams," by B. F. Jakobsen. *Proceedings of the American Society of Civil Engineers*, January, 1928, p. 228.

"A Graphic Method for Determining the Stresses in Circular Arches under Normal Loads by the Cain Formulas," by F. H. Fowler. *Proceedings of the American Society of Civil Engineers*, January, 1928, p. 333.

ARCHIBALD HENDERSON: Observations on Simultaneous Quadratic Equations. A paper read at Nashville, Tennessee, Dec. 30, 1927, before the American Mathematical Society.

The usual methods employed for the solution of simultaneous quadratic equations lead to the solution of a quartic equation in either variable, which lends itself to solution according to familiar processes. Equations of the type  $x^2 + y = a^2 + b$ ,  $x + y^2 = a + b^2$ , where  $a$  and  $b$  are real, may be readily reduced to the solution of a cubic representing the points of intersection in either coordinate of either of the original parabolas with the hyperbola  $(x + a)(y + b) - 1 = 0$ .

A general method, depending upon the solution of a cubic equation, is presented, in this paper, for effecting the solution of a pair of quadratic equations in two variables written in the most general form. We equate to zero the condition that a one-parameter conic through the four points of intersection of the two given conics reduce to a pair of lines. The solutions of this cubic give rise to three pairs of lines  $p_1 = 0$ ,  $p_2 = 0$ ;  $q_1 = 0$ ,  $q_2 = 0$ ;  $r_1 = 0$ ,  $r_2 = 0$ . The solutions are then  $(p_1 q_1 r_1)$ ,  $(p_1 q_2 r_2)$ ,  $(p_2 q_1 r_2)$ ,  $(p_2 q_2 r_1)$ . All the different cases, depending upon particular collocations of the lines, in the progressive degeneration of the complete quadrangle, are analyzed. The method is general, and furnishes an admirable illustration of Felix Klein's program of treating elementary problems by the methods of the higher mathematics.

The Cylindrical and Spherical Worlds of Einstein and De Sitter. A paper read before the North Carolina Academy of Science, at Chapel Hill, N. C., April 28, 1928.

Both Einstein and De Sitter have put forth new conceptions of the universe as four-dimensional, space-time constructs. In 1917, Einstein proposed to consider the universe as closed but "unbounded" in the Riemann sense, the space being of an elliptical character. De Sitter later proposed a further generalization involving modification of the time element. The characteristic feature of Einstein's proposal is the assumption that matter throughout the universe be considered of uniform density, and that inertia is a function of matter, in conformity with the views of Ernst Mach.

The views of Newton, Einstein and De Sitter with reference to the universe are analyzed and compared with each other. The proposal of De Sitter appears to be the most satisfactory of the three, leading to zero values for all the

gravity potentials at infinity, for all transformations, and furnishing the conception of a completely isotropic universe. Elaborate calculations prove that all three "spaces" are of constant curvature. The results of the calculations of Kapteyn, Einstein, De Sitter, Lundmark, Silberstein and Henderson are reviewed and compared. As an illustration of the type of results arrived at, calculations were given to show that if the mean density of matter in the universe is taken to be the same as that of the Milky Way, which is known to a close degree of approximation, the following result is obtained: the "radius" of the resulting Einstein universe is one million times ten million times the distance from the earth to the sun.

ERNEST L. MACKIE. The Jacobi Condition for a Problem of Mayer with Variable End Points. (Doctoral Dissertation, University of Chicago, 1927.) The general outline and results of this study were presented to the American Mathematical Society at its meeting in Nashville, December, 1927; the specific proof of the main theorem, to the North Carolina Academy of Science, Mathematics Section, in Chapel Hill, N. C., April, 1928.

The question of minimizing the quotient of two simple integrals of arbitrary functions while keeping a third integral constant is considered. The Euler-Lagrange differential equations and transversality condition at the variable end point are set up by the method developed in a recent study by Bliss, and it is shown that a further necessary condition, an analogue of Jacobi's condition for simpler problems in the Calculus of Variations, must also hold here if the quotient is to be a minimum.

The following master's theses were accepted by the Department during the year:

ROBERT COZART BULLOCK. Some Properties of Orthogonal Matrices and Their Application to Elementary Mathematics. (Under the direction of E. T. BROWNE.)

The definition of an orthogonal matrix is given, together with certain properties that follow immediately from the definition. Other properties are expressed and proved in the form of theorems. Theorems are limited to those that have a definite application to the material that follows.

The orthogonal transformation of quadratic forms is taken up at some length, and the conclusions reached are applied to the classification of quadric surfaces and conics.

A canonical form of an orthogonal matrix is introduced for the purpose of investigating the connection between the matrix of rotations in space and the angle through which points are rotated. A definite expression for this angle is computed for the general case, and an unusual connection between this angle and the original matrix is brought out in the final theorem and illustrated in conclusion.

CLARKE WINTERS HOOK. A Comparison from the Pedagogical Point of View of Solutions in Radicals of the General Quartic Equation. (Under the direction of J. W. LASLEY.)

In this paper methods of solving the general quartic equation are presented as follows: three forms of Ferrari's solution, two solutions due to Descartes, Euler's solution, a solution which combines the methods of Descartes and Euler, and final formulas for the algebraic solution of the quartic.

These methods have been compared as to the advisability of their use in the classroom. Pedagogical advantages and disadvantages of each solution have been pointed out. Also numerical examples have been given after each to illustrate the method of solution.

FRANK TATOM WILLIAMS. Some Applications of Mathematics to the Problem of Fluid Motion. (Under the direction of A. W. HOBBS.)

The purpose of this paper is to investigate some applications of mathematics to a few of the simpler types of fluid motion. Some of the necessary machinery is set up and applied to the problem. The main difficulty is found to be that of obtaining a solution of the equation of continuity which satisfies the boundary conditions. This difficulty is avoided by considering certain types of solutions and finding the problem to which they may be applied. In this manner some important and interesting problems of fluid motion are solved.

#### DEPARTMENT OF PHARMACOLOGY

WILLIAM DE B. MACNIDER has completed the following papers which have been published during the year:

Studies Concerning the Influence of a Disturbance in the Acid-Base Equilibrium of the Blood on Renal Function and Pathology. Study IV: The Protection of the Kidney Against the Injury from Uranium Nitrate by the Use of Sodium Bicarbonate. *Journal of Metabolic Research*, VII and VIII: 1. 1928.

The Occurrence of Atypical Glomeruli in the Kidney of the Opossum (*Didelphys Virginiana*). *Proceedings of the Society of Experimental Biology and Medicine*, XXV: 130. 1927.

The Development of a Toxaemic Condition in the Dog During Gestation. Chairman's Address: Section on Pharmacology and Therapeutics, American Medical Association, 1927. *Journal of the American Medical Association*, IC: 71. 1928.

PROFESSOR MACNIDER is investigating the following problems:

The Histology of the Kidney in *Sphenodon punctatum*, *Echidna aculeata* and *Ornithorhynchus anatinus*. (*Paradoxus Blumenb.*)

An investigation of the changes of repair in the kidney of the dog injured by uranium nitrate and the relationship of such changes to the chemical composition of the blood and urine.

The production of a chronic nephritis in the dog.

#### DEPARTMENT OF PHYSICS

OTTO STUHLMAN, JR. The Use of a Broad Focus Coolidge Tube in Accurate Radiographic Localization. *Journal of the Franklin Institute*, CCVI: 345. 1928.

Broad focus Coolidge tubes were shown to possess virtual foci lying below their targets. By means of pinhole images and a triangulation calculation the virtual focus can always be located. If in the localization of a foreign body the source of the energy of the x-ray is taken at the virtual focus instead of lying at the surface of the target, then the mean error of localization can be decreased from 5mm. to 2mm.

PROFESSOR STUHLMAN has the following studies under way:

(With G. W. HEINITSCH.) X-ray Studies of Fishes, Using Iodeikon Injection.

(With M. W. TRAWICK, progress on master's thesis.) The Electrodeless Spectra of Some Gases.

(With G. W. HEINITSCH and J. E. MORRIS.) Localization of Foreign Bodies by Means of X-Rays. Presented to the Elisha Mitchell Scientific Society, May, 1928.

A new technique has been made possible through the location and identification of a virtual focus in an x-ray tube. Using a double exposure method with a known displacement of the virtual focus, it has been possible to reduce the error of localization to 2mm.

(With M. L. BRAUN.) Studies on the X-ray and Thermoluminescent Spectra of the Spodumenes.

A. F. DANIEL (Master's Thesis, June, 1928). The X-Ray Phosphorescent and Thermophosphorescent Radiations of Kunzite. (Published under the above title by OTTO STUHLMAN, JR. and A. F. DANIEL. *Journal of the Optical Society of America*, XVII: 289. 1928.)

The x-ray phosphorescent spectrum of kunzite was shown to be composed of two emission bands: a blue-green band possessing a maximum near  $.48 \mu$  and a strong band extending from  $.57$  to  $.65 \mu$  with a well defined maximum at  $.596 \mu$ . This showed that the x-ray spectrum and the cathode ray and radium excited

spectra previously discovered are identical, and are attributable to the same causes.

The thermophosphorescent spectrum of very low intensity was obtained at 400° C. Spectrograms were not obtainable. A series of color filters allowed one to identify a broad orange-red band at .64  $\mu$  and a weaker one at .50  $\mu$ .

E. R. MANN (Master's Thesis, June, 1928). The Distribution on a Surface of Evaporating Parallel Wires for Producing Uniform Metallic Films. (Under the direction of OTTO STUHLMAN, JR.) Paper read before the American Physical Society, Washington Meeting, April 20, 1928.

A theoretical discussion of the distribution on a concave surface of a small number of evaporating parallel wires, whose condensed metallic vapour can produce, upon a plane located at some distance below, a plane metallic film of any desired thickness. For a single wire placed at a height above and parallel to the condensing plane, the thickness  $t = \frac{m h}{2\pi \left( \frac{2}{h+x} \right)}$ , where  $m$  is the mass evaporated per second per unit length of wire and  $x$  the distance in the plane of condensation, measured on either side of the wire. Theoretically the necessary conditions for uniform thickness are an infinite number of parallel wires placed infinitesimally close together in a plane parallel to the condensing plane. The best experimental approximation obtained by five wires is a distribution forming a cylindrical surface. A specific case experimentally under consideration was: positions of wires with respect to the condensing plane (-5, 5), (-1.34, 8.66), (0, 10), (1.34, 8.66), (5, 5) producing theoretically a film of uniform thickness having a width of 8 cm. and any desired length. The thickness was in error not exceeding 2 per cent at the edge.

E. K. PLYLER has completed the following researches:

The Detection of Small Adiabatic Changes. (In press.)

A method of detecting small adiabatic changes in the atmosphere due to changes in pressure has been devised by the use of a thermopile. A sensitive thermopile will detect a sudden change in temperature of one-millionth of a degree Centigrade when used with a galvanometer of high sensitivity. By enclosing one set of the junctions of the thermopile and leaving the other set exposed to air very good results were obtained. The arrangement was so sensitive that small changes in pressure produced by opening or closing a door in the building could readily be detected.

The Combination of Frequencies in the Infra-Red Bands of Quartz. (In press.)

The infra-red absorption of a quartz crystal has been observed and several bands not recorded by other observers have been found. These bands, in connection with those found by other workers, have been placed in a series. This

series has a total of thirteen bands and the calculated and observed position of each band correspond closely. This is one of the few materials for which series have been found to exist for the bands.

PROFESSOR PLYLER is attempting to determine whether a similar series exists in the infra bands of the carbonates.

HUGH DUDLEY USSERY. Studies in Electrolysis. (Under the direction of E. K. PLYLER.)

Assuming that isotopes have different decomposition potentials, an effort was made to detect them through a study of the electrolysis curves of several salt solutions whose elements are isotopic.

A number of methods of electrolysis have been used, and the results of each given. No evidence of isotopic influence was found on the curves for  $\text{CuSO}_4$ ,  $\text{ZnSO}_4$ , or  $\text{CdSO}_4$ . In the case of lithium chloride, two points on the curve were in evidence indicating the presence of two substances. It has not been fully decided whether or not these points are due to isotopic decomposition or to some other heterogeneity of the compound.

These methods were also applied successfully to the detection of the components of a mixture of two salts. In the experiments with a salt of zirconium, there was found no point on the electrolysis curve which could be definitely assigned to the element hafnium, an impurity contained in zirconium compounds.

## DEPARTMENT OF PHYSIOLOGY

FREDERICK P. BROOKS has conducted the following research during the year:

The Bunsen Valve in Blood-Urea Determinations. *The Journal of Laboratory and Clinical Medicine*, VIII: 7, 668. 1928.

The use of the simple Bunsen valve is suggested as a substitute for the flutter valve devised by S. Lloyd Johnson in blood-urea distillations by the Folin method. The use of fixing paraffin as an antifoamant is found to be satisfactory, and is used in the place of paraffin oil.

### Dietary Studies on Medical Students.

Urinary analyses on specimens from medical students at the University of North Carolina have been run in an attempt to determine how the voluntary diet of such students compares with the recognized dietary standards and with the results of similar determinations run on medical students in the North and in the far South.

FREDERICK P. BROOKS and D. A. MCPHERSON. A Study on the Determination of Amino Acid Nitrogen in Bacteriological Culture Media.

A series of studies has been run on the methods of determining amino acid nitrogen in an effort to ascertain whether they are accurate when applied to bacteriological culture media. The results show that the Van Slyke and Folin methods are applicable and capable of giving accurate results when the proper conditions are observed.

PROFESSOR BROOKS has under way library and laboratory studies in an attempt to determine the structural formula of cholesterol.

### DEPARTMENT OF PSYCHOLOGY

J. F. DASHIELL has completed a book entitled *Fundamentals of Objective Psychology* (571 pages and 111 illustrations). Houghton Mifflin Company.

This represents a task of resurveying and reorganizing the experimental data of behaviorist psychology. Original contributions are made, especially to the envisagement of problems in motivation, postural reactions, perceiving, and thinking.

PROFESSOR DASHIELL has also contributed the following article for publication: *Are There Any Native Emotions?* *Psychological Review*, July, 1928.

On the basis of recent experimental research, are we warranted in assuming that there are distinct native visceral reaction patterns corresponding to the traditional names of the emotions? Summaries are presented (a) of the direct instrumental attacks upon visceral processes, (b) of the "facial expression" work, (c) of the many attempts to find respiratory and circulatory changes paralleling "pleasant"—"unpleasant," and (d) of observations on infants. Attention is directed to inconsistencies of findings throughout.

The thesis is proposed that the conventional emotion-names refer really to types of viscerally-facilitated or -inhibited overt behavior patterns, and that whatever patterning there is among the visceral segments themselves is acquired. There are no original and distinct emotions.

PROFESSOR DASHIELL is continuing his series of studies on direction-orientation in animals, using white rats as his subjects and his specially devised take-down maze material as the apparatus.

ENGLISH BAGBY has completed the following:

*The Nature of Traumatic Experience.* A paper read before the Southern Society of Psychology and Philosophy, April, 1928.

A statement of certain conclusions as to the nature of episodes from which maladjusting emotional tendencies result. The examination of numerous clinical cases seems to indicate:

- (a) That no episode is traumatic because of its peculiar nature as an event.
- (b) That any episode which provokes a profound fear reaction may be traumatic if the individual's reaction is of a certain type.
- (c) That episodes which are reacted to with assimilative processes of thinking are never traumatic.
- (d) That an episode has a traumatic effect when the individual reacts to it with any substitute for assimilative thinking, such as repression, hysterical symptoms, or phantasy formation.

The Psychology of Personality. Henry Holt and Company, 1928.  
A systematic treatment of common emotional disorders. Problems of genesis and treatment are discussed with abundant illustrative material.

### DEPARTMENT OF ROMANCE LANGUAGES

URBAN T. HOLMES has published during the past year:  
Old French *Carole*. *Language*, IV: 28-30.

This Old French word must be a derivative or be influenced by Celtic *cor*, a circle.

Renaut de Beaujeu. *The Romanic Review*, XVIII: 334-338.

Renaut de Beaujeu, the author of *Le Bel Inconnu* is probably Renaut de Décize, son-in-law of Humbert IV of Beaujeu. *Li alens de Chaalon* should be corrected to *li aleus de Chaalons*, "the feudal vassal of the Count of Chalon."

The Vulgar Latin Question and the Origin of the Romance Tongues. *Studies in Philology*, XXV: 51-61.

A survey of the various theories once held for the origin of the Romance tongues, including the development of the Vulgar Latin theory.

The Saracen Oath in the Chansons de Geste. *Modern Language Notes*, XLIII: 84-87.

In Old French literature the Saracen swears a peculiar oath by placing a finger against a tooth. This is a misunderstanding of a genuine Moslem practice.

MR. HOLMES read the following papers:

French Loanwords in Scottish: a Brief Survey. Read before the Medieval French Section of the Modern Language Association at Louisville on December 30, 1927.

Medieval Bestiaries. Read before the Philological Club of the University of North Carolina.

PROFESSOR HOLMES has completed for publication:

The Books of Claude Fauchet (with M. L. RADOFF). The Publications of the Modern Language Association.

A Reply to Max Förster of Munich. *Language*.

Old French *Camalot*. *The Romanic Review*.

PROFESSOR HOLMES has in progress:

An edition of the Works of Du Bartas (with several collaborators). The introduction is virtually complete and the text is being prepared as rapidly as possible.

A History of Old French Literature (with J. D. M. FORD). The material is being slowly reworked.

Frankish Influence on Old French Syntax.

Cligès and Germany.

STURGIS E. LEAVITT has completed during the year:

Guillen de Castro's *Mocedades del Cid*, Unappreciated by Critics. Read before the Modern Language Association, December, 1927.

It was pointed out that the first part of the play, which has received generally unfavorable comment, is a carefully executed piece of work. King Sancho is led by the hand of Fate to his doom, disregarding the numerous warnings which, if heeded, might have saved him.

HENRY DEXTER LEARNED has in progress:

A Dictionary of Anglo-French (1066-1400).

Arrangements are not yet complete for this undertaking, which will be fully announced later in the year.

A Critical List of Old French Loanwords in English to 1400. (Previously announced.)

Collaboration on the *Dictionary of Late Medieval British Latin* (the letters of Adam Marsh).

Collaboration on the *Historical Dictionary of American English* and the *American Dialect Dictionary*.

Middle English Loanwords: Latin or Old French Sources

A review of the OF etymologies in Vols. I and II of the New English Dictionary, soon to be published.

The Cause of the Breaking in Vulgar Latin Open *e* and *o*. (Soon to be published.)

The Phonetic Value of Old French *ue* from Vulgar Latin Open *o*. (Completed; soon to be published.)

For abstract see *Research in Progress*, July, 1927.

ELISHA K. KANE has published during the year:

Gongorism and the Golden Age, a Study of Exuberance and Unrestraint in the Arts. University of North Carolina Press. 1928. 272 pages.

Gongorism considered not as the sole result of Góngora but as a long and gradual growth in the literature of Spain. Parallels to gongorism in the music, architecture, sculpture and painting contemporary with gongorism indicate that the poetical decadence is merely a single phase of a general cultural disintegration. Styles similar to gongorism in other literatures further point to the conclusion that gongoristic effusions are a regular and inevitable phase in the cyclic evolution of an artistic culture. This volume is illustrated with twenty half-tone plates and forty pen and ink sketches by the author.

Parrot and Pajarote. *Modern Language Notes*, XLII: 4: 246-248.

The augmentative of Spanish *pájaro* suggested as the etymon of English parrot.

The Jargon of the Underworld. *Dialect Notes*, V: x: 434-467.

An outline of the various orders of rogues together with a word list.

The Negro Dialects Along the Savannah River. *Dialect Notes*, V: viii: 354-357.

A description of the dialects between Augusta and the Gullah country, with phonetic transcriptions.

El gongorismo y la cultura artistica de la Edad de Oro. *Boletín de la Real Academia de Ciencias, Bellas Letras y Nobles Artes de Córdoba*, VI: 18: 319-321.

The decadence in the fine arts of Spain during the sixteenth and seventeenth centuries as evidence pointing toward a deeper underlying cause of gongorism.

PROFESSOR KANE has in preparation:

The Book of Good Love, by the Archpriest of Hita, Juan Ruiz.

A metrical translation of the *Libro de buen amor*.

J. CORIDEN LYONS has in preparation :

A critical edition of a section of Guillaume Colletet's *Vies des Poètes Français* dealing with the Lyonese poet of the sixteenth century, Maurice Scève.

The original seventeenth century manuscript was destroyed by fire in 1871; the edition deals with a fragmentary nineteenth century transcription now preserved at the Bibliothèque Nationale.

The *Littérature de Colportage* (or Hawkers' Literature) in France in the Decades Immediately Preceding Rabelais. A paper to be delivered before the next meeting of the Renaissance Section of the Modern Language Association.

An edition of the works of Du Bartas (in collaboration with U. T. HOLMES, JR., G. C. TAYLOR, and others.)

The following doctoral dissertation was accepted by the Department during the year :

LUCY LEINBACH WENHOLD. *La Chanson des Chetifs: A Crusade Epic*. An Edition with Introduction, Notes, and Variants. (Under the direction of U. T. HOLMES.)

As stated in the preface, this edition is intended to redeem from long obscurity the last unpublished poem of the Cycle of the Crusades, and to contribute to the reawakening of interest in general in that Cycle.

The introduction first considers the rise and decline of interest in the Crusade epics which fell between 1829 and 1875. Next is studied the literary form of the Crusade poems as they now exist in the surviving manuscripts. The extant redactions were made around 1189 by Gtairdor de Douay who joined together and revised independent older poems. There are five divisions of plot to the *Chetifs*. Part I describes the destruction of the expedition of Peter the Hermit and the capture by the pagan Corbaran of five French knights. They are led in captivity to his home in Mosul. In Part II there is a lengthy recital of a trial by combat in which Richard de Caumont, one of the French prisoners, establishes the innocence of Corbaran, who has been accused of treason by the Sultan of Persia. The five captives are freed. In Part III Baldwin of Beauvais slays a great serpent which has devastated the land and all the Christians in the Sultan's territory are then released as the reward. Part IV describes two adventures of Harpin de Bourges which occur while the Christians are still guests of the Saracens. In Part V is given the journey of the captives or "chetifs" from Olierne to Jerusalem, where they join once more the Crusaders under Godfrey de Bouillon.

Following this there is considerable discussion in the introduction of the sources and the original authorship of the *Chetifs*. The poem is a transition product between the ancient type of the *chanson de geste* and the late twelfth

century romance. It reflects a more mature observation of the Moslem peoples by the Christians.

Finally, the nine extant manuscripts of the poem are examined and classified. The text of this edition is that of the oldest manuscript, Bibl. Nat. fond fr. 12558, which dates from the early thirteenth century. Variants are given from B.N. f.f. 1621 and the Arsenal 165 Belles-Lettres. The other versions found in manuscripts at the Bibliothèque Nationale, at Brussels, and in the Bodleian, are so late that they furnish little of value. In a linguistic analysis the dialect is found to be a combination of Picard and Francian with constantly alternating forms. The meter is the alexandrine in monorhymed *laisses* (5,233 lines in all). Few lines are faulty in meter; the rhyme is accurate. Only forty-two of the hundred and seventy-seven rhymes are feminine.

The text was established according to the method presented by Joseph Bédier in the introduction to his edition of the *Lai de l'Ombre* (Société des Anciens Textes).

The following master's theses were accepted by the Department during the year:

ALICE RANDOLPH COLLINS. The Comic Tradition of Molière and Beaumarchais in Augier. (Under the direction of W. M. DEY.)

The purpose of this thesis is to study Augier as a worthy successor to Molière and Beaumarchais. All three composed their best comedies not for laughter alone but in an effort to correct the vices of their time by the deadly weapon of ridicule. To Voltaire this was one of the essentials of an ideal comedy.

Granted a common purpose, their methods were not always the same. Molière was concerned with characters, to the frequent neglect of plot. He would become absorbed in the picture of an individual or of a group and show by ridicule, satire, and words from the mouth of a *bon sens* how the protagonist's influence was pernicious. Beaumarchais was concerned with the established order—the nobility, to which he belonged by purchased title. It was not the vice of the individual noble but the whole heritage and the whole feudal system that required the flail. Beaumarchais was warning them of the approach of the revolution. Rarely did he use ridicule for his comic effect; his characters are victims of biting satire. His comedy lies in the action.

In Augier we find a combination of these two predecessors. His treatment of character is strongly similar to that of Molière; his care for situations bespeaks Beaumarchais. Although it is hard to compare any dramatist to Molière, Augier by uniting what is best in his two predecessors continues the great tradition.

EVELYN WILSON. The Development of Stage Settings in Eighteenth Century French Drama. (Under the direction of W. M. DEY.)

This study concerns the eighteenth century interpretation of the serious stage and particularly emphasizes the interest in settings. It accepts the general opinion that classical tragedy degenerated during the century and observes that the decline of this *genre* parallels the increasing interest in external features or in manner of presentation. With the hope of injecting new life into the art which he revered, Voltaire initiated a movement which wrought the annihilation of pure tragedy. Foreign influences facilitated innovations and weakened classic ideals. Diderot, who manifested keen interest in the external features of the drama and advocated the natural depiction of a tragic situation from every day life, found many adherents among contemporary and later dramatists, and thus gave tremendous momentum to the changing conception of the serious *genre*. The theater of the eighteenth century, in fact, paved the way for the romantic drama of the following century, and its interest in external possibilities pointed to our spectacular performances of today.

#### DEPARTMENT OF RURAL SOCIAL-ECONOMICS

E. C. BRANSON. County Government and County Affairs in North Carolina.

Economic-social-civic studies of fourteen counties since July, 1927, by Brandon Trussell, Charles Edwards, Myron Green, Edward A. Terry and Clifton J. Bradley (Camden, Clay, Haywood, Johnston, Madison, Orange, Duplin, Halifax, Sampson, Franklin, Nash, Greene, Catawba counties in North Carolina, and Elmore county, Alabama) for the University of North Carolina Institute for Research in Social Science, for guidance in behalf of improved county government in the state and the country at large. Prior to July 1, 1927, forty-five counties had been covered. These field studies furnished abundant material for the deliberations of the State Commission on County Government appointed by Governor McLean, resulting in the five statewide county government laws of the 1927 legislature. The remaining thirty-three rural counties of the state will be surveyed during the next eighteen months.

S. H. HOBBS, JR. North Carolina, Economic and Social. (Doctoral Dissertation.)

Continuation of work previously reported. See *Research in Progress*, July, 1927.

PAUL W. WAGER, in addition to being the research assistant of the Department, is director of the North Carolina Club studies and editor of the Club yearbook.

The chapters of the 1927-1928 yearbook of the Club, *Studies in Taxation*, are as follows: The Historical Background of the Tax Question, by R. B. House; The Financial Condition of Counties, by Fred W. Morrison; An Analysis of the Present Tax System, by Paul W. Wager; The Distribution of Governmental Functions, by Clarence Heer; Equalizing the Burden of School Support, by Leroy Martin; The Tax Burden on Industry, by H. L. Macon; The Use and Possibilities of Specific Commodity Taxes, by S. M. Derrick; An Examination of the General Property Tax, by Ralph C. Hon; Some Phases of Municipal Finance, by Ina V. Young; The Assessment of Property for Taxation, by J. M. Mitchelle; License Taxes in North Carolina, by Caesar Cone; Farm Income and Farm Taxes, by G. W. Forster.

During the year the following studies were directed by the Department:

Social-Economic History of South Carolina during the Colonial Period. S. M. Derrick of South Carolina. (Progress on doctoral dissertation.)

Caldwell County, North Carolina: Resources, Problems, and Possibilities. Columbus Andrews (Master's Thesis).

Alamance County, N. C.: Economic and Social. John W. Harden.

How Inevitable is Cotton? Rupert B. Vance. Covers (1) the ecology of the cotton belt and (2) the social-economics of the cotton system.

Delinquent Boy Backgrounds. Clyde V. Kiser. A study of the boys in the three state-supported training schools.

Countryside Contributions to the Faculty of the University of North Carolina. Estelle Lawson. Based on questionnaires and interviews.

Economic-Social Effects of Good Roads, Automobiles, and Auto-Trucks on Rural Communities. S. M. Eddleman.

Economic Status of Orange County Prisoners. Roy M. Brown. Covers the dockets of the superior courts of Orange County from July 1, 1924, to June 30, 1926.

Town and Country Coöperation in Public Health Work in Rutherford County, Tenn. Miranda Bradley.

Economic-Social Study of West Chester, Pa. Hugh P. Brinton, Jr.

What a Country Town Can Do for Its Trade Area. Columbus Andrews. A field study of Lenoir, N. C.

The Educational Efficiency of the Small Town. Ina V. Young. A statistical study.

One Hundred Country-Dwelling Negroes and their Crimes in Durham City, N. C. Hugh P. Brinton, Jr. A statistical study of Durham city court dockets from July 1, 1926, to June 30, 1927.

Types of Farming and Farm Life in Sixteen Counties of North Carolina. Clyde V. Kiser. A field-study, case-method study.

The Compounded School in a Satisfying Country Civilization. Winnie Leach Duncan.

Forms of Farm Group Enterprise. Columbus Andrews. A study focused upon Caldwell County, N. C.

Farm Colonies of Directed Farm Owners. S. M. Eddleman. A study of the Crisp-McKellar bill in Congress.

Religious Consciousness in Southern Rural Areas. Louise Young. A field study.

The Rural Mind as Related to Farm and Home Demonstration Service. J. Paul McConnell.

Social Doctrine as Applied to the Mississippi Delta. Louise Young.

The Tax Burden on Farm Lands. Roy M. Brown. A study of the delinquent tax list of Orange county, 1927.

A Psycho-Social Study of Camden County, North Carolina. S. M. Eddleman. A field study.

The Farmer's Occupation and Farmer Personality. S. M. Derrick.

Farmer Attitudes toward Coöperative Enterprises. Sydney Frissell. Based on the documents of the Virginia-Carolina Tobacco Growers Coöperative.

Farm Life and the Personality of the Farm Child. Lucy A. Studley.

The College that Built a Town: A School Rightly Related to Town and Country Life. K. Lee Barkley.

The following master's thesis was accepted by the Department during the year:

**COLUMBUS ANDREWS.** The Economic and Social Foundations and Possibilities of Caldwell County, North Carolina. (Under the direction of E. C. BRANSON.)

A regional sociological study of a county of northwestern North Carolina consisting of two parts. Part I is divided into nine sections.

Section one gives a brief history of the county from the first settlement, probably around 1750, up to the present. Section two describes the situation, topography, natural resources, and transportation system of the county. Section three traces population growth from 1850, and gives the proportions of urban and rural elements in the population, illiteracy and tenancy ratios, per capita wealth and bonded debt.

Section four traces briefly the development of agriculture from 1850 to 1925, noting especially the rapid decrease in size of farms and showing the present deficit in staple food and feed stuffs. In section five considerable attention is given to the textile and furniture industries. It also gives the banking resources of the county and the number and distribution of retail establishments.

The sixth section describes the development of schools in the county. The increase in expenditures for educational purposes since 1920 is especially noticeable. Section seven reveals the fact that the county is over-supplied with churches with the result that many of them are weak and ineffectual. Section eight treats the county newspaper, clubs and organizations, health and

recreation facilities, and points out the lack of public libraries in the county. Section nine describes the present town-country relationships and finds them relatively favorable on the whole.

Part II deals with the economic and social possibilities of the county. A plan is suggested for solving the local market problem. It is also pointed out that consumers' stores on the Rochdale plan might be established in the towns and that a number of rural communities might establish local power and light plants.

The completion of the program of consolidation of schools, the equalization of educational opportunities in the county, and the establishment of a county-wide library service are suggested as possibilities that might be realized in the near future. Since the bulk of the rural churches belong to the Methodist and Baptist denominations, it is suggested that these denominations put on a program of church consolidation.

In the conclusion it is suggested that under adequate leadership a county council, made up of representatives of the various institutions in the county, might work out a program of economic and social progress and help to bring about some measure of coöperation for its realization, but that lacking leadership such a course is not likely to be followed.

## DEPARTMENT OF SOCIOLOGY

HOWARD W. ODUM has published during the year the following: *Man's Quest for Social Guidance*. Henry Holt and Company. *Rainbow Round My Shoulder*. Bobbs-Merrill Company.

*How New Is the South in Social Work?* *The Survey*, June 15, 1928.

PROFESSOR ODUM is working on the following:

*The Regional South: A Study of Social Resources and Social Waste*.

*The War Record of Black Ulysses*.

*Introduction to Social Research* (with KATHARINE JOCHER).

*Folk Music Survivals of the White South* (with THOMASINE MCGEHEE).

He has edited for the American Social Science Series during the year the following:

Kelso's *The Science of Public Welfare*.

Groves and Ogburn's *American Marriage and Family Relationships*.

Steiner's *The American Community in Action*.

House's *The Range of Social Theory*.

ERNEST R. GROVES has published the following books during the year:

Introduction to Sociology. Longmans, Green and Company.

Wholesome Marriage (with GLADYS HOAGLAND GROVES). Houghton, Mifflin and Company.

American Marriages and Family Relationships (with WILLIAM F. OGBURN). Henry Holt and Company.

Parents and Children (with GLADYS HOAGLAND GROVES). Lippincott and Company.

The Marriage Crisis. Longmans, Green and Company.

(For special articles and researches see further under Institute for Research in Social Science.)

HAROLD D. MEYER is continuing the study of the social significance of leisure time and extra-curricular activities; also the direction of the study of rural recreation and social life being made by the Committee on Recreation and Social Life of the American Country Life Association.

H. G. DUNCAN has completed the manuscript for Race and Population to be published by Longmans, Green and Company. He is now completing Backgrounds for Sociology and has published The Concept of Personal Ecology (*Social Forces*, March, 1928).

T. J. WOOFER, JR. has published during the year the following: Negro Problems in Cities. Doubleday, Doran and Company.

The Negro Migration to Cities. *The Survey*, February 15, 1928. (See further under Institute for Research in Social Science.)

WILEY B. SANDERS is completing his manuscript on The Administration of Poor Relief in Illinois.

The following doctoral dissertations were accepted by the Department during the year:

JOHN ROY STEELMAN. A Study of Mob Action in the South. (Under the direction of H. W. ODUM.)

The importance of the general subject of mob violence throughout the nation and special reasons why an investigation should be made of this type of social phenomena relating to the South are given as the occasion for this particular study.

Emphasizing the social-psychological aspects, a combination of the historical, statistical, and case-study methods is employed.

Lynch-law as first practiced in America was not a defiance of law but a substitute for a better law, an attempt to correct defects in an inchoate society. A study of the various stories concerning its origin indicates a widespread practice far in advance of the general diffusion of the term "lynch-law." Cases and other original source-material are given to show the occasion

for the spread of lynching to the South and West as the borders were pushed out in these directions. Before legal procedure and practice were firmly grounded in the South, anti-slavery agitation entered into the situation as an aggravating cause. Negro crimes, almost unknown before, rapidly increased; insurrections, attempted and imaginary, brought fear and hatred of the Negro. Between 1850 and 1865 for the first time a high proportion of mob victims in the South were black men, slaves and free. Then came emancipation with a complete disruption of the former state of racial accommodation. Reconstruction, carpet-bag rule, Negro politicians, soldiers, and criminals brought a rapid increase of lynching.

The statistical analysis is of necessity confined to lynchings on which data are available from 1881. Of the 4,799 persons lynched in the nation during this period, 3,939 or 82 per cent were lynched in the South.

Chapter IX consists of fifteen cases of mob action. Various crimes and forms of lynching are treated descriptively in cases selected from widely scattered localities of the South.

The final chapter, "The Man and the Mob," gives a type of social-psychological analysis of southern mob action based largely upon data presented in preceding chapters.

RUPERT B. VANCE. Human Factors in Cotton Culture. (Under the direction of H. W. ODUM.)

The study may be regarded as an attempt to show interaction of cotton culture upon its producers. The subject has been treated in the findings of human geography, economics, history, agricultural economics, and sociology.

Of the natural agricultural regions of the United States the Cotton Belt seems the most specialized. In Chapter II it is shown that the Cotton Belt is divided into four main divisions: Eastern, Gulf, Alluvial, and Western Belts, each with definite subregions. The distribution of races, forms of tenure, and cities has been conditioned by the fitness of these subregions for cotton culture. In the third chapter it is shown that the present industrial organization of cotton production is the result of an evolution from the cotton plantation to cotton tenancy. The plantation system, defined as an industrial organization for the production of staple crops by the exercise of close supervision over producers, still exists.

Weather variations, plant diseases, and insect pests have contributed toward making cotton production especially hazardous. In Chapter IV the course of weather damage and the history of the boll weevil invasion are traced. When coupled with fluctuations in acreage and world demand, these factors create hazards in the market which fall with especial force upon the growers and the section. Chapter V, accordingly, deals with the risks of the market and the failure of attempts at acreage stabilization and price regulation.

The seasonal routines of southern rural life as conditioned by cotton chopping, planting, picking, and marketing, with the two seasons of rest, "laying by" and "Christmas," are described in a sixth chapter. A discussion of the

cotton system in Chapter VII involves an account of the crop lien, the methods of financing the growers, the extent of diversification, family labor in cotton fields, and the system of marketing.

A review of opinions and studies on the cotton farmer's standard of living in the eighth chapter shows variations among the various belts. Differences in living furnished by the farm and living purchased exist among owners, share tenants, and croppers. It is suggested that the lower levels of tenure approach a rural poverty line. In Chapter IX a series of case studies from the field presents the human factors in interaction with the cotton system, showing success and failure in specialized and diversified farming and in attempts to climb the ladder of tenure.

A concluding chapter attempts to define a cotton culture complex. Food habits, family labor in the fields, speculation, exclusive devotion to cotton, non-coöperation, and lack of thrift are regarded as psychological attitudes growing out of cotton culture. The effect of cotton on the survival of the inefficient farmer is also estimated.

The following master's theses have been accepted by the Department during the year :

WESLEY PHILLIPS BEANS. *The Influence of Music on the American Family.* (Under the direction of H. W. ODUM.)

This thesis is a discussion of the socializing influence of music as it operates on family life and the social institutions and conditions that express and make the home. The study shows the operation of this powerful socializing influence on primitive people, the child, the family, the community, industry, and the nation. The emphasis was placed on music as the art best adapted for such a purpose because of its universality and perfection.

A definition of music and the various theories of its origin are given, followed by a discussion of the part music played among primitive peoples. The musical education of the child is critically analyzed—including creative music in the home and public school music. The musical program of Denmark is given as an ideal example.

Music in the family is discussed as to its effects on family recreation, emotional life, and unity. The material and spiritual values in our community life are evaluated and group singing is studied from the viewpoint of actual participation. The Bethlehem Bach Choir and the Dayton Westminster Choir are given as examples of the ideal community and church music program.

The leisure value of music and its influence on various social problems are dealt with, as well as the several musical leisure attractions. The influence of music in industry, the therapeutic value of music, and the influence of music on international affairs and Americanization are mentioned briefly.

The study shows that the value of the socializing aspect of music has been realized, but that it has only been partly put into use in America in recent times. The discussion also reveals the need for a greater emphasis on music in the educational program of today.

MARGARET C. BRIETZ. Case Studies of Delinquent Girls in North Carolina. (Under the direction of W. B. SANDERS.)

This study presents the case histories of eighteen delinquent white girls committed to the North Carolina State Training School for Delinquent Girls, at Samarcand, N. C., during the years 1921-1925 inclusive, from the city of Y, a nationally known industrial center in North Carolina.

The study aims primarily to depict for the lay reader the complete life-setting in which these girls became social problems, with the belief that the same forces operating to produce the delinquent girl in the town of Y might also be influential in producing the same type of girl in other industrial communities. A distinct effort is made to refrain from bias either on the side of heredity or environment in the indication of probable causal factors. As far as possible, the portrayal of the true life-setting is the aim, and all known factors in both inheritance and environment are presented.

In each case study three distinct periods of social treatment are presented—the probationary, the institutional, and the parole periods. Each study is concluded with the comments of the writer as to possibilities in both causation and treatment.

In addition to the case histories, the scope of this study includes a sketch of the social resources of Y, the industrial community from which the cases are drawn, with emphasis on the equipment, personnel, technique, and outstanding needs for the welfare department and juvenile court in which the eighteen girls under study were treated.

From the standpoint of causation, many factors in both the inheritance and environmental backgrounds of these girls seemed definitely active in producing their delinquencies.

Successful treatment in future must be met by increased preventive and remedial measures. To insure absolute prevention, a wider use of eugenics, more stringent marriage laws, and increased birth control constitute the sole guarantees against mental defectiveness in the future. Needed remedial measures in the city of Y include a staff of social workers more adequate in number and training than the present personnel, improved public recreation facilities, a social program in the churches, a higher industrial wage, improved housing conditions, a more intelligent insight into the meaning of social problems, and an organized council of social agencies to effect better coöperation between all social agencies functioning in the community.

Notwithstanding present inadequacies, the outlook for the delinquent girl in Y is optimistic. The community is beginning to realize that delinquency is the product not only of the girl herself but of the vicious influences operating in the community of which she is a part. To effect a cure for delinquency both the girl and her surroundings must be equally improved. Both the social agencies and citizens at large in the community of Y are sympathetic to her needs, and there is a sufficiency of funds and friendship in the city to predict a gradual expansion of the social program and a more perfect understanding of the delinquent girl and her needs.

MARJORIE H. GARFIELD. Unmarried Mothers, A Study in Attitudes. (Under the direction of H. W. ODUM.)

For purposes of this paper a list of novels dealing with unmarried mothers was compiled. With these novels as case studies, and with the aid of the meagre literature on the subject, the problem of illegitimacy was studied as it affects modern girls.

Inquiry into the environment of the modern girl found numerous factors tending to increase the difficulties of sex adjustment. Among these factors is the heritage of convention which imposes upon girls the customs of monogamous marriage, of mystery surrounding sex affairs, and of a supposedly sexless life for virtuous women. The modern girl is allowed great freedom in her social contacts, especially in her recreation, and at the same time is poorly equipped to meet difficulties which these freer contacts multiply. Varieties of opportunity due to economic status, or to differences in race, nationality, or social group also complicate the situation for girls. And, finally, social workers have been too busy about their cures to trouble themselves about many preventive measures.

Since only a very small percentage of girls actually become unmarried mothers, those special factors which cause girls to overstep conventional boundaries were noted. For purposes of ease in studying them these causative factors were grouped under three headings: physical or mental deficiency (of which there are few), previous experiences causing personality disorders (especially uncongenial environmental conditions), and unusual circumstances with stress of emotion, reacting on girls with no personality disorders. There could be no cut and dried classification of causes because of overlapping, but the greater number of cases studied were strongly affected by environment.

The largest single portion of the paper analyzes the attitudes of various members of society, including the father of the child, parents, friends, churches, doctors, teachers, etc., toward the girl, after she had borne an illegitimate child. Although there were few cases of girls who found no one sympathetic, the chief reaction upon the girl was made by those who were unsympathetic. Thus employers refused her respectable jobs at good wages, friends refused to take her into their customary groups, and she found that she could not live a normally adjusted life in the group who knew of her misfortune (for such it usually proved to be).

The latter section of the paper is given over to a projection of thought into the future to try to see what would be the natural trend of conventions and attitudes; and also to see what possibilities there are for controlling the situation so that there would be a smaller proportion of unmarried mothers, and so that those fewer mothers could live more normal lives in the society to which they had been accustomed since birth. These suggestions for control are directed chiefly toward parent education, improved working conditions, more liberal illegitimacy laws, preventive social work, and social education for teachers.

GEORGE H. LAWRENCE. *The Organization and Administration of Public Welfare in Orange County, North Carolina.* (Under the direction of H. W. ODUM.)

This study is an attempted analysis of public welfare as applied to Orange County. It includes a review of county background relative to the subject, a description and evaluation of the various phases of public welfare hitherto attempted within this territory, and a program for the future.

Considerable emphasis is placed upon the importance of the acquisition of adequate local information, especially of a social and economic nature, before a well-rounded plan of public welfare can be formulated. A discussion of the Four-County Demonstration in Public Welfare as it applied to Orange County constitutes the major portion of the material upon which is based the plan for future development. The advantages and limitations of this demonstration and its accomplishments and shortcomings are treated largely from the standpoint of their bearing upon the county as a whole. The inadequacies of this project are discussed in considerable detail.

In addition to the statement of a theoretical basis, the plans for subsequent public welfare development in Orange County include detailed arrangements for the immediate future. A specific agreement for a coöperative project fostered by the School of Public Welfare and Orange County is presented. The suggested plan of development recommends far greater use of volunteer assistance than has ordinarily been considered advisable, and it stresses the importance of the county as the fundamental unit of operations. The various duties of the county superintendent of public welfare are coördinated with the plan advocated and it is shown how each duty might be handled under existent circumstances.

GEORGE EDWARD PANKEY. *Life Histories of Rural Negro Teachers in the South.* (Under the direction of H. W. ODUM.)

The purpose of this study has been to present a cemented life picture of the southern Negro teacher, to investigate his origins, his source of motivation, his training, and his work. The method of investigation has been that of case study. It deviates from the usual case study in that the case histories have been written up by the persons themselves instead of the case student. This method has been used to picture the lives of outstanding leaders in the past as single cases. Here it is employed to picture outstanding phases in the lives of representative cases. Through this method a double result is obtained: (1) statistical data are collected and presented according to the various categories employed, and from them generalizations are drawn; (2) the attitude of the teacher presents itself with each selection from the life-history. The method of presentation is that of quoting the account of each teacher concerning each specific category, without comment or criticism. A general introduction and a summary of the findings in each chapter are made at the beginning of the chapter. Their educational training, their past lives

as teachers over a large number of years, and the recommendation given them by the white school authorities of their respective states, all furnish evidence of the ability of these teachers to write their life-stories.

The material of the study has been obtained through correspondence with Negro teachers and white school superintendents. This material consists of twenty-four life-histories of leading Negro teachers in the secondary schools of nine southern states. Thirteen of them are principals of county training schools and three others are supervisors of Negro schools in their counties or districts. All of the teachers were born and reared in southern states. Their average age is approximately forty-seven years.

There are several tendencies that seem distinctive in the majority of the life-histories. The favor that they ask of the white people is almost unanimously improving Negro school facilities, which points toward the conclusion that the Negro teachers are trying to offer greater efficiency in their people before asking greater privileges. Another noteworthy tendency is found in the reading material of these teachers. They are reading Negro authors and editors, biography, professional books, and a large number of scientific and philosophical works. This group of teachers has attended thirty-seven colleges and universities, which include Harvard University, Columbia University, the University of Chicago, Boston University, the University of Kansas, the University of Michigan, Fisk University, Hampton Institute, and Tuskegee Institute. With two exceptions, their mean salary at the present time is only eighty-four dollars a month. There is a very noticeable tendency to be optimistic throughout each life-story. One of the most hopeful tendencies for the Negro race is that the teachers remain in one school for a large number of years. The average length of time that they have taught in the schools in which they are now teaching is a little more than eleven years. They express sentiments of loyalty toward the southern white people.

#### HANNAH PLOWDEN. Present Trends in Chinese Family Life. (Under the direction of H. W. ODUM.)

It is the purpose of this study to show the trends in Chinese life under the present changing conditions. These changes are brought about by the impact of the progressive forward-looking West upon the ancient ancestor-worshipping civilization of China. The immediate result of contact has produced a chaotic condition in China. Great revolutions are under way, social, religious, educational, economic, and political. Each of these revolutions has a very definite bearing on the old family organization. The ancient family system is breaking down and the individual is growing in importance. This is expressing itself in a new interest in home life, child welfare, civic enterprise, social reforms, development of a state educational system and political and religious readjustments. One section is taken up with case studies of Chinese family life representing three types of Chinese at the present time: the old type unchanged for the past hundreds of years; the new type, which is thoroughly at home under the present conditions; and the mixed type com-

posed of individuals who have broken away from the old but who have not found their place in the new.

The information in this paper has been gained through an extended association with Chinese family life, through correspondence, and through research.

#### DEPARTMENT OF ZOOLOGY

H. V. WILSON and J. T. PENNY have been engaged in a detailed investigation of the cellular biology in the regeneration of sponges from dissociated cells. The experimental work was carried on during the summer of 1927 at the Beaufort Laboratory of the U. S. Bureau of Fisheries. The histological study is still in progress. Some results were presented at the recent meeting of the N. C. Academy of Science and the paper, Cell Behavior in the Regeneration of Sponges from Dissociated Cells, will appear in an early number of the *Journal of the Elisha Mitchell Scientific Society*.

R. E. COKER has continued investigations of the systematic relations and natural history of freshwater *Entomostraca*.

H. R. SEIWELL, under the direction of PROFESSOR COKER, completed early in the year a preliminary study of the influence of temperature on the rate of beating of the heart of a cladoceran, *Simocephalus exspinosus*.

L. L. HILL, under the direction of PROFESSOR COKER, has made observations on the rearing and crossbreeding of recognizably distinct forms of freshwater copepods. At the recent meeting of the North Carolina Academy of Science he presented a paper entitled Observations on Mating of Copepods.

C. DALE BEERS has published during the year:

The Relation between Hydrogen-Ion Concentration and Encystment in *Didinium nasutum*. *Journal of Morphology and Physiology*, XLIV: 21-28.

The experimental results indicate (1) that the limits of hydrogen-ion concentration within which *Didinium* can live are practically the same as those found by Crane for *Paramecium* (pH 5.0 and pH 9.6), (2) that concentrations of hydrogen ions which are unfavorable for the growth of *Didinium* do not facilitate encystment, and (3) that hydrogen-ion concentration is not a significant environmental factor in inducing encystment in *Didinium*.

Some Effects of Dietary Insufficiency in the Ciliate *Didinium nasutum*. *Proceedings of the National Academy of Sciences*, XIV: 132-137.

The effect of the nature of the food on various life-processes in *Didinium* was investigated by culturing in parallel upon dissimilar diets two sets of pure lines of identical lineage, one set feeding upon starved paramecia and one upon well-fed paramecia. The lines maintained on starved paramecia suffered progressive degeneration and diminution in vitality, as evidenced by decrease in fission rate, increase in death rate, decrease in encystment rate and loss of ability to encyst, production of monstrous, distorted, and miniature individuals, sluggishness and general debility, and death of the lines after approximately thirty days or forty generations of culture. The lines maintained on well-fed paramecia exhibited no symptoms of degeneration and suffered no decrease in vitality. The degeneration and death of the first set are attributed to dietary inadequacies, since starved paramecia lack the reserve of food substances present in well-fed ones. The symptoms of degeneration are similar to those observed by Maupas in *Stylonychia* and other ciliates, but attributed by him to a kind of senescence inherent in the process of living, and not to environmental factors. The experiments suggest that Maupas' animals succumbed in reality to cultural inadequacies, and point to the importance of establishing with complete certainty the cultural requisites of an infusorian before formulating conclusions in reference to an intrinsic life cycle terminating in senescence and death.

The following master's theses were accepted by the Department during the year:

J. L. BAILEY. Segmental Sense Organs and their Development in Teleost Fishes. (Under the direction of H. V. WILSON.)

The paper is restricted to a consideration of the origin and development of the lens, branchial sense organs, auditory organs, and lateral line organs. In studying the literature the outstanding thing that comes to one's attention is the fact that there are two widely divergent views as to the origin of the branchial sense organs, auditory organ, and lateral line organs. One view is that these three sets of organs arise separately and independently of one another. The other is that all three sets of organs are derived from a common sensory anlage. Both views are supported by competent investigators. It is found that in the cod *Gadus morrhua* the branchial sense organs, auditory organ, and organs of the lateral line originate from a common sensory anlage in the shape of a furrow in the deep layer of the ectoderm lying longitudinally along the dorso-lateral surface of the body behind the head.

The further development of these three organs in the cod is traced and found to be very similar to that described for the sea bass (H. V. Wilson, 1891).

The lens arises in the cod as a thickening in the deep layer of the ectoderm on the dorso-lateral surface of the body. From this position it grows down as an open invagination between the periblast and the distal wall of the optic cup. The lens develops from the inner wall of this invagination. Except for this modification (first described by H. V. Wilson for the sea bass),

by means of which the cod is enabled to develop the lens early in embryonic life, the lens develops in the cod very much as in other forms.

LEMUEL LEE HILL. The Mesoblastic Somites in Teleost Fishes. (Under the direction of H. V. WILSON.)

The mesoderm in the cod *Gadus morrhua* takes its origin from the primitive hypoblast. The mesodermic plates are at first more or less horizontal, later they become inclined upwards as we pass outward from the notochord. The coelomic mesoderm splits off as the outer portion, leaving an inner or somitic strip, which divides into somites.

The coelomic mesoderm gives rise to the excretory duct, epithelial lining of the coelom, and part of the pectoral fin. The excretory duct is constricted off from the internal border of the coelomic plate and is composed of both somatic and splanchnic layers, although through later shifting it is removed from the original position and comes to lie dorsal to the coelomic plate, in much the same way as has been described for the trout (Swaen and Brachet '00, Ziegler '02). The duct when fully formed extends from the region of the first three somites to the hind gut. Anteriorly it is bent on itself, and here remains continuous with the coelom, thus constituting a reduced type of pronephros. Posteriorly the two ducts later unite to form the anlage of the urinary bladder, which opens into the hind gut in front of the anus.

The somites when first split off are composed of polyhedral cells which at the surface of the somite approach the cubical or columnar shape. The epithelial structure of this outer layer of cells is lost in the more anterior somites.

In the somite about the time when it divides into dorsal and ventral parts there are recognizable a distinct dermatome, a myotomic part, and a distinct sclerotome. In the further development of the myotomic cells into muscle fibers the muscle fibrils appear at an early stage in the peripheral part of the cell, the nucleus lying in the axis of the cell or toward the notochordal side. The sclerotome creeps up over the sides of the notochord and neural tube and forms a thin layer of skeletogenous tissue lying between these latter structures and the myotomes. In the deeper part of the cells of the dermatome muscle fibrils appear, and these basal portions of the dermatome cells with the contained fibrils separate off as muscle fibers, the further history of which has not been traced.

SELMA MCCOMAS LEE. The Development of the Alimentary Canal in Teleost Fishes. (Under the direction of H. V. WILSON.)

The primitive endoderm, *viz.*, the endoderm of the gastrula, is usually described as originating by an invagination of the blastodermic cells in general. The primitive endoderm thus originating is said later to split into mesoderm, notochord, and definitive endoderm.

From this view Sumner (1903) departs in a measure in that while he finds that the mesoderm, notochord, and definitive endoderm are all derived from blastodermic cells which invaginate, there is among these cells a special anlage

that gives rise to the definitive endoderm. This anlage is a thickening of the epidermic layer situated at the dorsal lip of the blastopore, which he designates as the prostomal thickening. Although Brachet (1912) in *Amia calva* recognizes a structure which he calls a prostomal thickening, he finds that it is composed of cells belonging to the primitive endoderm and neither in origin nor in fate is to be set apart from the latter.

In the sagittal sections of cod gastrulae prepared during the investigation on which the writer is now reporting no such structure as the prostomal thickening has been observed, and this makes it unlikely that it occurs in the cod. It would seem probable, therefore, that in respect to this point teleost fishes differ.

The splitting of the primitive endoderm in the cod follows the classical type of embryogeny in so far that after notochord and mesoderm have been delaminated, the definitive endoderm is left discontinuous in the mid-line just above the notochord.

As regards the formation of the gut from the definitive endoderm, at least two methods have been described by investigators. H. V. Wilson (1889) says the alimentary canal of the sea bass is formed from the endoderm lamella by a process of folding. The folded lamella is converted into a tube by the meeting of its lower edges. Ryder (1884) states that the intestine of teleosts is primitively solid. Swaen and Brachet (1902) give figures showing a solid anlage in some of the types studied by them (*Leuciscus* and *Solea*). The writer has found that in the cod the alimentary canal is formed in certain regions by what is obviously a simple process of folding. In some other parts of the body a solid anlage is undoubtedly produced, but the detailed structure of this leads one to interpret it as produced by cells shifting in from both sides toward the sagittal plane. And it is easy to see that such an embryogenic method is only a variant of the folding process. In the latter process the endoderm cells behave collectively as an epithelial membrane; in the variant they exhibit cellular independence.

## INSTITUTE FOR RESEARCH IN SOCIAL SCIENCE

The increasing emphasis placed upon the social sciences within recent years and the need for scientific research in this field have given rise to a number of organizations for promoting research. Among these are such organizations as The Social Science Research Council and several of the national foundations which have set aside major portions of their funds for this purpose. In history, government, economics, sociology, jurisprudence, anthropology, statistics, social psychology, and other related fields there is need for new standards of research, for coördination, and for correlation.

At the University of North Carolina there has been for some time special need for assistance if the many investigations in the

social sciences, already under way or projected, were to be carried out.

It was a fortunate circumstance, therefore, when the Laura Spelman Rockefeller Memorial in 1924 made a first grant of \$97,500 to the University of North Carolina, to be used over a period of three years, and in 1927 a second grant for \$240,000, covering a five-year period, for the study of problems in the social sciences arising out of state and regional conditions. For the administration and expenditure of these funds, the President of the University has set up an Institute for Research in Social Science, the main purpose of which is to assist faculty members in the prosecution of their research by means of research assistants, field expenses, and clerical help. Research professors and associates, who by training and experience are well qualified to direct research in the particular fields to which they have been assigned, and research assistants with graduate training are now the chief agents for carrying on the work of the Institute.

The work of the Institute represents a specific program of regional social research, study, and interpretation. In both content and method it has undertaken and will continue to undertake to cover a wide range of study and interpretation of regional problems and culture patterns, as well as to present its problem-study results and occasional volumes in method, principles, and social practice, in so far as they are related to the promotion of the social sciences. The selection and prosecution of regional studies in general are made the joint basis of the availability and timeliness of the particular problem and its original contribution to the larger field of the social sciences.

The Institute, in coöperation with the University of North Carolina Press, has published to date:

- The North Carolina Chain Gang. By Jesse F. Steiner and Roy M. Brown.  
 A State Movement in Railroad Development. By Cecil Kenneth Brown.  
 Phonophotography in Folk Music. By Milton Metfessel.  
 William Gregg: Pioneer in Southern Textile Development. By Broadus Mitchell.  
 County Government and Administration in North Carolina. By Paul W. Wager.  
 Folk Beliefs of the Southern Negro. By N. N. Puckett.  
 The Negro and His Songs. By Howard W. Odum and Guy B. Johnson.  
 Negro Workaday Songs. By Howard W. Odum and Guy B. Johnson.

Children's Interests in Reading. By A. M. Jordan.

Southern Pioneers. Edited by Howard W. Odum.

State Systems of Public Welfare. By Howard W. Odum and D. W. Willard.

The following MSS. are in press or ready for publication :

The Development of the Administration of Public Poor Relief in North Carolina. By Roy M. Brown.

Social Work and the Training of Social Workers. By Sydnor Walker.

The Negro Sings a New Heaven. By Mary Grissom.

A History of Industrial Social Work. By Harriet L. Herring.

Negro Economic Studies. By T. J. Woofter, Jr., Roland B. Eutsler, and Thomas W. Holland.

John Henry: A Study of the Origin and Diffusion of a Negro Legend. By Guy B. Johnson.

Human Factors in Cotton Culture: A Study in the Social Geography of the American South. By Rupert B. Vance.

ERNEST R. GROVES is directing the following research :

Successful Marriage, a Study of the Problems and Methods of Family Adjustment.

In association with Ruth Lindquist and Lucy A. Studley, A Group of Selected Cases in Home Management; with Lee M. Brooks, The Conditions of American Isolated Families; with C. H. Hamilton, A Survey of Young People's Organizations.

PROFESSOR GROVES also has coöperated with PROFESSOR WOOFTER in the Study of St. Helena Island Negroes with reference to aspects of family life.

He has published during the year the following :

American Marriages and Family Relationships, with Professor William F. Ogburn. Henry Holt and Company.

The Marriage Crisis. Longmans, Green and Company.

"The Influence of Parents' Attitudes toward Marriage and Parenthood." *Journal of Religious Education*, October, 1927.

"Influence of the Family on the Mental Health of the Child." *Publications*, Buffalo Mental Hygiene Council.

"The Child and the Home." *U. N. C. Extension Bulletin*, VII, 11. 1928.

"History of the Family of 1927." *American Journal of Sociology*, 1927.

"Some Sociological Suggestions for Treating Family Discord by Social Workers." *Social Forces*, June, 1928.

PROFESSOR GROVES has in preparation :

Source Book of Readings on the Family. Lippincott and Company.  
Successful Marriage and Its Conditions.

THOMAS J. WOOFER, JR., has published during the year the following :

Negro Problems in Cities. Doubleday, Doran and Company.  
Constructive Forces in Race Relations. International Missionary Council.  
The Negro Migrations to Cities. *The Survey*, February 15, 1928.

PROFESSOR WOOFER is directing a study of Negro culture and development on Saint Helena Island, South Carolina, which has been made possible by a special grant but is under the auspices of the Institute.

The principal objective of this study is to give a precise description of the customs, institutions, and organization of one of the most primitive and isolated groups of Negroes in the United States. This analysis will give an accurate picture of an unique culture pattern; assist in determining the results of certain social forces; visualize the organization of a truly homogeneous community rather than a bi-racial community or an owner-tenant community; give the analysis of a social situation as a whole rather than of some phase of community life such as health, agriculture, education, etc.; comprehend a society in one area rather than attempt to arrive at an analysis by drawing materials from a number of groups in a number of areas.

He is also directing a study of rural organization in Greene and Macon counties, Georgia, which is being done by ARTHUR F. RAPER, and has collaborated in the Negro economic studies made by ROLAND B. EUTSLER and THOMAS HOLLAND.

CLARENCE HEER, assisted by HERSCHAL, MACON, is making a detailed study of the taxation of public service corporations in North Carolina.

This investigation has been undertaken in coöperation with the State Tax Commission concerning the fairness of the present burden of taxation borne by various classes of public utilities in the state. The study includes a survey of the several economic standards of fairness in public utility taxation, a review of the legal limitations on the taxation of such enterprises, and a statistical analysis of the actual tax payments and operating results of specific utilities with a view to ascertaining the disparity, if any, between present practices and theoretical and legal norms.

PROFESSOR HEER is also doing a study of the tax problem on Saint Helena Island, which will be a statistical study of the burdensomeness of taxation in Saint Helena Township, Beaufort, South Carolina, in relation to the value of the various governmental services which the taxpayers receive in return.

GUY B. JOHNSON has published the following during the year:  
The Negro and Musical Talent. *Southern Workman*, October, 1927.

John Henry: A Negro Legend. *Ebony and Topaz*, a collectanea edited by Charles S. Johnson, New York, 1927.

The Blues: Negro Sorrow Songs. *Carolina Magazine*, February, 1928.

DR. JOHNSON has also completed the manuscript of John Henry: A Study of the Origin and Diffusion of a Negro Legend, to be published by the University of North Carolina Press.

He has also engaged in special researches in connection with the Study of Negro Culture on Saint Helena Island, South Carolina, collecting data on folklore, folk-songs, dialect, customs, etc.

GUION GRIFFIS JOHNSON has completed during the year:

Civic Affairs in the Ante-Bellum Town of North Carolina, to be published in the *North Carolina Historical Review*.

Cultural Activities of the Ante-Bellum Town of North Carolina, to be published in the *North Carolina Historical Review*.

The Monroe Doctrine and the Panama Congress, Studies in Hispanic-American History. *James Sprunt Historical Studies*, Vol. 19, No. 2.

DR. JOHNSON has continued her researches in the social history of North Carolina from 1800 to 1860.

She has also made special researches in social history and in the location of valuable historical source materials in connection with the Study of Negro Culture on Saint Helena Island, South Carolina.

HARRIET L. HERRING has published during the year:

Tracing the Development of Welfare Work in the North Carolina Textile Industry. *Social Forces*, VI: 4.

12 Cents, the Troops, and the Union. *The Survey*, November 15, 1927.

Working Mothers and Their Children. To be published in *The Family*.

MISS HERRING has added a chapter to her History of Industrial Social Work and made certain revisions to the manuscript. It is now ready for publication by the University of North Carolina Press.

She has made a study of the available literature on centralized hiring and on physical examinations for employees and has written a special report on these two phases of industry.

She has done the preparatory work for a study of family mobility in the textile industry in North Carolina and for another study of the relative work and earnings of farm and mill families.

MISS HERRING now has under way a history of the textile industry in the South.

This study will cover the development of textile manufacturing from the domestic stage in the colonial and early national periods; the rise of the mills, expansion and diversification, concentration and localization, and the transplanting of the industry; some attention to technical development and to financial, manufacturing and marketing organization; and with at least passing reference to group interests of owners and workers, to the social implications of the mills, and to the textile industry in southern public opinion and policy.

ROY M. BROWN has published during the year :

The North Carolina Chain Gang, with JESSE F. STEINER. The University of North Carolina Press.

He has completed and has now in press The Development of the Administration of Public Poor Relief in North Carolina. The University of North Carolina Press.

MR. BROWN has carried on the tabulation of data on crime in North Carolina from reports of clerks of the superior courts.

The study has now covered reports for a period of four years. These data, when the tabulation is complete, will provide the basic material for studies of types of crime by sections, race, sex, occupation, and age groups; of sentences imposed, by race, sex, age, occupation, judicial district, and judge presiding; and of recidivism.

He has begun a study of pardon and parole in North Carolina based on the governors' records of pardons, paroles, reprieves, and commutations.

He has made a study of crime on Saint Helena Island, South Carolina, in connection with the larger research into Negro culture and development on the Island.

MR. BROWN is directing:

A study of the localization of crime committed by Negroes in North Carolina cities, by Hugh P. Brinton. So far, only one city (Durham) has been studied, but other cities will be done during the coming year.

A study of the after-records of men released from the North Carolina State Prison, by J. P. McConnell, Jr. This study will be continued next year.

KATHARINE JOCHER, in collaboration with HOWARD W. ODUM, is completing a comprehensive outline of social study and social research, with special reference to Institute problems and methods.

MISS JOCHER published during the year:

Methods of Research in Studying the Family. *The Family*, May, 1928.

SYDNEY D. FRISSELL is continuing his comprehensive studies of the southern coöperative movement begun last year.

The larger program of research includes not only the general economic and social aspects of coöperation but also special features relating to community organization and adult education. Specialists in economics and sociology are assisting in the direction of the study. The major attack is being made through the utilization of a rare mass of concrete data available from the five-year effort to teach coöperative marketing and community spirit among tobacco farmers of the Carolinas and Virginia.

PROFESSOR E. C. BRANSON and his field assistants, CLIFTON J. BRADLEY and EDWARD A. TERRY, have continued their detailed examination of County Government and County Affairs in North Carolina.

Analyses of county expenditures and practices, largely by an intensive study of courthouse records in selected counties of the state, have been in progress for three years, and will be continued until all the counties of the state have been examined. The counties already surveyed are: Alamance, Alleghany, Ashe, Beaufort, Brunswick, Burke, Cabarrus, Caldwell, Camden, Carteret, Catawba, Cherokee, Chowan, Clay, Craven, Cumberland, Duplin, Edgecombe, Franklin, Gates, Greene, Halifax, Haywood, Hyde, Jackson, Johnston, Lee, Macon, Madison, McDowell, Montgomery, Moore, Nash, New Hanover, Orange, Pamlico, Perquimans, Person, Pitt, Polk, Randolph, Robeson, Rutherford, Sampson, Surry, Stanly, Union, Washington, Watauga, Wilson, Yadkin.

EDWARD J. WOODHOUSE with the assistance of MARY PHLEGAR SMITH is completing his source book on municipal government with special reference to North Carolina.

MISS SMITH has published during the year :

Special Legal Relations of Married Women in North Carolina as to Property, Contracts, and Guardianship. *University of North Carolina Extension Bulletin*, 1928. (This compilation of laws concerning the legal status of women in North Carolina was made with the advice and assistance of R. H. WETTACH and E. J. WOODHOUSE.)

JULIA C. SPRUILL, under the direction of R. D. W. CONNOR, has begun a comprehensive study of the changing attitude toward women in the South.

The first volume will present the woman of the ante-bellum South, with special reference to "Southern chivalry." The effects of slavery on the position and development of woman, the classes and types of women, and the education of women will be some of the important phases considered.

ROY W. MORRISON and GUSTAVE E. METZ, under the direction of M. R. TRABUE, are completing their investigations of the grade progress and elimination from school of the children of the various social and industrial groups.

MR. MORRISON is studying the elementary school group, while MR. METZ is investigating the secondary school. The records of both urban and rural schools in North Carolina are being studied in an effort to find the relative educational opportunity at present provided for children of agricultural workers, tradesmen, and other industrial groups; to determine the degree to which home conditions and allied factors nullify the educational advantages provided for children of the several groups; and to indicate modifications desirable in the curricula or organization of schools in various types of communities.

(See also statements in the several departments of social science.)

# RESEARCH IN ORGANIZATIONS

## THE ELISHA MITCHELL SCIENTIFIC SOCIETY

The Elisha Mitchell Scientific Society, composed of faculty and advanced students from the scientific departments of the University, numbered for the year 1927-1928, 199 members (65 active and 134 associate). The officers of the Society were: President W. C. George; Vice President, E. K. Plyler; Permanent Secretary, J. M. Bell; Recording Secretary, H. F. Janda; Editors of the *Journal of the Elisha Mitchell Scientific Society*, W. C. Coker, A. S. Wheeler, W. F. Prouty. Fifteen papers were presented at the eight meetings held during the year. Of these fourteen were presented by members of the faculty of the University, and one was presented by an advanced student in physics.

298TH MEETING, NOVEMBER 8, 1927

W. C. COKER. *The Limits of Life*. (Illustrated.)

Slides were shown illustrating the limits of achievements of animals and plants in various directions—for example, the oldest and largest trees, the largest animals living and extinct, the longest-lived living animals, the smallest living creatures, the extremes in resistance to heat and cold in active and dormant stages. The difference in the manner of growth of plants and animals was brought out, emphasis being put on the fact that many of the smaller creeping or running plants might be much older than the oldest living trees but that the parts that are at present alive are not older. Slides were shown to illustrate the remarkable mechanism shown in the simple fungus *Pilobolus* and its sensitive response to light leading to the projection of its sporangium in the direction of the light.

299TH MEETING, NOVEMBER, 1927

E. T. BROWNE. *Note on the Characteristic Equation of a Matrix*.

This paper is concerned with the characteristic equation of an algebraic matrix  $A$  of  $n$  rows and  $n$  columns, the elements of the matrix being any numbers whatever, real or complex. If the matrix  $A$  is of some particular type, certain definite statements can be made concerning the characteristic equation. Thus, for example, if  $A$  is a *real symmetric* matrix the roots of the characteristic equation are all real. Similarly, if  $A$  is a *real orthogonal* matrix the roots of the characteristic equation all have *unit modulus*. These facts are well known. However, if  $A$  is not a matrix of some special type, nothing definite was known as to the nature of the roots of its characteristic equation

until 1900 when Bendixson, Hirsch and Bromwich gave criteria for the upper limits to the real and the imaginary parts of the roots in terms of the roots of the characteristic equations of the auxiliary matrices  $\frac{1}{2} (A + \overline{A}')$ ,  $\frac{1}{2} (A - \overline{A}')$ . Here  $\overline{A}'$  is the *conjugate* of the *transpose* of  $A$ .

In this paper a new criterion is given for an upper limit to the modulus of a characteristic root of  $A$ . We introduce the auxiliary matrix  $A\overline{A}'$ . We show that the characteristic equation of this matrix is identical with that of the matrix  $\overline{A}'A$ , and that the roots of this equation are always real and never negative. If  $R$  and  $r$  denote, respectively, the largest and the smallest of the roots of this equation, then the modulus of a characteristic root of  $A$  is never less than  $r$  and never exceeds  $R$ .

Geometrically, Bendixson's theorem states that the characteristic roots of  $A$  lie within a certain rectangle in the complex plane. The criterion given in this paper states that these roots lie within a certain annular region, in fact, a region included between two concentric circles with centre at the origin. In some cases Bendixson's criterion gives the more restricted limits, while in other cases, notably when  $A$  is a real orthogonal matrix, the criterion established in this paper gives better limits.

This paper is to appear in full in an early issue of the *Bulletin of The American Mathematical Society*. It has not been presented before any other scientific society.

COLLIER COBB. *Some American Pioneers in Soil Investigation.*

(Abstract appears on page 56.)

300TH MEETING, DECEMBER 13, 1927

C. D. BEERS. *Some Effects of Dietary Insufficiency in the Ciliate *Didinium nasutum*.*

(Abstract appears on page 93.)

THORNDIKE SAVILLE. *Water Supply Investigations in Venezuela.*  
(Illustrated.)

Following a general presentation of water supply conditions in Venezuela, Mr. Saville proceeded by means of lantern slides to illustrate in some detail his studies made on behalf of the Government of Venezuela for additional water supply for the City of Caracas. It was shown that rainfall amounted only to about 32 inches in the average year, and often dropped as low as 21 inches. During recent droughts the city has been seriously handicapped by lack of water. Elaborate studies of rainfall and stream flow were made, and so far as known constitute the first of this kind ever carried on in Venezuela. The seasonal character of the rainfall was shown to be due to the variation in the intensity of the trade winds due to movement of the heat equator north and south of Caracas. Probability studies of rainfall were presented, and also studies of dry season rainfall. Investigations of stream flow were carried on together with study to determine the effect of storage in meeting water supply necessities.

## 301ST MEETING, JANUARY 17, 1928

J. W. LASLEY. *A Note on the Cubic with a Cusp.*

The projective differential geometry of plane curves associates with every curve an ordinary linear homogenous differential equation of the third order. The Lagrange adjoint of the latter is satisfied by the line coördinates of the curve. The parametric point equations furnish integrating factors for this adjoint. In this paper the above computations are made for the cubic with a cusp. The integrations involved are performed and the general solution of the adjoint obtained. There is, however, much latitude involved in the choice both of dependent and of independent variables, and this choice materially affects both the differential equation of the given curve and its adjoint. Moreover, one must be careful that the fundamental system of solutions finally obtained leads to the original curve in lines, and not merely to some projectively equivalent curve. A method for doing this is outlined, and the well-known line equation of the cuspidal cubic results.

J. N. COUCH. *The Structure and Development of Some Tropical Fungi Parasitic on Trees.* (Illustrated.)

## 302ND MEETING, FEBRUARY 14, 1928

E. V. KYSER. *The Flowers and Flower Oils.* (Illustrated.)

An illustrated discussion of the flowers which yield volatile oils, principally those which are cultivated for the purpose in the Grasse section of France. The methods of cultivation, harvesting, and obtaining the oils were given. Details were presented concerning the use of the processes of distillation, hot and cold maceration, extraction and expression, and the types of flowers adaptable to each process. The chemical composition of a number of the oils was discussed and also the part which synthetic chemicals play in the creation of artificial flower odors.

G. R. MACCARTHY. *Experimental Work on Some of the Processes Involved in the Building of Mountains.* (Illustrated.)

## 303RD MEETING, MARCH 13, 1928

A. H. PATTERSON. *The Packing-Fraction in Atomic Nuclei.*

W. DEB. MACNIDER. *The Occurrence of Atypical Glomeruli in the Kidney of the Opossum.* (Illustrated.)

## 304TH MEETING, APRIL 10, 1928

W. F. PROUTY. *The Newark Sediments of the Durham Basin.*

ARCHIBALD HENDERSON. *The Spherical and Cylindrical Worlds of Einstein.*

## 305TH MEETING, MAY 8, 1928

GEORGE HEINITSH. *The Location of Foreign Bodies by Means of X-rays.*

T. F. HICKERSON. *Fundamental Units of Force.*

## THE PHILOLOGICAL CLUB

October 4, 1927—J. F. ROYSTER: Some Beginning and End Conventions in Chaucer.

As a result of his study of Chaucerian manuscripts with particular consideration of the beginnings and endings of separate tales of the *Canterbury Tales*, Dr. Royster suggests a re-division of the "Canon's Yeoman's Tales."

November 1, 1927—U. T. HOLMES: Medieval Bestiaries.

While making a study of the sources of Du Bartas we are confronted with the problem of deciding the relative importance of Pliny and the medieval bestiaries (principally that of Bartholomaeus Anglicus) in the sixteenth century. Pliny ran nearly a hundred editions during the sixteenth century; the most popular of the bestiaries had very few editors and they were largely vernacular translations, intended for the unlettered.

Further, did the material in the medieval bestiaries differ markedly from that of their sources, the ancient? It did not. The medieval "zoölogist" made extensive use of Pliny, Solinus, and Isidore and far less of vulgar tradition than we imagine. Even the Greek Physiologos, if it ever existed, had as its chief innovation only the introduction of Christian allegory.

In conclusion we may state that the critics do not appear to be consistent in the tracing of the sources for Renaissance bestiary material. Bartholomaeus Anglicus is supposed to have been largely responsible for such allusions in the Elizabethan Era. Villey says that Montaigne did not know the bestiaries; Belon and Brantôm, it is claimed, used them extensively; Saineau is not certain with regard to Rabelais. We think that Du Bartas owes his beast-lore exclusively to Pliny and Saint Augustine.

December 6, 1927—DAVID A. ROBERTSON: Graduate School Criteria.

Dr. Robertson discussed the criteria of a graduate school, such as library facilities, laboratories, endowments, etc. He illustrated his remarks by extracts from his book, *American Universities and Colleges*, published by Charles Scribner's Sons, New York, 1928.

January 11, 1928—G. C. TAYLOR: Stoll's *Shakespearian Studies*.

The review conceded that *Shakespearian Studies* is a vigorous and stimulating book, but for the most part it concerned itself with pointing out how the writer's conclusions are not to be trusted. It touched, among other things,

on Mr. Stoll's rhetorical tendencies and his generally iconoclastic attitude towards the traditional opinions of Shakespeare and the fallacies these lead him into. Dr. Taylor particularly criticized the following conclusions:

That Shakespeare makes his characters superior to their actions for striking stage purposes only;

That Shakespeare's portrayal of human nature is psychologically wrong and that Stoll's knowledge of human nature is right;

That Shakespeare's villains are contrary to life;

That Shakespeare moves on a high emotional plane and on a low intellectual and philosophical level;

That Shakespeare is entirely unsympathetic with Jews in *The Merchant of Venice*;

That Falstaff is to be considered primarily in relation to such matters as cowardice and morality; and,

That the modern mind is superior to the Elizabethan.

February 7, 1928—J. P. HARLAND: Excavations of the Prehistoric Site at Nemea. (Illustrated.)

March 6, 1928—J. O. BAILEY: Some Probability Devices in Wells' Scientific Novels.

April 3, 1928—N. B. ADAMS: Notes on the Influence of Ossian in Spain.

While the influence of the Ossianic poems was by no means as great in Spain as in France and Germany, it is not negligible. Previous critics have commented upon the translations of Ortiz, Montegón and Marchene; while these translations enjoyed but little success, scattered references to them and to the Ossianic controversy show that the poems were fairly well known to a small circle, and there was a sporadic interest in them to the end of the nineteenth century. In the Romantic Period they exerted some influence on the Duke of Rivas, Espronceda, and Garcia Gutiérrez. The last named published a five-act dramatic fantasy entitled *Fingal* in 1840. The plot is Garcia Gutiérrez's own; from Macpherson's *Fingal* (and *Temora*) he takes the general melancholy tone, the setting, suggestions from a few episodes, and names of places and persons.

May 1, 1928—LEON RADOFF: The Renaissance Attitude toward the Middle Ages.

## SOCIETY OF THE SIGMA XI

The University of North Carolina Chapter of the Society of the Sigma Xi (the Society for the Promotion of Research) was the first and, until recently, the only chapter of the Society in the South. Two general meetings, to which were invited members of the So-

ciety resident in other institutions, have been held during the past year. During the year two alumni members, three active members, and fourteen associates were elected. In addition, two active members of other chapters became affiliated with this chapter. At the commencement meeting of the chapter the new members were initiated. Following the initiation, Dr. W. C. Davison, Dean of the Medical School of Duke University, gave a very interesting talk on "Medical Education," calling attention to the weakness of our present system from a clinical point of view and outlining the plans which are being made to overcome this weakness in the new Duke Medical School.

The annual Sigma Xi lectures were delivered on May 26 and 27 by Dr. C. A. Shore, Director of the State Laboratory of Hygiene, Raleigh, N. C., in the main auditorium of Phillips Hall. The first lecture, entitled "The Evolution of Preventive Medicine," dealt with the origin of preventive medicine, its early development, the increase of interest in prevention of disease, the recognition by the state of its responsibility in the matter of disease prevention, and the development of public health service as an important state function. The second lecture, entitled "Present Tendencies in Public Health Work," discussed the legitimate objectives of public health work and the rapid advances which are being made towards the attainment of those objectives.

# RESEARCH PUBLICATIONS

JOURNAL OF THE ELISHA MITCHELL SCIENTIFIC SOCIETY  
VOLUME XLIII

DECEMBER, 1927, NOS. 1 and 2

Proceedings of the Twenty-sixth Annual Meeting of the North Carolina Academy of Science.

Proceedings of the Elisha Mitchell Scientific Society.

Contributions of Experimental Embryology to the Study of Germinal Organization. *Bert Cunningham.*

Some Dangers in Specialization. *Geo. W. Lay.*

A Zinc Spot in the Marsh Test. *H. B. Arbuckle and O. J. Thies, Jr.*

The Status of Chemical Industries in North Carolina in 1926—III. *Frank C. Vilbrandt.*

Insulation for Refrigerators. *W. C. Hammond, Jr., and F. C. Vilbrandt.*

A Study of Some North Carolina Waste Products. *E. E. Randolph.*

A Proposed New Formula for the Strength of Columns. *T. F. Hickerson.*

Life History of the Plum Curculio (*Conotrachelus Nenuphar* Herbst). *C. H. Brannon.*

Cave Fauna with Especial Reference to Ecological Factors. *J. D. Ives.*

Blight of Arparagus Fern. *Frederick A. Wolf.*

The Morphology and Systematic Position of the Fungus, *Microstroma Juglandis* (Bereng.) Sacc. *Frederick A. Wolf.*

A Variety of *Collybia Dryophila* Parasitic on Dewberry. *R. F. Poole.*

A Study of Direction Trends in Maze Learning of White Rats. *John C. Bagwell.*

Fertilization and Oogenesis in *Achlya colorata*. *Paul M. Patterson.*

Oogenesis in *Pythium torulosum*. *Paul M. Patterson.*

New or Noteworthy Basidiomycetes. *W. C. Coker.*

Lars Romell. *W. C. Coker.*

JULY, 1928, NOS. 3 and 4

Notes on Some Amphibians and Reptiles from the Southeastern States with a Description of a New Salamander from North Carolina. *Sherman C. Bishop.*

Arachnids Found on Nigerian Rodents and Insectivores. *A. S. Pearse.*

A New Trematode from the Newt *Triturus viridescens*. *Fred J. Holl.*

Two New Nematode Parasites. *Fred J. Holl.*

The Influence of Ultra-Violet Radiations on the Blood Sugar of the Rabbit. *F. G. Hall and R. W. Root.*

The Occlusion Membrane in Snakes. *Bert Cunningham and M. C. Dunn.*

A New Trematode from the Snapping Turtle. *Dean W. Rumbold.*

Some New Wasps (*Hymenoptera*) and Two New *Dipteria* from North Carolina. *C. S. Brimley.*

The Pound as Compared with the "Slug" as a Unit of Mass. *T. F. Hickerson.*

Estimation of Nickel in Steels. *C. L. Thomas.*

The Development of Peach Sooty Mold at Normal and Low Temperatures. *G. W. Fant.*

The Distribution of Venus's Fly Trap (*Dionaea muscipula*). *W. C. Coker.*  
Nowakowskiella and a New Species of *Pythium*. *Velma Dare Matthews.*  
Notes on Basidiomycetes. *W. C. Coker.*

The Chapel Hill Species of the Genus *Psalliota*. *W. C. Coker.*

## STUDIES IN PHILOLOGY

VOLUME XXIV, 3—July, 1927

*McDowell, Tremaine*—Sensibility in the Eighteenth-Century American Novel.

*Coad, Oral Sumner*—The Dunlap Diaries at Yale.

*Bowman, Mary Rives*—Dunlap and the 'Theatrical Register' of the *New-York Magazine*.

*Jones, Howard Mumford*—Notes on the Knowledge of French in Eighteenth-Century America.

*Thompson, Frank T.*—Emerson and Carlyle.

*Foerster, Norman*—The Creed of Lowell as Literary Critic.

*Campbell, Killis*—Recent Books About Poe.

*Leisy, Ernest E.*—Materials for Investigation in American Literature (1926).

VOLUME XXIV, 4—October, 1927

*Stoll, Elmer Edgar*—Certain Fallacies in the Literary Scholarship of the Day.

*Rollins, Hyder E.*—Samuel Sheppard and His Praise of Poets.

*Adams, M. Ray*—The Use of the Vulgate in *Piers Plowman*.

*Metzenthin, E. C.*—The Home of the *Heliand*—A Non-Linguistic Approach.

*Judson, A. C.*—The Source of Henry Vaughan's Ideas Concerning God in Nature.

*Howe, George*—The Outbreak of War in the Seventh *Aeneid*.

VOLUME XXV, 1—January, 1928

*Fairchild, Hoxie Neale*—Unpublished References to Blake by Hayley and Lady Hesketh.

*Pierce, Frederick E.*—Blake and Klopstock.

*Partridge, Eric*—The 1762 Efflorescence of Poetics.

*Havens, Raymond D.*—Thomas Warton and the Eighteenth Century Dilemma.

*Holmes, Urban T.*—The Vulgar Latin Question and the Origin of the Romance Tongues: Notes for a Chapter of the History of Romance Philology Prior to 1849.

*Royster, James F.*—The Chaucer Concordance.

*Harrer, G. A.*—Some Verses of Cicero.

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*Albright, Evelyn May*—Spenser's Reason for Rejecting the Cantos of Mutability.

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