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# *The* Morehouse *Journal of Science*

BURWELL T. HARVEY, JR., *Editor*

**By**

**The Great Benefactor of Humanity**

*"Take interest, I implore you, in those sacred dwellings which one designates by the expressive term:*

**Laboratories**

*Demand that they be multiplied, that they be adorned: these are the temples of the future—temples of well being and of happiness. There it is that humanity grows greater, stronger, better."*

LOUIS PASTEUR.

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The Morehouse

# Journal of Science

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FEATURES



## OUR VIEWPOINT

JANUS.

The month of January was named in honor of Janus, a divinity of the ancient Latins, porter of heaven and guardian of portals. He was represented with two heads, in order that he might guard both sides, since a door faces two ways. Surely this is the month in which we look both ways, backward and forward.

Backward, THE JOURNAL OF SCIENCE looks with gratification upon the four issues of Volume Three. Personal and written commendations received seem to indicate that our readers are deriving greater pleasure and benefit from each succeeding issue. Unsolicited individual new subscribers indicate that our readers are broadcasting the values of our periodical. Requests for complete files of back issues to be placed on the *gratis* list of Public Libraries in Chicago, New York, Jacksonville, and other places, lend significance to the value of the material published as useful for reference work. The steady increase in submission of articles for publication shows that the JOURNAL is a worthy medium of dissemination of scientific and educational information. To our advertisers we express our appreciation for their co-operation and support.

Forward THE JOURNAL OF SCIENCE, wishes to re-affirm its desires to carry out the following aims:—

I. To bring to the teachers of Science in Negro Schools articles on methods of instruction, objectives, and curriculum organization in both secondary schools and colleges.
II. To publish articles by the profession, giving publicity to individual ideas, methods, *et cetera*, of interest and mutual helpfulness.
III. To act as a clearing house in an attempt to standardize courses in science in the different denominational and public secondary schools, as to aims, content and evaluation, in order to facilitate transfers, and entrance upon standard college courses.
IV. To point out and emphasize the practical application of the theories of science.
V. To record the achievements of Negroes in the field of Science as historical data for the purposes of inspiration.
VI. To publish unbiased and critical book reviews.
VII. To abstract articles of interest appearing in the periodicals for the benefit of our readers.
VIII. To adhere more or less closely to this general outline but gradually making such improvements and additions as may recommend themselves from time to time.

We urgently desire your aid in carrying out the above aims. Do not hesitate to forward to this office, any paper, interesting information, or biography of Negroes engaged in scientific pursuits. Let us have the help of your suggestions as to ways or means by which our periodical can more fully justify itself and be of assistance to our readers.

"What does the future hold? Will these coming twelve months chronicle advancement, and new contributions to the welfare of mankind, or will these unwritten pages of history be a record of stagnation and regression?

No man can say exactly, but a safe prediction can be made on the basis of the past. Progress has been continuous over the years, and the outlook for the future is justifiably optimistic."

### Lewis Howard Latimer

In our last issue, attention was given to Edison and the celebration of Light's Golden Jubilee. We have learned with deep interest that the Edison Pioneers included a Negro, about whom elsewhere in this issue we take pleasure in publishing information. We take the liberty of quoting from a letter received from Mr. Frank A. Wardlaw, Secretary of the Edison Pioneers, the following:

> "Right glady do I comply with your request for information about Mr. L. H. Latimer and am sending you herewith a copy of the 'In Memoriam' I wrote up for the Edison Pioneer membership. Seldom, if ever, in my association have I met a man of finer instincts and more lovable character. I knew him personally since 1881, and I have the pleasure of knowing his family, all worthy of the highest esteem.

### To Our Subscribers

To those of our readers who to date have not sent in their subscription for 1930, we are sending a personal letter. We hope you will take advantage of our liberal offer and respond immediately. We would sincerely regret to strike a single name from our mailing list. But beginning with the next issue we expect to have addressograph plates made of our mailing list, and apply for special mailing rates. This becomes necessary because of our increasing circulation. We must present with our application a list of paid up subscribers, and hereafter will be limited as to the number of sample and *gratis* copies we may distribute. We feel confident we shall hear from our letter to you before March 10th. We thank you.

# THE ATOMIC THEORY

Clara M. Standish,

*Talladega College, Talladega, Alabama*

From the earliest times thinking people have asked questions concerning the ultimate composition of matter. One type of mind has thought of matter as continuous, so that no matter how often it is divided, each fragment is still divisible. The other type has assumed that when subdivision has reached a certain point, further subdivision is impossible without losing the properties of the substance. As early as 500 B. C. the Hindu philosopher, Kanada, held that matter was made up of minute particles in constant motion. About the same time Leucippus among the Greeks held the same theory. Democritus (470-360 B. C.) gave these imaginary particles the name of *atoms*, because they could not be further subdivided. He stated that they were absolutely small, full, incompressible, and homogeneous, but allowed them to differ in form, position, and magnitude. Since the Greeks did not have the experimental methods of discovering the truth, their chief contribution to the atomic theory, was to formulate an attitude of mind which found expression in the real atomic theory over twenty centuries later.

In the realm of physics Sir Isaac Newton in 1782 expresses his belief in the atomic constitution of matter as follows: "It seems probable to me that God in the beginning formed matter in solid, impenetrable, movable particles, of such sizes and figures, and with such other properties, and in such proportion, as most conduced to the end for which he formed them; and that these primitive particles, being solids, are incomparably harder than any porous bodies compounded of them; even so very hard as never to wear or break in pieces, no ordinary power being able to divide what God Himself made one in the first creation."

To the humble Quaker weaver's son, John Dalton, born in a small hill town, and chiefly self-educated, we owe the Atomic Theory, which Tilden characterizes as the "predominant and indispensable doctrine to which every question in modern chemistry is referred, and of which the triumphs of modern theory supply the justification." While the idea of the atomic constitution of matter was by no means new, it was Dalton's task to apply the hypothesis of atoms to the domain of quantitative chemistry.

There has been considerable discussion as to which came first to Dalton, the Atomic Theory or the Law of Multiple Proportions. His contemporaries Thomson and Henry believed that he deduced the Atomic Theory from the Law of Multiple Proportions, as exemplified in his work on marsh gas and olefiant gas. It is true that the Atomic Theory was not published till 1808 when his "New System of Chemical Philosophy" appeared, but the fundamental ideas involved in it were stated informally as early at 1803, when a table of atomic weights was added to a paper on solubility of mixed gases.

Dalton's own notebooks, unearthed many years later from the archives of the Manchester Literary and Philosophical Society, seem to give the correct answer to the question, especially in view of what we know of Dalton's studies in meteorology. His remarkable interest in this science is shown by the fact that he made two hundred thousand observations and kept daily records of the weather for fifty-seven years. He spent his vacations climbing mountains for the purpose of comparing atmospheric conditions at different altitudes. The syllabus of a lecture delivered in 1810 states that he wondered how a *compound* atmosphere, or a mixture of two or more elastic fluids, should constitute apparently a homogeneous mass. He rejected various hypotheses, including that of the chemical constitution of the atmosphere. He says, "I soon found that the *sizes* of the particles of elastic fluids *must* be different. For a measure of azotic gas and one of oxygen if chemically united, would make nearly *two* measures of nitrous gas, and these *two* could not have *more* atoms of nitrous gas than the *one* measure had of azotic or oxygen. The different *sizes* of the particles of elastic fluids under like circumstances of temperature and pressure being once established, it became an object to determine the relative *sizes* and *weights*, together with the relative *number*, of atoms in a given volume."

The principal points in Dalton's Atomic Theory as summarized by Freund are as follows:

1. Rejection of the idea of one kind of primitive matter.
2. The divisibility of matter is finite.
3. The name of atom is given alike to the ultimate particles of elements and compounds.
4. The indestructibility of atoms is affirmed.
5. Atoms of one homogeneous substance are all alike, but different from those constituting any other substance. There is an atomic weight peculiar to each kind of atom.
6. Chemical combination occurs between *simple* number of elementary atoms of fixed atomic weight.
7. One of the fundamental problems of chemistry is to determine the relative weights of different kinds of atoms as well as the number of each kind of elementary atoms entering into the composition of one compound atom. The available data are insufficient.
8. Follow the rule of the greatest simplicity in the number of elementary atoms combining.
9. A symbolic notation is suggested. (This consists of circles with various distinguishing marks.)

As a direct deduction from the Atomic Theory, the Law of Multiple Proportions was revealed. If several compounds be formed, the fixed proportions in which two elements combine are in simple integral ratios to one another. The constant proportions increase by leaps, and not gradually, when two compounds are formed. At this time there was a tacit assumption that the percentage composition of a chemical compound is always the same, although it was not adequately supported by experiment. Cavendish had shown that two measures of hydrogen combine with one measure of oxygen, and Proust had proved the constant composition of natural and of artificial carbonates of copper. These were cases of fact and not of theory. On examining the analyses of nitrous oxide and nitric oxide made by Davy, Dalton concluded that the former consists of two atoms of nitrogen and one atom of oxygen, while the latter is composed of one atom of each gas. Here was a case of multiple proportions. Another was the case of marsh gas and olefiant gas. We can see how the various examples of the Law of Multiple Proportions strengthened Dalton's conviction of the truth of the Atomic Theory.



In the statement of his Theory, Dalton had admitted the insufficiency of correct data on atomic weights. Consequently, he set himself to work upon this problem. His methods of experiment were rough and his skill as an experimenter was not of a high order. As a result, his atomic weights are in many cases far from correct. This fact, however, does not detract from the value of the Theory, and many experimenters of more skill but less originality have made up this deficiency.

As one might expect, the reactions to Dalton's Theory were varied. Some hailed it with enthusiasm at once, while others pointed out its shortcomings. The weakest point in it was undoubtedly his assumption that the simplest formula should be assigned to the best-known compound. This was purely arbitrary, of course. He also assumed that where the elements united in but one proportion, only one atom of each was concerned. Accordingly water was H-O, ammonia was N-H, and ethylene C-H.

Of the Theory, Berzelius said, "The Theory of Multiple Proportions is a mystery but for the Atomic hypothesis." In 1811 he pronounced it "the greatest advance that chemistry has ever yet made in its development into a science,"—good testimony from the chief organizer of the science. Dumas and Faraday stated, "Whether matter be atomic or not, this much is certain, that granting it to be atomic, it would appear as it now does."

To explain the lack of understanding of the terms atomic weight and equivalent, it is necessary to go back to the work of Wenzel, the last of the alchemists. By a series of exact analyses he established the principle that when two neutral salts mutually decompose each other, the neutrality is maintained for the reason that the amount of base which is neutralized by a certain weight of one acid, is also neutralized by a definite weight of another acid. The same quantities of each base neutralized successively a given weight of each acid, and are consequently *equivalent* to each other, and to the weights of acids used. The time was not ripe for Wenzel's work to be appreciated, but twenty years later Richter revived the idea in his book on Stoechiometry. He gave us our first tables of equivalents. Although many of the figures are incorrect, he showed that the composition of many salts could be calculated from the known composition of other salts. His work was not widely read and in the time of Dalton chemists had no conception of the difference between equivalents and atomic weights.

In the midst of this confusion Gay-Lussac was able to throw some light on the problem. In 1808 he propounded the well-known laws of the combination of gases by volume. Combining the statement of Dalton that the definite combining proportions represent the weights of the atoms and the Law of Gay-Lussac that the volumes according to which gases unite bear to each other simple and invariable proportions, we see that the densities of the gases should represent the relative weights of the atoms. Therefore to find the relative atomic weights of simple gases it is sufficient to compare their densities. This gave a new means for the determination of atomic weights and it led chemists to realize the distinction between equivalents and atomic weights. Gay-Lussac regarded his own work as a confirmation of Dalton's fundamental theory. Berzelius agreed with him and considered his discovery "one of the most direct arguments in favor of Dalton's hypothesis." Strange as it may seem, the Law of Combining Volumes did not appeal to Dalton and he never accepted it as evidence in favor of his own Theory. He supposed Gay-Lussac's results to be less trustworthy than his own. Another objection was the case of nitric oxide which occupies the same volume as the constituent quantities of nitrogen and oxygen which compose it, and yet the number of "atoms" of nitric oxide must be one-half that of the oxygen and nitrogen combined.

Berzelius made several very practical contributions to the development of the Atomic Theory. The superiority of his analytical methods made it possible for him to issue a table of atomic weights far more accurate than any previously determined. He adopted oxygen as the standard in place of Dalton's hydrogen. Our modern symbols are due to him and he expressed water by its present formula, which was quite an advance over H-O of Dalton. However, Dalton never gave up his own symbols, as he considered the alphabetical ones "unscientific!"

To fully justify the Atomic Theory it was necessary to establish the Law of Definite Proportions. This law was formulated by Proust about 1802. He says, "Proportions are fixed by nature and the power of augmenting or diminishing these proportions is not given to men. One must recognize an invisible hand which holds the balance in the formation of compounds that fastens their attributes at its will. One must conclude that nature does not act otherwise in the depths of the earth than on its surface, or in the hands of men."

In 1803 Berthollet challenged the LAW in his "Essay on Chemical Statistics," in which he said the chemist can control the proportions, that constancy of composition is secured only when some constituent crystallizes out, or distils from a mixture of interacting substances. Zinc takes a constant proportion of oxygen because it oxidizes by volatilizing, while lead and tin with tranquil fusion oxidize from minimum to maximum with a succession of colors.

Proust defended the Law until 1808. He used it as a test to distinguish chemical compounds from mere solutions. He showed that a solution of sugar in water is variable, while the proportions of the elements in sugar are fixed. His distinctions between a solution and a combination, and his description of the characteristics of a chemical compound has prevailed to the present. Since 1808 no chemist has doubted the validity of the Law of Definite Proportions.



One of the enthusiastic but rash supporters of the Atomic Theory was William Prout, who published a paper in which he called attention to the closeness with which the atomic weights of the elements approximated whole numbers. This caused him to go a step farther and say that hydrogen was the universal substance from which all other elements were made. This hypothesis was disproved when chlorine was found to have the atomic weight, 35.5. Reducting the hypothetical unit to the half, and then to the tenth of an atom of hydrogen, showed how tenaciously some of its supporters clung to the false doctrine. The startling thing about it is its resemblance to the modern idea of the composition of matter.

The chief objection which Dalton made to accepting Gay-Lussac's Law should have, in the mind of the modern chemist, been removed by the statement of Avogadro's Hypothesis in 1811. He pointed out that the smallest particles of the elementary gases are themselves compound, just as in the so-called compound gases. He thus drew a distinction between the physical units which we now know as molecules, and the chemical units which we call atoms. He showed that there may be any number of atoms in the molecule of an elementary gas, although two is the usual number. This hypothesis received little attention from its author's contemporaries for various reasons. Avogadro was visionary and did not support this hypothesis with experiments. A hypothesis should explain facts more remote than those for which it was originally designed, and should lead to the discovery of new facts. Largely because it could not do these things, it was disregarded for fifty years until the author's fellow countryman, Cannizzaro, put it in the high place which it deserves to occupy.

The Atomic Theory was strengthened in 1818 by the Law of Dulong and Petit, which states that the specific heats of simple bodies are in inverse ratio to their atomic weights, in such a way that the product of the two quantities produces a constant. This is another way of saying that the atoms of simple bodies possess practically the same specific heat. After a time exceptions to this Law were shown in many cases, and it remained for Dumas to state its limitations. It does not apply to elements tested in the gaseous form, but simply to solid elements, with the exception of those below 31 in atomic weight. With these limitations, it serves as a useful check on other methods of determining atomic weights.

The work of Mitscherlich in 1818-19 on Isomorphism proved to be of real service in the determination of atomic weights. A student of crystallography, he invented an apparatus for measuring crystal angles. He discovered that similar crystalline forms result from similarity in atomic structure, and isomorphous bodies have the peculiarity of mixing in indefinite proportions in crystals without change of form. Since it is true that whenever two bodies are isomorphous they possess similar atomic structure, the composition ought to be by analogous formulæ. For example, iron alum and ordinary alum will crystallize together, and whatever the proportions are in the mixture, the form of crystals is always that of the regular octahedron. The double sulphate of alumina and potash is thus isomorphous with the sulphate of iron and potash. Consequently, since ferric oxide contains two atoms of iron and three atoms of oxygen, alumina must be composed of two atoms of aluminum and three atoms of oxygen. Another example is the case of crystallized ferrous sulphate and magnesium sulphate. If it is known that the former has the composion $Fe(SO_4)\ 7H_2O$, it is true that the latter has a similar composition, since the crystals are isomorphous. From this the atomic weight of magnesium can be determined.

Although the atomic weight determinations of Berzelius were so accurate as to merit the tribute from Dumas: "Whoever works under the same conditions as Berzelius obtains the same results as Berzelius; otherwise he has not worked correctly"; still after a generation or so, it was thought wise to revise them. The Belgian chemist, Stas undertook the work and spent the best part of his life in making the most accurate determinations possible of the atomic weights. He succeeded in determining the weights of all but three of the elements in the table.

The proof of the value of any theory is in the way it works. Judged by this standard, the Atomic Theory has not been found wanting. We have tried to show that the Law of Definite Proportions, the Law of Multiple Proportions, Gay-Lussac's Law of Combining Volumes, and Avogadro's Laws are all in accordance with it and dependent upon it. This is sufficient justification. Even now our present knowledge of complex atomic structure, does not in any way lessen the value of the atom as the elementary unit. It supplements the Atomic Theory instead of destroying it.

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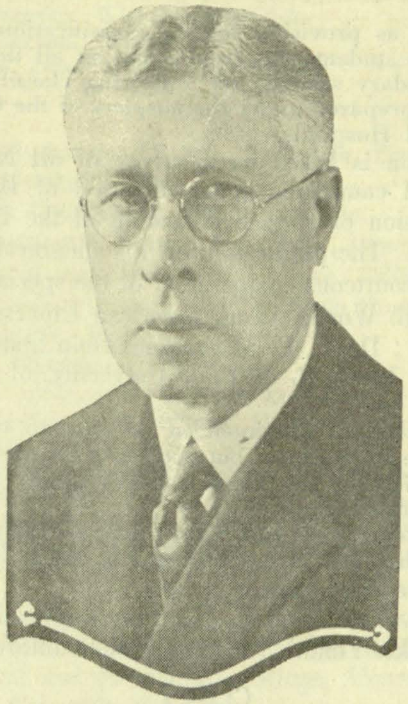
Lowry—"*Historical Introduction to Chemistry.*"
Moore—"*History of Chemistry.*"
Tilden—"*Progress of Scientific Chemistry.*"
Meyer—"*History of Chemistry.*"
Freund—"*Study of Chemical Composition.*"
Wurtz—"*Introduction to Chemical Philosophy.*"
Tilden—"*Famous Chemists—the Men and Their Work.*"
Millington—"*John Dalton.*"
Roscoe—"*John Dalton and the Rise of Modern Chemistry.*"



## PRESIDENT JOHN HOPE HONORED



National recognition of the work done in the field of Negro education by Dr. John Hope, President of Atlanta University, was given with announcement of award of the gold medal and $400 honorarium by the William E. Harmon Foundation to the Atlanta educator. It represents one of the important Harmon awards for distinguished achievement among Negroes for the year 1929, the report stated.

In announcing the awards, the Foundation report for the year states of Dr. Hope that he is a graduate of Brown University and holds honorary degrees from Howard, Brown, Bucknell and McMaster Universities. He has been active in promoting college education among Negroes in the South.

"The present Atlanta University is the result of a merger on the English plan, brought about largely through his efforts, of Spelman College for Women, Morehouse College for Men, and Atlanta University, a graduate school. Nine heads of other Negro colleges have been graduated from Morehouse during the time Dr. Hope has been associated with the college," the Harmon 1929 report states in making the citation.

## CLASSIFICATION OF NEGRO COLLEGES

*Council on Medical Education and Hospitals*
*American Medical Association*

Until such time as provision for the classification or approval of colleges for Negro students has been made by all the associations of colleges and secondary schools, the following classification of Negro colleges has been prepared under the auspices of the Council on Medical Education and Hospitals.

This classification is based on a survey of all Negro colleges in 1927 by a special committee under direction of Dr. Arthur Klein, Chief of the Division of Higher Education of the United States Bureau of Education. The publication of this classification is made possible through the courteous co-operation of the special committee consisting of Dr. G. B. Woods, Dean, American University, Washington, D. C. (Chairman); Dr. C. C. McCracken, Ohio State University, Columbus, and Dr. Louis R. Wilson, University of North Carolina, Chapel Hill.

The ratings given are not intended to refer to the four years of work given by the institutions, but represent, in the judgment of the committee, the ability of the Negro colleges to offer two years of acceptable pre-medical college work.

A re-investigation will be made each year of such colleges as will pay the cost, so that due recognition can be given for such improvements as may have been made.

The expense involved in preparing this classification has been met by the Phelps Stokes Fund. The classification follows:

### Class I

Atlanta University, Atlanta, Georgia.
Benedict College, Columbia, South Carolina.
Clark University, Atlanta, Georgia.
Fisk University, Nashville, Tennessee.
Howard University, Washington, D. C.
Johnson C. Smith University, Charlotte, North Carolina.
Knoxville College, Knoxville, Tennessee.
Lincoln University, Chester County, Pennsylvania.
Lincoln University of Missouri, Jefferson City, Missouri.
Livingstone College, Salisbury, North Carolina.
Morehouse College, Atlanta, Georgia.
Negro Agricultural and Technical College of North Carolina, Greensboro, North Carolina.
Rust College, Holly Springs, Mississippi.
St. Augustine's School, Raleigh, North Carolina.
Samuel Houston College, Austin, Texas.
Shaw University, Raleigh, North Carolina.
Southern University and Agricultural and Mechanical College, Baton Rouge, Louisiana.
Spelman College, Atlanta, Georgia.



Straight College, New Orleans, Louisiana.
Talladega College, Talladega, Alabama.
Virginia Normal and Industrial Institute, Ettricks, Virginia.
West Virginia Collegiate Institute, Institute, West Virginia.
Wilberforce University, Wilberforce, Ohio.
Wiley College, Marshall, Texas.
Xavier University, New Orleans, Louisiana.

### Class II

Agricultural and Industrial College, Nashville, Tennessee.
Bishop College, Marshall, Texas.
Claflin University, Orangeburg, South Carolina.
Colored Agricultural and Normal University, Langston, Oklahoma.
Florida Agricultural and Mechanical College, Tallahassee, Florida.
Joseph K. Brick Junior College, Bricks, North Carolina.
Lane College, Jackson, Tennessee.
Morgan College, Baltimore, Maryland.
New Orleans University, New Orleans, Louisiana.
North Carolina College for Negroes, Durham, North Carolina.
Paine College, Augusta, Georgia.
Prairie View State Normal and Industrial College, Prairie View, Texas.
State Agricultural and Mechanical College, Orangeburg, South Carolina
Tuskegee Normal and Industrial Institute, Tuskegee Institute, Alabama.
Virginia Union University, Richmond, Virginia.

### Class III.

Agricultural, Mechanical and Normal College, Pine Bluff, Arkansas.
Alcorn Agricultural and Mechanical College, Alcorn, Mississippi.
Allen University, Columbia, South Carolina.
Barber College for Women, Anniston, Alabama.
Bennett College for Women, Greensboro, North Carolina.
Bethune-Cookman College, Daytona Beach, Florida.
Cheyney Training School for Teachers, Cheyney, Pennsylvania.
Georgia Normal and Agricultural College, Albany, Georgia.
Georgia State Industrial College, Savannah, Georgia.
Jackson College, Jackson, Mississippi.
Kittrell College, Kittrell, North Carolina.
LeMoyne Junior College, Memphis, Tennessee.
Lincoln Institute, Lincoln Ridge, Kentucky.
Miles Memorial College, Birmingham, Alabama.
Morris College, Sumter, South Carolina.
Morristown Normal and Industrial College, Morristown, Tennessee.
North Carolina State Colored Normal School, Elizabeth City, North Carolina.
Paul Quinn College, Waco, Texas.
Philander Smith College, Little Rock, Arkansas.
Roger Williams University, Memphis, Tennessee.
St. Paul Normal and Industrial School, Lawrenceville, Virginia.
Selma University, Selma, Alabama.

Shorter College, North Little Rock, Arkansas.
Simmons University, Lexington, Kentucky.
Southern Christian Institute, Edwards, Mississippi.
State College for Colored Youth of Delaware, Dover, Delaware.
State Normal School for the Negro Race, Fayetteville, North Carolina.
Texas College, Tyler, Texas.
Tougaloo College, Tougaloo, Mississippi.
Winston-Salem Teachers' College, Winston-Salem, North Carolina.

UNCLASSIFIED

Coleman College, Tougaloo, Mississippi.
Edward Waters College, Jacksonville, Florida.
Hampton Normal and Industrial Institute, Hampton, Virginia.
Jarvis Christian Institute, Hawkins, Texas.
Morris Brown University, Atlanta, Georgia.
Princess Anne Academy, Princess Anne, Maryland.
State Agricutural and Mechanical College for Negroes, Forsyth, Georgia.
Tillotson College, Austin, Texas.

BASIS OF CLASSIFICATION

In classifying the institutions the Committee has been guided by the standard pre-medical course published by the American Medical Association. A scoring chart was prepared with a total evaluation of 1,000 points, the data being sub-divided under the four main heads as follows:

(a) Faculty—evaluated at 300 points.
(b) Curriculum—evaluated at 300 points.
(c) Buildings and Equipment—evaluated at 255 points.
(d) Administration and Supervision—evaluated at 175 points.

A fifth provision provided excess credits amounting to 50 points for exceptional *esprit de corps* and for unusually high quality of work required for graduation in addition to the usual quantity requirement. Attention was given in:

Group (a), to the number of the faculty and proportion of the faculty to student enrollment, training, teaching loads, etc.

Group (b), to the facilities for teaching the required subjects of physics, chemistry, biology and English, and advanced work in science and a proper number of elective subjects in modern foreign language, psychology, etc.

Group (c), to the equipment in the library; the various scientific laboratories and the amount of the annual appropriation for books and movable scientific apparatus.

Group (d), to the length of the college year and class periods; the relationship between preparatory and college faculty, classes, budget, etc.; the organization of departments; the distribution of work among instructors; the requirements for admission to college and the income from the stable sources.

Class 1 includes the institutions which obtained at least 800 points out of a possible 1,000 including at least 60 per cent of the points assigned to Group (a), 70 per cent of the points assigned to Groups (b) and (c) and 50 per cent of the points assigned to Group (d).



Class II includes the institutions which obtained a score of 650 points. With proper attention to various details, with additional equipment, supplies, etc., colleges in Class II may hope later to be included among the institutions rated in Class I.

Class III includes institutions which obtained less than 650 points. Colleges in this group fall far short of meeting the requirements and should undergo a complete re-organization and strengthening in order to be rated in Class I.

Unclassified. Colleges so listed have failed to supply the committee with supplementary data so that a fair classification was not possible.

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# ACCREDITING COLLEGES AND SECONDARY SCHOOLS FOR NEGRO YOUTHS

PRESIDENT EMERITUS M. W. ADAMS
*Atlanta University, Atlanta, Ga.*

To the Constituent Members of the
Association of Colleges for Negro Youth:

Pursuant to a request from President Peacock of our Association, the undersigned attended the thirty-third annual meeting of the Association of Colleges and Secondary Schools of the Southern States, held in Fort Worth, Texas, December 4-7. The duty assigned to him was to present to that association the facts of the present situation with reference to accrediting colleges for Negro youth, and to seek its rectification. As the situation now stands, if such a college is in northern territory, like Howard and Lincoln, it is eligible for accrediting in case it is deemed worthy. But if in strictly southern territory it is not considered at all, however worthy it may be. No institution of our group from Virginia to Texas, including such states as Kentucky and Tennessee, is on the accredited lists, by reason of being in the territory of the Southern Association.

Effort has previously been made in this direction, not only by ourselves but also by representatives of the U. S. Bureau of Education. But up to the present year no representative of our Association has personally presented the case at a meeting of the Southern Association. The undersigned was probably asked to undertake this mission because of the fact that last spring he personally took occasion to interview Chancellor Kirkland of Vanderbilt University and Dean Jack of Emory University, both of whom were members of the executive committee of the Southern Association. The outcome of these interviews was not encouraging, but a report concerning them was made to President Peacock; the assignment to this personal mission followed in the fall.

A matter of this character, in the proceedings of the Southern Association, is usually debated and decided by the executive committee, and ratified by the whole Association, ordinarily without discussion. Your representative appeared before the executive committee and presented our case on the night of Tuesday, December the fourth. His presentation of the case was given courteous consideration, but no intimation was made that the response would be favorable. However, though without the knowledge of your representative, the matter was again discussed by the executive committee on Wednesday night, and still again on Thursday night. And on Friday morning the report of the executive committee was presented and adopted without objection and with very little discussion. It was as follows:

The Executive Committee recommends that the Secretary of the Association write the American Council on Education a request to support the plan of organizing as a standardizing agency the Association of Colleges for Negro Youth, and to offer the assistance of this organization in any way, either as an organization or through the aid of individual members.

The Committee further recommends that the Secretary write the Association of Negro High School Education, in response to their request for help in standardizing of their work, that they request the Association of Colleges for Negro Youth to associate them in their standardizing plans, taking as a basis list the Negro high schools now approved by the respective state agencies in our territory.

The Committee also recommends that the incoming President of the Association of Colleges and Secondary Schools of the Southern States be authorized to appoint a committee of three to act for this Association in assisting the proposed Negro Standardizing Agencies, as provided for in the preceding recommendations, and to report its action to the next meeting of the Association through the Executive Committee.

The above recommendations were passed by the Association at its meeting on Friday, December 7, 1928, at Fort Worth, Texas.

Such personal conference as your representative had with officers of the Association, after the action had been decided upon, led him to believe that the Southern Association was now wholly in earnest in wishing to give us proper help towards accrediting. The names of the Committee of Three, which is evidently intended to function in a real sense, will doubtless be known before our next annual meeting, so that we can get into close connection with that committee.

The outcome of this effort is far more favorable than your representative could have possibly expected. And he is quite sure that our Association will be deeply gratified at the progress made. Personally he was given all due consideration, though not called in for official conference at any time except Tuesday night. And he also wishes it to be understood by our own Association that his efforts were only a part of the influences which led to the final result. This can be seen from the phraseology of the second paragraph of the resolutions adopted by the Southern Association. And mention should especially be made of Mr. J. Henry Highsmith, High School Inspector in the State Department of North Carolina, who presented the claims of Negro high schools before the Commission on Secondary Schools, which was that part of the Southern Association which had to do especially with that phase of the educational problem.



# REPORT ON STANDARDS FOR NEGRO SCHOOLS AND COLLEGES

*Adopted By The Southern Association*
*At Lexington, Kentucky.*

Pursuant to the action taken by the Southern Association at the meeting held in Forth Worth, December, 1928, the committee met in Atlanta on March 30, 1929, to consider the question of the rating or approval of Negro high schools and colleges by the Southern Association.

The members of the Southern Association Committee, Dr. H. M. Ivy, Meridian, Miss.; Dean T. H. Jack, Emory University, Atlanta; and Dr. J. Henry Highsmith, State Department of Public Instruction, Raleigh, N. C., were present. There were present also by invitation, a number of persons interested in the matter for consideration and representing the Association for the Promotion of the Education of Negro Youth, those being Dr. M. W. Adams, Atlanta University; Dean D. O. W. Holmes, Howard University; President T. E. Jones, Fisk University; President H. C. Trenholm, Negro State Normal School, Montgomery, Ala.; Dean S. H. Archer, Morehouse College, Atlanta; and Dr. A. J. Klein, United States Bureau of Education, Washington, D. C.

The general problem of rating Negro schools was discussed for some time by the members of the group. After canvassing the whole situation it was agreed that there is not now in existence any agency or organization that can handle the problem satisfactorily, and the Southern Association was asked to do whatever in its judgment may seem best.

The Southern Association held a meeting to consider ways and means of handling the problem of rating or approving Negro schools, the conclusion of the committee being merely suggestions to the Association as to the Methods of procedure.

It was decided that the executive Committee of the Southern Association should be asked to appoint a standing committee on the approval of Negro schools. This committee will be appointed from the membership of the Association and make its report to the Executive Committee.

The Committee on Approval of Negro Schools will work through a Committee in each State, this Committee to be composed of one member of the Commission on Higher Education, one member of the Commission on Secondary Education, and one or more persons selected from the Division of Negro Education or some other Department of State Department of Education in the respective states. This State Committee will submit to the Association Committee all recommendations relative to schools, and the Association Committee will determine the schools which shall be submitted to the Executive Committee for approval.

The machinery for carrying on this work may be stated as follows:

1. Southern Association; Executive Committee, Standing Commit-

tee on Approval of Negro Schools selected from membership of Association, State Committee composed of one member of Higher Education Committee, one from the Secondary Education Committee, one or more from Division of Negro Education in State or approval of Division.

Three or more members.

The Committee appointed at Fort Worth in December, 1928, to go into this question of Approving Negro Schools, recommends that the Executive Committee of the Southern Association endorse the plan for Approving Negro Schools upon condition that funds are made available to make a survey of Negro Schools in Southern Association territory. Expert assistance will be necessary, and the Executive Committee is requested to authorize the Committee composed of H. M. Ivy, T. H. Jack and J. Henry Highsmith to secure funds of the amount of $20,000 or more to defray the expense of a survey, said survey forming the basis for the recommendation of the State Committee to the Association Committee of those schools which may be approved. The plan provides that each college shall be required to contribute $25.00 toward the expense of inspection, no inspection or survey of a given school to be made except upon receipt of invitation from the institution.

It is expected that the survey will give information for the classification of Negro Schools into at least three groups, A, B, and C, upon the basis of Southern Association requirements. Such classification should prove most helpful to the various institutions.

—*The High School Quarterly.*

## ISN'T IT STRANGE

Isn't it strange
That princes and kings
And clowns who caper
In sawdust rings,
And common people
Like you and me,
Are workers for Eternity?

Each is given a bag of tools
A shapeless mass and
Book of rules
And each must make
Ere life is flown
A stumbling
Or a stepping stone.

—UNKNOWN.



# THE PERISCOPE

## THE NATIONAL TECHNICAL ASSOCIATION

"At the present time, economic considerations seem to be uppermost in the minds of the ruling classes of the world. Economic advantage is won and maintained through the operation of efficient organization and mass action. The physical resources of the entire world are divided up and parcelled out geographically to the more favored groups of humanity.

If through force of circumstances, a group must maintain its racial identity, it will be only through effective mass organization directed by the most efficient apostles of applied science that that group will be able to maintain its place in the sun. The other alternative is commercial and economic servitude. In a society where he happens to constitute the minority group, the person of color will be able to impress himself favorably upon that society only through the reaction of the brains and character of its men of the applied sciences."

Realizing the need of organizing the colored technicians throughout the country, a group of Negro engineers, chemists, and architects which had been organized in Chicago, Illinois, some years previous, communicated with a similar group in Ohio, known as the American Negro Technical Society, and with the Howard University Engineering Society, composed of students of engineering and architecture at Howard University, inviting them to send delegates to a convention that was held in Chicago in June of 1928.

Delegates from the above named societies met with the Chicago group in Chicago on June 23, 1928, forming a temporary organization known as the National Technical Association. This meeting was attended by about twenty-five technicians and was quite a success. All present were thoroughly in accord with the idea of organizing the Negro technicians into a body national in scope. Every one high in spirit and jubilant over the pleasant prospects for this organization, the group decided to meet the following year during the month of August, in Chicago.

August 17th and 18th, 1929, the temporary organization met in Chicago, Illinois, with Mr. Charles S. Duke, acting as chairman. August 17th was spent going on inspection trips to points of engineering interest in the city. It was the next day, August 18th, that the delegates met in the Appomattox Club where, with representatives from the Chicago group of technicians, the American Negro Technical Society, and the Howard University Engineering Society, they adopted a constitution and voted to go into permanent organization under the name National Technical Association. At this time the following officers were elected: President Chas. S. Duke, 184 W. Washington St., Chicago, Ill.; Vice President, A. M. Chavous, Wilberforce University, Wilbefore, Ohio; Secretary-Treasurer, Ernest R. Welch, Howard University, Washington, D. C.

The object of the National Technical Association is to organize and unite in fellowship, architects, engineers and workers in allied technical professions, to combine their efforts so as to enhance the proficiency of its members through the exchange of ideas, to foster technical education, to assist in facilitating the opportunities of the worker, and to break down the barriers due to race prejudice. The association, which now consists of the Chicago Branch and the Howard University Engineering Society, hopes to accomplish this by forming other groups similar to these, in all of the principal cities of the country and through these groups bring together all Negro technicians. Organizations of technicians are invited to file application for membership in the Technical Association.

## LEWIS HOWARD LATIMER, EDISON PIONEER

Mr. Latimer was born at Chelsea, Mass., September 4th, 1848. At ten years of age, after a few years of rudimentary education, Mr. Latimer seeming to sense the heavy load carried by his parents to support their family of four children, decided to subdue his thirst for knowledge as a school attendant and assist his father to the best of his ability, meanwhile devoting every spare opportunity, and utilizing every available source to acquire the education for which he yearned. At the age of 16 he enlisted in the Naval service of the Federal Government, serving as a "landsman" on the U. S. S. "Massasoit" from which he was honorably discharged in 1885, when he returned to Boston and secured employment as an office boy in the office of Messrs. Crosby and Gould, patent solicitors. In this office he became interested in draughting and gradually perfected himself to such a degree as to become their chief draughtsman, remaining with this firm for about eleven years. It was Mr. Latimer who executed the drawings and assisted in preparing the applications for the telephone patents of Alexander Graham Bell. In 1880 he entered the employ of Hiram S. Maxim, Electrician of the United States Electric Lighting Co., then located at Bridgeport, Connecticut. It was while in this employ that Mr. Latimer successfully produced a method of making carbon filaments for the Maxim electric incandescent lamp, which he patented. His keen perception of the possibilities of the electric light and kindred industries resulted in his being the author of several other inventions. He assisted in installing and placing in operation some of the first "Maxim" incandescent electric light plants in New York City, Philadelphia and Canada for the United States Electric Light Company, and supervised the production of the carbon filaments employed there-in, such as the Equitable Building, Fiske & Hatch, Caswell & Massey's and the Union League Club of New York City, as well as the offices of Philadelphia "Ledger" in Philadelphia. In the autumn of 1881 Mr. Latimer was sent to London, England, to establish an incandescent lamp department for the Maxim-Weston Electric Light Company. In 1882-3 he was employed by the Olmstead Electric Lighting Company of Brooklyn, New York, and then by the Acme Electric Light Company of New York City. In 1884 he became associated with the Engineering Department of the Edison Electric Light Company at 65 Fifth Avenue, New York City, but in 1890 was transferred to the Legal Department where he remained until the formation of the Board of Patent Control in 1896 by the General Electric and Westinghouse Companies, becoming its chief draughtsman, a position he held until the abolition of this Board in 1911, when he became associated with Edwin W. Hammer, Patent Solicitor, and Engineer of New York City, and later with the firm of Hammer and Schwarz. Mr. Latimer's activities were brought to an unfortunate conclusion in the early part of 1924 by infirmities that finally caused his demise.



He was of the colored race, the only one in our organization and was one of those to respond to the initial call that led to the formation of the Edison Pioneers, January 24th, 1918.

Broad-mindedness, versatility in the accomplishment of things intellectual and cultural, a linguist, a devoted husband and father, all were characteristic of him, and his genial presence will be missed from our gatherings.

Mr. Latimer was a member of George Huntsman Post, G. A. R., of Flushing, Long Island, and for several years the adjutant of that organization. The funeral services at his late home in Flushing, his casket covered with the flag he loved, was attended by many of his former comrades in arms, and his remains sent to Fall River, Mass., where at his request they were cremated and placed in the same grave with those of his beloved wife.

He is survived by his sister, Mrs. Margaret Hawley, of Bridgeport, Conn., and two daughters, Mrs. Gerald Norman and Miss Louise R. Latimer, of Flushing, Long Island, N. Y.

Mr. Latimer was a full member, and an esteemed one, of the Edison Pioneers.

40 West 40 Street,
New York City.

## HARLEM LABORATORIES

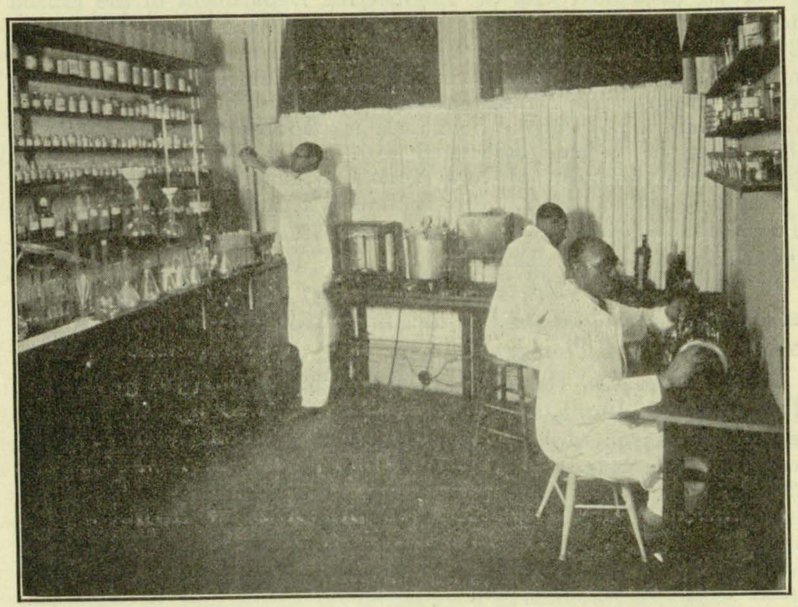
Harlem Laboratories, a corporation under the laws of the State of New York with offices in the City of New York, was founded by its president, A. Maurice Moore, Jr., in July 1927. It is the first commercial institution of its kind to be successfully established and operated by Negroes.

The work done here is classified in four sections: chemical analysis, bacteriological examinations, pathological examinations and light manufacture.

Embodied in the chemical work are: analysis of foods, waxes, fats, oils, paints, dyes, ores, alloys, fuels, drugs, pharmaceuticals, poisons, etc.

The bacteriological phase includes the examination of pyotic and other fluids from the human body for pathogenic micro-organisms. In like manner, milk, water, shellfish, etc., are investigated.

Some of the more important pathological examinations are: the



Wassermann test for syphilis; the Kahn test for syphilis; the Widal test for typhoid fever; the numerical estimation and classification of red and white blood corpuscles; blood analysis; phenolsulphoneptha-lein test for kidney function; analysis of spinal fluid and the diagnosis of pathological tissues.

In the scope of light manufacture is the preparation of autogenous vaccines,, standard laboratory reagents and specialties.

Since such a tremendous amount of this work is being done, it may be interesting to mention some of the sources from which it comes. The chemical work is referred by concerns having problems of manufacture or who wish to know the composition of competitive products in common use. Likewise, this work comes from the establishments who wish to insure themselves against adulteration and maintain high standards of purity in their own products as well as the raw materials they purchase.

To illustrate this, it is also interesting to note a few State and Federal requirements for foods. The enforcement of these regulations necesitates accurate laboratory examinations and expert interpretation of the findings.

Ice cream should contain not less than 8 per cent of fat nor more than 1 per cent of gelatin.

Cream cheese should contain not less that 65 per cent of fat. No cheese should contain more than 25 per cent nuts, pickles, etc.

Butter should contain not less than 80 per cent fat and not more than 16 per cent moisture.

Shellfish should have a color bacillus rating of not more than 50



and should be washed in water having a salinity of not less than 1.007.

Milk should contain not more than 88 per cent water or fluids, not less than 11 1-2 per cent solids and not less than per cent of fat.

Grade "A" milk (raw) should yield not more than 30,000 bacterial colonies per cubic centimeter.

No cream should contain less than 18 per cent fat.

Light cream should contain not less than 18 per cent fat.

Medium cream should contain not less than 25 per cent fat.

Whipping cream should contain not less than 30 per cent fat.

Extra heavy cream should contain not less than 36 per cent fat.

Special extra heavy cream should contain not less than 45 per cent fat.

Grade "A" cream should yield not more than 150,000 bacterial colonies per cubic centimeter.

Grade "B" cream should yield not more than 500,000 bacterial colonies per cubic centimeter.

Non-alcoholic carbonated drink (ordinary soda waters) should contain not less than 7 per cent sucrose or cane sugar except dry ginger ale which should contain not less than 5 per cent sucrose. "Soda water" should contain not more than 0.004 per cent of saccharin.

Flour should contain not more than 13.5 per cent of moisture or yield more than 1 per cent ash, 5 per cent crude fibre and not less than 1.25 per cent nitrogen.

Alert intelligent citizens protect public health and modern businesses avoid being defrauded with adulterated products by submitting samples of food, etc., to laboratories, such as this article describes, for analysis.

The bacteriological and pathological work is referred principally by physicians.

Cornelius L. Johnson, treasurer of Harlem Laboratories, conducts the bacteriological work and investigations in clinical microscopy. John H. P. Eckles is assistant in pathology, and the chemical work as well as investigations in clinical chemistry is under the direction of A. Maurice Moore, Jr.

This corporation owns and operates a department for the sale of surgical instruments, hospital and physicians' office equipment, surgical appliances and dressings, ampoules, biologicals and the specialties manufactured in the laboratories. Mr. Caswell P. Johnson is managing director of this division.

Commercial analysis: a rich field in diversity and spacious in amplitude has been overlooked by our men in selecting their professions. There should be institutions of this type in the principal cities throughout the entire United States. The tremendous success of Harlem Laboratories in inducing thoughtful attention in this direction.

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## DR. ERNEST E. JUST GOES TO GERMANY

Dr. Ernest E. Just, head of the Department of Zoology of Howard University, sailed for Berlin where he will spend six months as guest investigator in the Kaiser Wilhelm Institute for Biologie, Berlin-Dahlem.

On the day of his departure the Associated Press announced the election of Dr. Just to the vice presidency of the American Association of Zoologists, one of the highest honors ever accorded a Negro scientist.

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## T. K. LAWLESS RECEIVES HARMON AWARD

To Theodore Kenneth Lawless, 37, 4207 South Parkway, Chicago, Illinois, has been granted the gold medal and $400 in Science for his studies in dermatology.

Dr. Lawless holds a research and lecture fellowship in dermatology at Northwestern University. His monograph, "Intercutaneous Method of Treating Argyria" is considered to be authoritative. He is a graduate of Talladega College, Alabama, and of Northwestern University Medical School; he has studied in hospitals in New York, at Harvard Medical School; in Berlin, Paris, Freiburg and Vienna.

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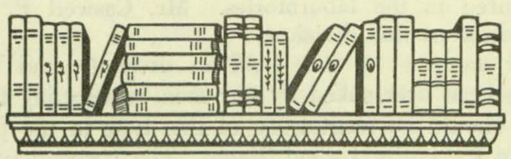
## GEORGE W. CARVER, OF TUSKEGEE, IS SUBJECT OF NEW BIOGRAPHY

"From Captivity to Fame" is the title of a recently published biography of George Washington Carver, agricultural chemist of Tuskegee Institute, by Raleigh H. Merritt. The book is published by the Meador Publishing Company.

Mr. Merritt, a former student of Dr. Carver, briefly sketches the career of his famed tutor, telling of his early struggles for an education, of his work at Tuskegee, of the versatility of the man and of his achievements in discovering new products from the native resources of the south. The volume also includes a supplement which contains a number of pamphlets issued by Dr. Carver.





# ABOUT TEACHER - TRAINING

J. H. Dillard, *The John F. Slater Fund*
*Charlotteville, Va.*

We see what a great part is played by schools in our modern civilization. We see the need that schools be places of real education. We want them to be places where young people can get certain needed knowledge, and more than this can get a certain power in the way of thinking accurately and judging rightly. To get these results we see how much hangs on the ability and equipment of the teacher. Hence, it is, and well it is, that we are hearing so much about the problem of Teacher-Training.

## I

Plenty of people can remember the time when teaching was hardly thought of as a profession. Young men and women and older men and women took it up to make a living or to earn an extra penny when nothing better seemed at hand. A plan of professional preparation, as for law or medicine, was nowhere in the landscape or even the horizon.

One may have a doubt whether the profession of teaching can ever be, in a technical way, quite on par with law and medicine. For while the thing we call personality cuts a figure in whatever one does, it is in teaching that personality cuts deepest. So much is this the case that one may doubt about our thinking of teaching along quite the same line as we do of other professions. It is in our favor that we do not have to be so professional as other professions. For the more a "professor" of anything can continue to be just a human being, the better. All of us know personally numbers of fine teachers who have not had professional training. There is no use in denying this, it is a fact. And it is a fact quite apart from the way any one would call a doctor or a lawyer fine in his work who has not had the regular professional training. It is different in the teaching profession, and even those of us who most wish to magnify our profession must acknowledge the difference.

And yet this of course is true, teaching has become a profession. As such it demands technical preparation. But this can easily be overdone. It can easily fall into the fault of killing originality and making molds. And when it runs too glibly into psychology, it is getting on dubious ground. There are writers on the subject of teacher-training who speak as if some problems in psychology were settled which are not. There are questions in psychology that have been positively settled in a dozen different ways in the last thirty years, like problems in philosophy, and the same problems will probably be settled in another dozen different ways within the coming thirty years. But aside from such cock-sureness in psychology, there is a body of principles founded on experiment, experience and practice, with which every candidate for the profession of teaching ought to be familiar. There is undoubtedly a solid reason for a certain amount of strictly professional training. And good teachers with gifted personalities who have not had the special training would be the first to recognize help from such training.

II

So it has come about that we are provided with normal schools, college departments of education and teachers' colleges galore, all directed toward professional preparation. To so great an extent has the purely professional side been emphasized that we have for some time been on the edge of the danger of losing sight of the scholastic requirements of a well equipped teacher. The professional movement has been perfectly natural. It has been a natural, if excessive, rebound from the days when nobody questioned that anybody could teach school.

Evidences are thick around us that the rebound was excessive. There are many teachers today who have had the professional training and yet have a very thin knowledge of the subjects they are teaching. This lack of leadership, lack of full and accurate knowledge of subject-matter, has of course a harmful effect. The pupils are influenced by the looseness and superficiality of the work. They get used to being shallow and inaccurate. Not once, but many times, one hears professional and business men complain that it seems almost impossible to find high school graduates who have the spirit of thoroughness and accuracy. There must be some truth in the charge. Those who actually examine pupils are more often than not surprised at the lack of accurate knowledge which they find. This is due to the lack in the teacher, and the lack in the teacher arises from the fact that we have been laying emphasis too much on the professional technique and neglecting the weightier matters. Happily there is beginning to be a reation against this excess. We are beginning to hear more about subject-matter and scholarship.

III

When today we use the expression Teacher-Training, nine out of ten of us think of the professional training rather than of the education that ought to precede and accompany the professional training. It is for this reason that even professors of education, certainly some of them, have come to dislike the term Teacher-Training. If somebody could hit upon a better word, or combination of words, it would be a welcoming chance. We need a name that savors not only of the process of professional training but of the spirit of scholarship. But even keeping the misleading name, we have come to the point where we ought to understand, very distinctly, that teacher-training implies thorough and accurate knowledge and, more important still, the solid training that comes from acquiring such knowledge. It is this which ought to antedate the special training. It is this, and only this, which can form a firm foundation of preparation for the teacher's work.

IV

Let us think a moment about the primary qualities we would all like to find in a teacher. Let us see what at least two of these are.



Whatever object we have in view and are working to get, there is always a gain in reducing the idea and the process to simple terms. There is always the danger of becoming confused in complexities and so losing sight of the main point. Simplicity is a virtue of all our work of education. This is not to say that there are short-cuts. There are no short-cuts in education any more than there are short-cuts in our manifold social problems. Simplicity in education simply means for us teachers that we try to state in as simple words as possible what we think education is, and that we try to see what is the simplest, not necessarily the easiest way, of getting it ourselves and then helping others to get it. In other words, there is virtue in getting down to first principles.

V

Of course one rarely speaks of a real teacher without mentioning first of all his or her personality. How often we hear emphasis laid and rightly laid, on the teacher's personality. Dean Inge and others, in speaking of religious work and influence, say that what we are matters much more than what we do or say. It must be so, because what we are must inevitably flavor all that we say or do. We know that it is so. The background of teachers, as of others, gets itself expressed in some way at every turn. In the profession of teaching this idea is especially important for the reason that teachers have to do with the young minds that are easily influenced.

Now this element of personality is something that can be planted and nourished. However subtle it may be it is a real thing. To realize it is one of the simple purposes to be kept in view in all our education and especially in our training of teachers. In begetting or fostering personality immense help comes from two acquirements, which are good in themselves apart from any resultant personality. Without them no one could rightly be classed as more than half educated. We might call them two main objectives in the preparation of those who are to engage in the profession of educating others.

VI

One of these main requirements in the training of a good teacher is the spirit of scholarship. It is not so much the amount of scholarship or the subject of scholarship as the spirit. It is the spirit of valuing, reverencing and seeking the fact, whatever the matter be. It is the spirit of accuracy, thoroughness, genuiness. Abraham Lincoln, without going to high school or college, had this spirit. However much it may have been a part of his nature, the study of Euclid by the light of a wood fire helped him to perfect it. We call well imagine that he did not turn a page until he knew what was on that page. He took a definite subject and pursued it in genuine way. This is the whole simple secret. To this end would it not be well, in any normal school, school of education or teachers' college, that the curriculum should include at least one definite subject like mathematics, physics, Latin or English which would be required throughout the course: Whether or not one such subject be carried all the way, would it not be well, no matter how jealous may be the insistence on professional subjects, to stand by the requirement of at least one such definite subject each year? To get the spirit of scholarship the choice of subject is of little moment, provided it be a subject in which absolute accuracy can be and will be demanded.

Teachers who have this spirit of accuracy and genuineness spread it through their classes. It is a part of their personality. *They can get it by close, continued study of some definite subject, and there are no short-cuts.* Having got it in any one thing, they take it into other things.

VII

The second thing which it seems to me may be justified in naming as one of the two main objectives in the preparation of teachers is the spirit of discrimination, good taste, culture. Culture is a word abused, but it serves. Teachers who have culture change the atmosphere of their schools. A person of culture discriminates between good and bad in manners, in literature, dress, pictures, music and what not. How can we get this power of discrimination? Many things help. The reading of good books helps. The mastery of one of Gilbert Murray's translations of a Greek drama, the mastery of Mathew Arnold's introduction to his edition of Wordsworth, anything like these would help. Travel helps. Looking carefully at a good picture helps. Listening attentively to good music helps. Looking lovingly into the face of a beautiful rose helps. All contact with beautiful things helps.

But for most of us the greatest help comes from getting in touch directly with those who have this power of discrimination. When Sidney Lanier was half starving, suppose some college had found him out and paid him only to come and sit before an English class and talk about Shakespeare. What a well-spring of culture he would have been to the students who came thus in touch with him.

The personal contact is the main thing. It would be a good move if all places where teachers are trained would increase the practice of bringing in from the outside people of taste and discrimination. Not the professional platform people. Heaven, No! But people who by their ways and works have shown that they know the significance of culture and good taste. It may be a clergyman, or merchant, or doctor, or lawyer, or achitect. There are some in all callings, some in almost every community.

VIII

So then let us not be confounded by a complexity of demands. Let us seek simplicity and ensue it. Whatever our teacher-training must include, no matter how much professional technique may be required, let us keep in view the two simple objectives of accuracy, which is the truth of things, and culture, which is the beauty of things. Teachers who have themselves the spirit of accuracy and the spirit of culture will inevitably inspire the like spirit in their pupils. They will beget in pupils the habit of accuracy and the tendency to discriminate between what is true and what is false in all the various contacts of life.



# NEWS FROM HERE AND THERE

## PATHS OF MEDICAL PROGRESS FOR 1930 MAY FOLLOW TWO LINES

Solution of problems on new diseases and also of some of the old familiar ones are hoped for by medical scientists during 1930. The ever-widening extent of undulant fever, the threat of a menigitis outbreak, the increase in malaria and pellagra in the South will be subjects of study and investigation in laboratories and in the field during the coming year. Progress in the control of one or all these is to be looked for, public health experts believe.

New and possibly radical methods of caring for children may be evolved by members of the various committees who will be making intensive studies of child welfare for report at the White House Conference on Child Health which will meet late in the year. The personnel of the committees includes outstanding leaders in every branch of the field, so that their concerted studies are expected to be of enormous value and significance.

Progress in pharmacy will be considerable, due to the decennial revision of the U. S. Pharmacopoeia which will take place during 1930. Marked and important changes in the character of modern pharmacy may also be expected. An increase is foretold in the number of purely professional pharmacies or chemists shops, planned along the lines of the old-time ones with only such modern improvements as pertain exclusively to the practice of pharmacy.

In view of the earnest scientific effort being expended throughout the world in cancer research, progress will undoubtedly be made in this field, though it is perhaps too much to hope that the discovery of a "cure" will be made in the new year.

The Ransdell bill for the establishment of a National Health Institute will doubtless come up before Congress during 1930. Should this bill become a law, public health activities will take a big step with possibly far-reaching consequences.

The chemical reagent capable of detecting minute amounts of dread mustard gas in the air will probably be made during the coming year as a result of the competition sponsored by the International Committee of the Red Cross.

*Science Service.*

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## PRIZE PHYSICS WORK PROVES ATOMIC HEART TO BE LIKE WAVE

*By* Prof. A. J. Dempster
*Ryerson Physical Laboratory, University of Chicago*
(Winner $1000 American Association for Advancement of Science Prize.)

Knowledge of the nature of matter is the object toward which physicists are striving in such experiments as the one that I presented before the American Association for the Advancement of Science at its recent meeting.

The physicists have already found that neutral matter is made up of positive and negative parts, and my experiments deal with the behavior of positive parts of hydrogen atoms when allowed to fall on a crystal.

Hitherto experiments have indicated that these positive rays behaved as charged particles but my experiments show that they also have a wave nature. This is revealed by the complex way in which they are deflected by the crystal.

My experiments form a counterpart to the experiment of Davison and Germer which dealt with the wave nature of the electrons. My experiments show the wave nature of the positive part or nucleus of the atom.

At present we think of all chemical atoms as built upon hydrogen nuclei and the nature of the fundamental building block is of great interest in connection with the phenomenon of radio activity and atomic transformation in general.

Its bearing on the theory at present is connected with the development of wave mechanics in that it provides a phenomenon which must be taken account of by that theory.

The French physicists De Broglie, who has just been awarded the Nobel Prize, was the pioneer in the formulating of wave mechanics and my experiment is a proof of some of the phrases of that theory.

Theories in physics and elsewhere must check with concrete phenomena otherwise the theories grow too vague.

The German physicist, Laue, made important studies of the structure of crystals in 1911 and these were the beginning of much of the present work in physics.

He found that crystals could be considered to have a regular arrangement of molecules which acts like the structure of a silk umbrella when looked through at a distant light, diffracting the light.

This was the first real evidence that X-rays were of wave nature.

My experiments have now shown that the same crystal arrangement acts in an analogous way on streams of positive hydrogen atoms indicating that they also have a wave structure.

*Science Service.*

## ACETONEDICARBOXLIC ACID—IT'S A NEW BAKING POWDER

A baking powder which does not leave a residue in the finished bread or cake has just been worked out in the chemistry laboratories, at the University of Wisconsin, by Edwin O. Wiig. This new leavening agent has as its active agent acetonedicarboxylic acid, which during the baking process disappears entirely as gases.

The formation of carbon dioxide, the gas which "raises" the cake, is only part of the story of baking powder. The other part concerns the product which remains in the cake as a residue. The various commercial baking powders on the market at present leave as



residue saline cathartics, such as sodium tartrate, Rochelle salt, disodium, sodium sulfate or aluminum hydroxide. There is still a question as to the possible ill effect of some of these materials upon health. Hence the advantage of a baking powder which leaves no residue whatsoever. Acetone is the only other substances formed besides carbon dioxide, and the acetone completely evaporates at baking temperatures.

The new powder depends for its action on combination with the water of the dough, just as do the present powders. Hence in order to protect it from atmospheric moisture it is mixed with starch. The cornstarch has a second function, more important than that just mentioned. Starch makes it possible for the chemist to standardize his product. All baking powders must have approximately the same "raising" strength to make possible the use of any recipe. The housewife-consumer will not consult the label of her tin of baking powder, and then compute whether the "two tsp. b. p." of her recipe should have to be doubled or halved. Starch takes care of any variation in the amount of carbon dioxide given off by active agents of differing compositions.

The keeping properties of acetonedicarboxylic acid baking powder are excellent, as Mr. Wiig has shown by various tests. It needs only to be kept in the customary moisture-proof tin. The keeping power of a product is of utmost importance to the manufacturer.

Further study of the suitability of acetonedicarboxylic acid as a leavening agent is being continued at the University of Wisconsin. The question of a cheaper source of raw material is still under investigation. At present citric acid is the raw material used in the making of acetonedicarboxylic acid. Cull lemons form the natural source of citric acid, and is the principal one in use. A shorter name for the substance would also be highly desirable, but that is a simpler problem.

*Science Service.*

## MODERN SCIENCE IS NOT SCIENTIFIC

A large part of what the public calls science and much of the science teaching in schools and colleges today is not really science, Dr. A. J. Goldforb, retiring chairman of the medical science section of the American Association for the Advancement of science, declared a short time ago.

"The extent of which unscientific science is taught in our schools is amazing," he said. "Maltraining like malnutrition if long continued, has very serious and lasting effects on the organism." Evidence of scientific maltraining may be found in many of the papers sent to scientific journals which must be rejected for major and serious defects.

Science is difficult to define and few educated or "schooled" persons today agree on what subjects may be properly called science, outside of a few broad classifications.

"The experimental method, properly defined, characterizes real science and differentiates it from primitive science, from pseudo-science, from non-science, from anti-science," Dr. Goldforb said. He described the history of the development of science and compared it to the development of the human race, science having had its primitive stages, just as man had. The primitive stage of science included the fact-finding stage and the law-formulating stage, but the experimental stage represents a more complex and modern development.

"Collections of facts do not constitute science. At best they are the prelude to science, the building blocks with which the structure of science is built," Dr. Goldforb said. "To substitute the accumulation of facts and laws or dexterity of manipilation for experimental methodology is naive, erroneous and anti-science, the cartoon of science."

Fact and law worship dominates the science courses in nearly all schools and colleges, Dr. Goldforb said. He believes that the methods of experimental investigation may be pursued long before work is done for the doctor's thesis, and he looked forward to the day when there would be more scientific teaching of science in all schools and closer co-operation between all scientists no matter in what branches they are engaged.

*Science Service.*

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## HERE IS YOUR TEST FOR INVENTIVE ABILITY

Do you have the "divine spark" necessary for a great scientist or inventor, of the Edison type? Psychologists believe that scientific aptitude is born in specially gifted individuals instead of being acquired by training. Perhaps, if you had the opportunity, you too could be an inventor or scientific wizard.

Here is a test you can try on yourself. It is especially prepared for THE JOURNAL OF SCIENCE by a Science Service specialist but it is similar to other tests devised by psychologists to single out the few embryo scientists from among the thousands of "just ordinary folks." Compare it and your ability to do it with your success in tests that Mr. Edison gave the 49 aspirants for the Edison scholarship.

All you need is a pencil and a few minutes of time. Do not look at the answers before you finish. Anyone can take this test. It is a measure of your natural "bent," and not any special training or technical knowledge.

Ready? Begin!

1. Which of the following is the *best* definition of a thermometer?

(1) A glass tube containing mercury. (2) An instrument used in laboratories. (3) An instrument, usually employing mercury, for measuring temperature. (4) An instrument in common use in many homes and offices.

2. How many people in the United States earn their living from science today?

3. Suppose you were making an experiment and wished to know very exactly the weight of the substance you were using. You weighed it several times and got the following results: 12.25 oz; 12.50 oz., 12.25 oz., 15.75 oz., 12 oz. What is most probably the correct weight?



4. Suppose you wished to know the contents of a tank from which several of your co-workers were drawing supplies of a certain liquid. You could not actually measure the liquid, but you have the following facts at your disposal. Which of the facts would be important for your computation? (1) Total capacity of tank. (2) Number of persons using liquid. (3) Number of days tank was filled. (4) Total amount drawn from tank since it was full.. (5) average daily evaporation. (6) Density of the liquid. (7) Frequency with which tank is filled.

5. Read each of the following statements and decide whether it is consistent throughout.

(a) Moisture causes wood to swell. Today is a very damp day, and therefore the wooden peg can be more easily driven into the hole made for it.

(b) Accuracy is essential to scientific work. Measurements made by different individuals seldom agree exactly. In order to insure accuracy, scientific data should be checked by more than one person.

6. Suppose two handbook differed as to the best procedure for working out a certain experiment that you wanted to conduct. If you had plenty of time which of the following would you do?

(1) Use of a compromise procedure.

(2) Go to a good technical library and try to find a third textbook.

(3) Forget the handbooks and work out a procedure of your own.

(4) Try out both the methods recommended, and find out which is best.

(5) Call up some expert on the subject and ask him for the best procedure.

(6) Decide on one of the methods given and then follow it, ignoring the other.

7. Suppose you were driving in the country and your radiator sprung a leak. You had no equipment for repairing it, and there was no garage within miles—nothing but a small refreshment stand. What could you do, if anything, to lessen the leak until you got back to town?

Have you finished? If so, read answers below.

### ANSWERS TO INVENTIVE ABILITY TEST

Answers: 1. (3); 2. There is no correct answer to this question. It is designed to determine whether you tend to makes guesses or "snap judgment;" 3. (12.25 oz.); 4. (1), (3), (4), (5); 5a. (inconsistent); 5b. (consistent); 6. The answers to this question cannot be rated right or wrong, but they indicate whether you have a bent for experiment or research in books, or whether you are inclined to depend on the opinions of others: 7. Any reasonable plan is given credit, the question is a test of ingenuity when faced with a difficult situation.

*Science Service.*

# SELECTION AND PURCHASE OF EQUIPMENT AND FURNISHINGS FOR LABORATORIES

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*Professor of Natural Science, Teachers College*
*Columbia University*

The demands for equipment and furnishings for laboratories, particularly those for the secondary school levels, should be interpreted in the light of the new and enlarged conception of the objectives of secondary education and, in particular, of high school science. During the past decade there have been several reports of intensive studies of outcomes of laboratory instructions. Downing[1] and his students and others working independently have demonstrated fairly conclusively that the method of teacher demonstration is as effective as, and more economical of time, than, the usual method of individual laboratory work for training students so that they may pass the traditional informational examination. Horton[2] has demonstrated equally conclusively that through use of a modified form of individual laboratory work, students may be trained in laboratory technics and in problem solving. These and related studies suggest the new interpretation of problems of equipment and furnishings.

Two conclusions may be safely drawn from these studies. First, there must be larger provision for demonstrations, and, second, the equipment for individual work must allow for greater flexibility in methods of teaching. The student should have the facilities for doing other things than those set forth in the traditional list of exercises described in the laboratory manual. The demands are reasonable in that the practical school man may easily meet them.

The size of the school also has an important bearing upon laboratory plans. In small to medium-sized schools the combined laboratory and classroom is in favor. Rooms may be equipped for more than one science. A very careful planning is illustrated in the floor plans of the science laboratories of the Milwaukee University School designed by W. R. Leker. In the Lincoln School of Teachers College, separate rooms planned as combination classrooms and laboratories are arranged for each of the sciences of the secondary school. The arrangement of rooms is shown as Figure 1. In large schools, for example the Roosevelt High School of New York City, there are separate recitation rooms and laboratories as well as store and preparation rooms. Floor plans of the rooms set apart for Physics are shown as Figure 2. The arrangements for chemistry and biology are similar.

Rooms designated for science work are incomplete without equipment for visual education. Dark shades and projection apparatus for slides and 16-mm. films are essential equipment.

Minimum lists of equipment for each of the sciences are available from many sources. These are fairly uniform in their recommendations. A summary of these, together with other recommendations for laboratory equipment, is contained in a recent bulletin[3] of the United States Bureau of Education.

[1] Downing—Teaching Science in the Schools, Chapter VIII. University of Chicago Press.

[2] Horton—Outcomes from Laboratory Instruction in High School Chemistry. Teachers College Contributions to Education No. 303.



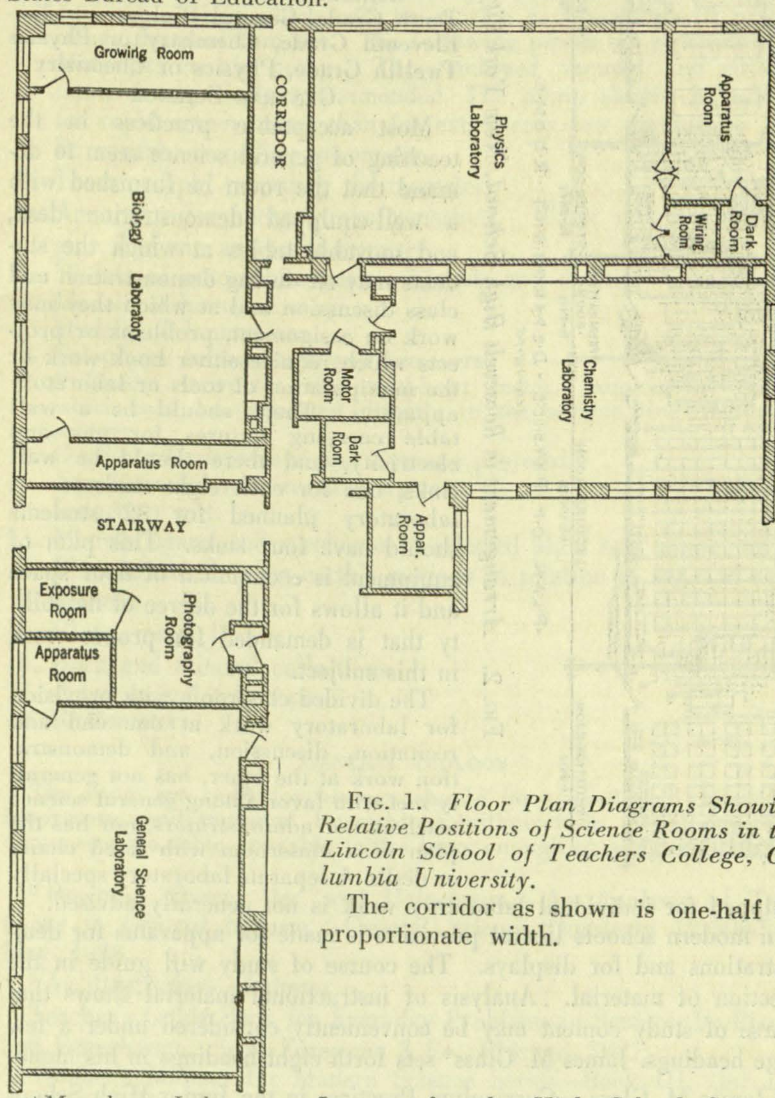


Fig. 1. *Floor Plan Diagrams Showing Relative Positions of Science Rooms in the Lincoln School of Teachers College, Columbia University.*

The corridor as shown is one-half its proportionate width.

[3] Monahan—Laboratory Layouts for the High School Sciences. Bureau of Education Bulletin, 1927. No. 22.

See also Standard State Lists of High School Laboratory Equipment. Central Scientific Co., Chicago, Ill.

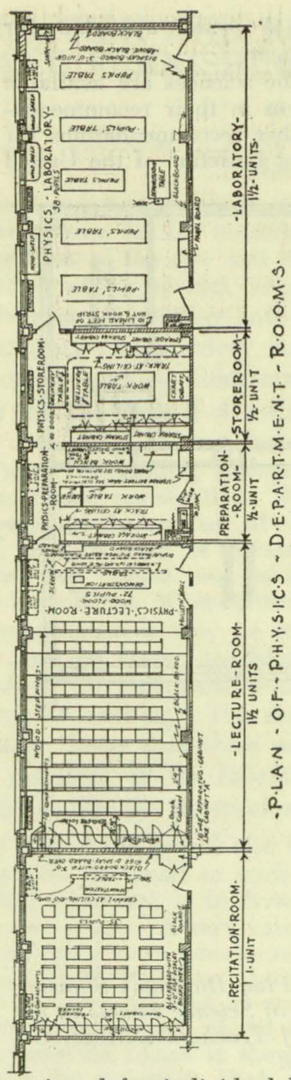


FIG. 2. *Arrangement in Roosevelt High School, New York City*

The sequences of science courses recommended by the Commission on Reorganization of Science in Secondary Schools, which has general acceptance throughout the United States is:

Junior High School or Ninth Grade, General Science
Tenth Grade, General Biology
Eleventh Grade, Chemistry or Physics
Twelfth Grade, Physics or Chemistry

GENERAL SCIENCE

Most acceptable practices in the teaching of general science seem to demand that the room be furnished with a well-equipped demonstration desk, and movable tables at which the students may sit during demonstration and class discussion and at which they may work on assignment, problems or projects which require either book work or the manipulation of tools or laboratory apparatus. There should be a wall table carrying fixtures for gas and electricity, and there should be wall sinks, one for each eight students. A laboratory planned for 32 students should have four sinks. This plan of equipment is economical of floor space and it allows for the degree of flexibility that is demanded for proper work in this subject.

The divided classroom with provision for laboratory work at one end and recitation, discussion, and demonstration work at the other, has not generally met with favor among general science teachers nor administrators, nor has the plan of a classroom with fixed chairs or desks. A separate laboratory specially equipped for individual laboratory work is not generally advised.

In modern schools liberal provision is made for apparatus for demonstrations and for displays. The course of study will guide in the selection of material. Analysis of instructional material shows that course of study content may be conveniently considered under a few large headings. James M. Glass[4] sets forth eight headings in his monograph on curriculum practices in the Junior High School; and Elliot R. Downing[5] reports the results of analysis of 25 textbooks in a more detailed table of 20 headings with many subheadings. These analyses will be useful guides in planning equipment.

Authors of textbooks commonly give a minimum list of apparatus.[6] The apparatus in these lists is recommended for first purchase. Progressive schools, that is, those guided by a desire to provide for their children experiences which will be as rich as possible, will provide more than the minimum list. The following pieces are recommended:

1. Motor-driven air pump. The combined vacuum and pressure pump is especially recommended. The pump should be selected for rapid action rather than for extremenly low pressure.
2. Baragraph, recording barometer.
3. Thermograph, recording thermometer.
4. Apparatus for energy transformations. Water motor, steam engine, dynamo and milli-ammeter.
5. Models of automobile parts. Chassis and engine.
6. Models of human eye.
7. Models of human ear.
8. Telephone transmitters and receivers.
9. Voltmeter, ammeter, and watt-hour meter, commercial forms, which may be connected directly to the service line of the laoratory.
10. Compound microscope and Euscope projector.
11. Aquarium fed with running water.
12. Induction coil.
13. Models, charts and specimens of selected plant and animal forms.
14. Planetarium showing earth's motions in relation to sun and other planets.
15. Globe (earth.)
16. Rock and mineral collections.
17. Astronomical telescope.
18. Radiometer.

GENERAL BIOLOGY

The room set apart for biology should be a combined classroom, laboratory, and museum. Furnishings will include a well-equipped demonstration table, movable tables large enough to accommodate two

[4] James M. Glass.—Curriculum Practices in the Junior High School and in Grades 5 and 6. Supplementary Educational Monograph No. 25, University of Chicago Press. Quoted in Department of Superintendence Fifth Year Book, p. 147.



[5] Downing, Overn, Iler, and Heinemann.—An Analysis of Textbooks in General Science. General Science Quarterly 12:509-515, May, 1928.

[6] As illustrations of these:

Teacher's Guide Book for Everyday Problems in Science, by Pieper and Beauchamp. Scott Foresman & Co., Chicago, 1927.

Teacher's Manual for Modern Science Series—Book III, Our Environment, How We Use and Control It, by Wood and Carpenter. Allyn & Bacon, Boston, 1928.

Monaham: Laboratory Layouts for the High School Sciences. Bureau of Education Bulletin, 1927, No. 22, pp 29-30.

or four students, wall table space with gas and electricity, and sinks at walls, one for approximately eight students. Standard minimum lists of apparatus have been prepared by the authors of most of the texts and laboratory manuals[7] and the pieces listed in these items for first purchase. The following pieces are recommended for schools which are able to purchase in excess of the minimum.

1. Compound microscope and Euscope for micro-projection.
2. Models, specimens, and other displays selected to illustrate biological phenomena and biological principles.
   a. Structure of monocotyledonous and dicotyledonous stems.
   b. Animal forms illustrating increasing complexity of structures.
   c. Structure of human eye, ear, head, chest, and abodmen.
   d. Displays illustrating animal and plant life, such as community life of insects, protective coloration, Mendel's laws, life histories, etc.
   e. Charts selected to illustrate phenomena and principles like those above (a to d).
3. Aquarium fed with running water.

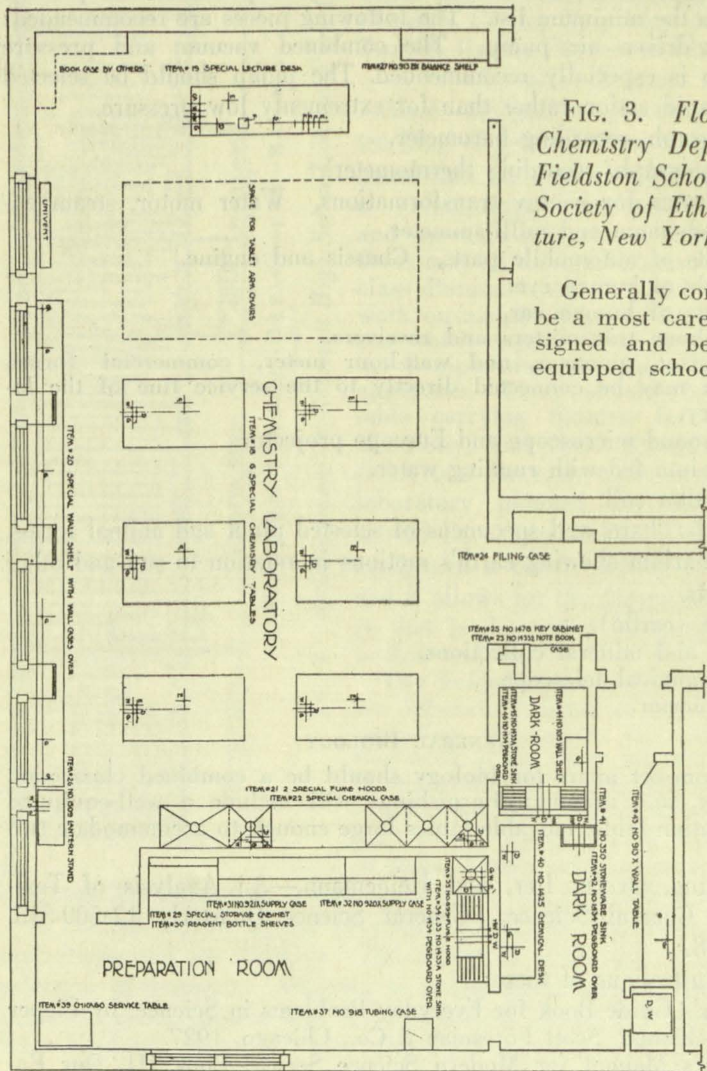


FIG. 3. *Floor Plan, Chemistry Department, Fieldston School of the Society of Ethical Culture, New York City.*

Generally conceded to be a most carefully designed and beautifully equipped school.

[7] See, for example,, Students' Manual of Exercises in Elementary Biology, by Gruenberg and Wheat. Ginn & Co., 1921; Monahan: Laboratory Layout for the High School Science, *loc. cit.*, pp. 28-29.



Adjoining the laboratory should be a growing-room with furnishings, including aquaria, terraria and cages. The room must have abundance of natural light and should have outlets for electric lighting. There should be no gas in this room. In large schools with more than one laboratory, the growing-room will be centrally located and accesible to all laboratories. The diagram of the laboratories of the Milwaukee University Schools shows a plan for a combined biology and general science room which has many points in its favor for the smaller schools. The fixed desks do not allow for the kind of flexibility that is demanded by teachers who specify movable tables.

### CHEMISTRY

Three distinct types of laboratories are recognized for chemistry. There are those of the so-called Lincoln type, used in the Lincoln School of Teachers College, in which the student uses the same space for laboratory as for recitation work. The second is the divided room one part for laboratory and one part for recitation. This is illustrated in the plan shown as Figure 3. The third is the case in which two rooms are used, one, only as a laboratory, and the other only as a recitation room. No one of these can be called best, unless its merits are considered in relation to the size of the school and the plans of the instructor. Common practice finds the Lincoln type and the divided room about equally in favor for the small to medium-sized school. In very large schools the separate laboratory and class room are preferred. Figure 3 shows a carefully planned arrangement for large schools.

In either case the room in which class discussion is carried on should be well equipped for demonstration work. Service to the demonstration tables should include water, gas and direct-current electricity. Student tables should carry gas and water.

The minimum list of apparatus is given in laboratory manuals[8] should be purchased to meet minimum requirements. The method of individual laboratory work is used extensively in chemistry. In

[8] See, for example, Laboratory Exercises to accompany Elementary Principles of Chemistry, by Brownlee and others; Allyn & Bacon, Boston, 1928. Laboratory Manual of Chemistry, by Bruce; World Book Co., Yonkers, N. Y., 1924. Laboratory Exercises in Chemistry, by Charles E. Dull; Henry Holt & Co., New York. Monahan: *loc crit.* pp. 19-22.

this work should be planned so that so far as possible the students are independent of each other and of the storeroom. Student kits may be made up so that they are complete for a semester's work. For schools that wish to provide more than the minimum requirements, the following items of equipment are recommended:

1. Analytical balance—medium-priced but with sensitivity to one-tenth milligram.
2. Distilling apparatus for water
3. Electrolysis apparatus for water
4. Eudiometer—Hoffman form
5. Induction coil for exploding gases
6. Liebig condenser for fractional distillation
7. Combustion furnace, electric
8. Apparatus for producing liquid air
9. Chart of the Atoms—Bureau of Standards form

The chemistry teacher may properly take as an objective of the demonstration, to show some refined method of laboratory work which has application in research or in industry. The special training of the teacher will guide in the selection of apparatus for this work.

PHYSICS

The three types of laboratories recognized for chemistry are also recognized for physics, and the same considerations will determine choice.

The course of study or manual selected for use[9] will determine the selection of appartus for student use. Student tables will be equipped with gas and electricity. Water should be available from wall sinks, one sink for each eight students. Electricity should be supplied from a panel board and should include service lines from lighting circuit, from motor-generator, and from storage batteries.

The demands for demonstrations are probably larger than in any of the other sciences unless perhaps general science. A steel beam close to the ceiling and over the demonstration table should be provided for suspending heavy weights. The demonstration table should be equipped with water, gas, and electricity. The electrical service should include current from the lighting circuit, from motor generator, and from storage batteries.

Apparatus for demonstration should include items number 1 to 10 inclusive, in the general science list and the following:

1. Metric Chart Bureau of Standards form
2. Chart of the Atoms, Bureau of Standards form
3. Acceleration apparatus
4. Motor rotator and attachments
5. Gyroscope, Foucault form
6. Pascal's vase apparatus
7. Boyle's law apparatus and air thermometer
8. Gas meter with large dial for easy reading, commercial form

[9] See, for example, Laboratory Exercises in Practical Physics, by N. Henry Black. The Macmillan Co., 1924.



9. Dissectable hand power dynamo
10. Galvano-volt ammeter
11. Optical bench with attachments
12. Optical disc
13. Astronomical telescope (3-inch)
14. Static machine. Wimshurst ambrolite plates
15. Foot-candle meter

The physics teacher should be encouraged to develop demonstrations of considerable refinement in the field of his special interest, and for this special apparatus will be required.

In addition to laboratories there is need for a room or rooms which shall be combination preparation and store room. Medium-sized and large schools will require at least two such rooms—one for general science and biology, and one for physics or chemistry. Furnishings and equipment should include benches and tools for wood and metal work. The service to the room should include gas, water, electricity, and air pressure for a blast lamp. Air pressure may be supplied by means of a foot bellows.

Modern schools will provide for their children a rich experience with science. This will be accomplished by revealing the possibilities of the field through the use of displays and good apparatus for demonstrations and individual work. The lists suggested above do not by any means exhaust the possibilities. Features that are important for their contribution to flexibility are the worshop and dark-room with good supplies of tools. Pupil activity is a natural development in science, as in other subjects, after the field for activity is revealed and after the materials with which to be active are made available to the pupil. There are large possibilities within each of the fields of science.

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5. Woodring, Oakes and Brown.—Enriched Teaching of Science in the High School. Bureau of Publications, Teachers College, 1928. This is a source book of information concerning supply houses for charts, models and apparatus.

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