American Association of Jesuit Scientists

EASTERN STATES DIVISION

PROCEEDINGS

of the

SECOND ANNUAL MEETING

FORDHAM UNIVERSITY

August 10 and 11
1923

PROCEEDINGS

The second annual meeting of the American Association of Jesuit Scientists, (Eastern States Division), was held at Fordham University, August 10th and 11th, 1923, with about forty members in attendance.

On account of the illness of the Reverend President of the University, E. P. Tivnan, S.J., the address of welcome was given by the Reverend Rush Rankin, S.J., Dean of the Graduate School. This was followed by the Presidential address by Reverend M. J. Ahern, S.J., entitled "The Length of Geological Time." Immediately after this a business meeting took place, in which changes in the constitution were proposed. A committee was appointed to go over the matter and report at the final session of the convention.

In the afternoon the various sections met and the papers were read and discussed. At 7.30 P. M. the members were treated to an interesting illustrated lecture on the Einstein theory by Fr. Phillips, S.J. The following morning the few remaining papers were read, and in the afternoon the final meeting was held. A number of changes in the constitution were proposed and voted on, and finally the appended constitution was adopted.

The following officers were elected for the coming year:

Rev. M. J. Ahern, S.J., President, and Mr. Joseph B. Muenzen, S.J., Secretary.

After a rising vote of thanks to the Fordham community for their hospitality and many kindnesses, the different sections met privately and elected the following officers for the coming year:

BIOLOGY	Fr. Didusch, Chairman Mr. D. V. McCauley, Secretary
CHEMISTRY	Fr. Coyle, Chairman Mr. Gookin, Secretary
MATHEMATICS	Fr. Phillips, Chairman Mr. J. P. Kelly, Secretary
PHYSICS	Fr. Brock, Chairman Mr. John Crowley, Secretary

In a meeting of the Executive Council which followed, Fr. Brock was elected Editor-in-chief of THE BULLETIN. A resolution was passed that the secretaries of the different sections be the assistant editors of THE BULLETIN.

The following is a copy of the official program of the convention:

FRIDAY, AUGUST 10TH, 9 A. M.

General Session, Alumni Rooms

Address of Welcome

Rev. Rush Rankin, Dean of Graduate and Extension School, Fordham University

Presidential Address

"The Length of Geological Time" Rev. M. J. Ahern, S.J.

Submission of revised constitutions for approval by the Association.

FRIDAY, 3.00 P. M.

Meeting of Physics and Mathematics Sections, Physics Lecture Hall

Vice-Presidential Address

"Some Problems Relating to Energy" H. M. Brock, S.J.

"Father Wessling's Cyclotomic Hyperbola" E. C. Phillips, S.J.

"The Correlation of High School and College Physics" J. M. Kelly, S.J.

"Recent Discoveries in Physics, and Substantial Change in Inorganic Matter" C. Depperman, S.J.

"An Aspect of Zero Velocity" J. P. Kelly, S.J.

"A New Kinemacolour Process' J. J. Lynch, S.J.

FRIDAY, 7.30 P. M.

"Some Astronomical and Other Tests of Einstein's Theory" (Illustrated) E. C. Phillips, S.J.

SATURDAY, AUGUST 11TH, 9.00 A. M.

Chemistry Section

Vice-Presidential Address

"Dyes and Dyeing" George L. Coyle, S.J.

"Laboratory Construction Problems" Arthur J. Hohman, S.J.

"Ionization Experimentally Demonstrated" T. J. Brown, S.J.

"Ionic Equilibrium in Basic Analysis" T. J. Butler, S.J.

"Chemical Defence of the Animal Organism" G. J. Shiple, S.J.

"Some Pedagogical Problems Connected with the Four Branches—Chemistry, Physics, Mathematics, Biology" George F. Strohaver, S.J.

Biological Section

Vice-Presidential Address

"Recent Discoveries of Pre-Historic Human Remains" Joseph S. Didusch, S.J.

"Practical Hints in Laboratory Technique" C. E. Shaffrey, S.J.

"Instinct and Intelligence in the Albino Rat" R. J. McWilliams, S.J.

"Biological Radiography" D. V. McCauley, S.J.

"An Experiment on Special Ganglia Nerve Cells" H. C. Avery, S.J.

SATURDAY 3.00 P. M.

General Session—Alumni Rooms

Sectional Meetings, Election of Officers and Transaction of Business

Members of the Association of Scientists

The following is a revised list of members received to date. If there is any mistake please notify the Secretary before the next meeting.

Physics and Mathematics

Archer, P.
O'Laughlin, F. D.
Phillips, E. C.
Lynch, D. J.
McDonnell, J. F.
Risacher, J. A.
McNally, P. A.
Logue, W. W.
Brock, H. M.
Dawson, J. F.
Sullivan, D. H.
Wessling, H. J.
Deppermann, C. E.
Miley, T. H.
Cullen, W. R.
Kelly, J. M.
Love, T. J.
Mahoney, J. B.
Gipprich, J. L.
McCormick, J. T.
Rafferty, P.
McHugh, P. J.
Lynch, J. J.
Kelly, J. P.
Kolkmeyer, E. J.
Murphy, J. J.
O'Conor, J. S.
Crowley, J. H.
McNally, H. P.
Reith, J.
Merrick, J. P.
McGarry, W. J.
Carasig, P.
Tobin, J. A.
Smith, J. P.
McAree, J. F.
Moore, T. H.
Mahoney, D. P.
Delaney, J. P.
Berry, E. B.
Roth, C. A.
Roth, A. C.
Maher, J. M.
Kennedy, W. W.
McLaughlin, T. L.
Logue, L. R.
Higgins, P. J.
Walsh, J. B.
Bouwhuis, A. L.

Chemistry

Ahern, M. J.
Coyle, G. L.
Hohman, A. J.
Tivnan, E. P.
Strohaver, G. F.
McLoughlin, H. W.
Brosnan, J. A.
Schmidt, R. B.
Gallagher, J. P.
Daly, J. A.
Langguth, A. B.
Martin, R.
Butler, T. P.
Brown, T. J.
Muenzen, J. B.
McCullough, H. B.
Shiple, G. J.
Sohon, F. W.
Blatchford, J. A.
Gookin, V. A.
Sullivan, J. J.
Fay, T. Aug. F.

Biology

Didusch, J. S.
Frisch, J. A.
Shaffrey, C. E.
Caballero, G.
Avery, H. C.
Tondorf, F. A.
Busam, J. F.
McCauley, D. V.
McWilliams, R. J.
Poutier, E. S.
Reinhard, E. G.
Pollock, J. A.

CONSTITUTION

OF THE

AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

(Eastern States Division)

ARTICLE ONE

NAME

The name of this Association shall be "*American Association of Jesuit Scientists,*" with the sub-title "Eastern States Division."

ARTICLE TWO

AIM

The aim of the Association is to promote the teaching of Science and Mathematics in our schools and colleges by mutual encouragement and stimulation, the presentation, discussion, and publication of papers.

ARTICLE THREE

MEMBERSHIP

1. Teachers of Biology, Chemistry, Mathematics, and Physics as a major branch in Jesuit Institutions, who are at the same time willing to co-operate in the work of the Association are eligible for membership. This condition shall apply to other sections of the Association that may be formed in the future. The co-operation referred to is the willingness to present a paper at the annual convention from time to time.

2. Former teachers of such major branches, and now engaged in the studies of the Society, as well as students of Science who intend to devote themselves to teaching one or the other of these branches are also eligible for membership.

3. Applications for membership will be accepted and passed upon by the Executive Council specified in Article Four.

4. There shall be no admission fee for membership. Necessary expenses of the Association shall be defrayed as set forth in Article Eight.

5. The privilege of attending the meetings of the Association is extended to non-members interested in these branches.

ARTICLE FOUR

OFFICERS

1. The officers shall consist of a President, a Secretary-Treasurer, and a Representative from each section. This Representative shall be the presiding officer of his section, and ipso facto, a Vice-President of the Association. These shall constitute an Executive Council for the government of the Association.

2. The President and Secretary-Treasurer shall be elected by the Association. The Representatives shall be elected by the respective sections.

3. The officers shall hold office for one year, or from the end of one convention to the end of the next.

4. The election of officers shall take place at the end of each annual meeting.

ARTICLE FIVE

DUTIES OF OFFICERS

A.—Officers of the Association:—

1. Duties of the President:
   (a) He shall preside at the general meetings;
   (b) he shall give a Presidential Address;
   (c) he shall call and preside at the meetings of the Executive Council.

2. Duties of the Vice-Presidents:
   (a) They shall represent their respective sections in the meetings of the Executive Council.
   (b) In the absence of the President, that Vice-President chosen by a majority vote of the Executive Council shall preside.

3. Duties of the Secretary-Treasurer:
   (a) He shall act as secretary of the Executive Council;
   (b) he shall keep a record of the membership and of all the transactions of the Association;
   (c) he shall be the editor of the Proceedings of the Association.

B.—Officers of the sections:—

1. Duties of the Vice-President:
   (a) He shall preside at all meetings of his own section;
   (b) he shall deliver a Vice-Presidential address;
   (c) his other duties are defined above under A-2.

2. Duties of the Secretary:
   (a) He shall keep a record of the membership and all the transactions of his section;
   (b) he shall arrange the program of his section in conjunction with the Vice-President;
   (c) he shall submit a report of the activities of his section at the annual meeting.

ARTICLE SIX

DUTIES OF THE EXECUTIVE COUNCIL

1. It shall define the general policy of the Association.
2. It shall arrange the general program of the annual meeting.
3. It shall make appointments to the Board of Editors as hereinafter specified.
4. It shall meet at least once a year at the call of the President.

ARTICLE SEVEN

SECTIONS

1. The sections of the Association shall be: Biology, Chemistry, Mathematics, and Physics, and such others as may be formed later.
2. Each section shall elect its own presiding officer who shall be a Vice-President of the Association. The Vice-President is to be the Representative of his section on the Executive Council. Each section shall also elect a secretary.

ARTICLE EIGHT

MEETINGS

1. There shall be an annual meeting of the Association and its sections at a time and place specified by the Executive Council.

ARTICLE NINE

PROCEEDINGS

1. The proceedings of the general meeting shall consist of scientific papers of universal interest.
2. The proceedings of the sectional meetings shall consist of papers and discussions on scientific and mathematical topics. Methods of presentation and demonstration, results of research work, developments in the art of teaching, historical investigations, etc., will be proper matter for discussion at these meetings.
3. The proceedings of the Association shall be printed and published annually under the direction of the Executive Council.

ARTICLE TEN

PUBLICATIONS

1. In accordance with Article II, section 1, besides the Proceedings, a periodical bulletin shall be issued containing news of interest to the Association and articles on scientific topics by the members.

2. This bulletin shall be under the direction of an Editor-in-chief to be appointed by the Executive Council.

3. The board of editors shall consist of the chief editor and an associate editor from each section. This board shall be appointed by the Executive Council and shall hold office until changed by the Council.

ARTICLE ELEVEN

FUNDS

1. In accordance with the provisions of Article III, section 4, no admission fees are required.

2. Necessary expenses shall be defrayed by a pro rata assessment upon the members.

ARTICLE TWELVE

ALTERATION OF THE CONSTITUTION

1. This constitution may be amended by a majority vote of the members present, subject to such restrictions as arise from the special nature of this Association.

The Length of Geological Time

(Abstract)

Interest in the question of the length of geological time arises not merely from the apparent conflict between the enormous length of the estimates of geological time and the Biblical account of the age of the world, but from the constant appeal of evolutionists to Geology for confirmation of their theories, especially regarding the evolution of man. Much obscure thinking results in this discussion from the confusion of Geological Time with Historical (Chronological) Time on the one hand and Archaelogical Time on the other. Of the three times, we can within proper limits be sure of years and centuries in Historical Time, but cannot be sure with any definiteness whatever of the years and centuries of Archaelogical Time, much less of Geological.

Three methods have been used by geologists in estimating the age of the earth; one based on the rate of accumulation of sediments compared with the total thickness of the stratified rocks of the globe; one based on the rate of accumulation of sodium chloride in the ocean; the third based on the rate of cooling of the earth. Physicists have suggested another method based on the rate of decay of the radioactive elements compared with their estimated total quantity in the globe. Some geologists adopting this suggestion have estimated the age of the earth at one and a half to two billions years, but the data are so uncertain that the estimates are highly conjectural and are not generally accepted by geologists.

Of the purely geological methods, the stratigraphical (accumulation rate) yields an age of from 50 to 80 million years; the sodium accumulation method an age of from 46 to 74 million years; the globe-refrigeration method yields values between 55 and 70 million years. Some value near 60 or perhaps 65 million years is the value towards which the geological methods converge.

What is certain about geological time is:

1. That it was enormously long.
2. That it cannot be expressed accurately in years but only in relation to other periods. Thus we are fairly safe in saying that the Paleozoic Era was three times as long as the Mesozoic, and the Mesozoic twice as long as the Cenozoic, because the ratio of the thickness of the strata of these eras is approximately 6:2:1.

Excellent discussions of this question may be found in "The Age of the Earth," by George F. Becker, Smithsonian Miscellaneous Collec-

tions, Volume 56, Number 5; and in Windle, "The Church and Science," Chapter 24.

Some Problems Concerning Energy

(Abstract.) H. M. Brock

The wonderful advances in Physical Science during the past decades have raised interesting problems concerning the laws of energy, while the rapidly increasing energy consumption due to our modern civilization has promoted the study of sources available for the future use of mankind. Fuel sources, by no means inexhaustible, are being exploited everywhere. Besides water power, such sources as wind, tides and waves and the heat of the sun, used either directly or indirectly in the form of solid or liquid fuel from vegetation, and also the internal heat of the earth are being utilized and will doubtless be utilized on a larger scale in the future.

The study of radioactivity early revealed a new and unsuspected energy source stored up in the atom itself. This is liberated in the form of heat. It is not under control and on account of the rarity of the elements has no practical value. This heat emission was thought at first by many to be incompatible with the principle of the Conservation of Energy. This great principle was, however, firmly established in the 19th century though perpetual motion inventors have tried to circumvent it. The latter have always failed. The heat emission of radium takes place in accordance with the principle, the energy being stored up in the atom and its liberation taking place during atomic disintegration. While in the past the conservation of energy has triumphed over all difficulties, modern discoveries in the radiation of energy and the development of the quantum theory have given rise to problems which have not yet been satisfactorily solved. It has not yet been possible to harmonize the classical wave theory with the new radiation theory. In the case of electron emission Bragg points out a difficulty in reconciling it with the accepted view of the principle of the Conservation of Energy.

There is a feeling among men of science that the practical utilization of atomic energy will soon be an accepted fact. Progress up to the present does not warrant such sanguine hopes. In this connection the work of Aston on the isotopes and in particular that of Rutherford and Chadwick are most significant. The latter have been the first to liberate atomic energy artificially. By bombarding the atoms of ordinary elements with swift alpha particles from radium they have obtained positively charged hydrogen particles possessing more energy than that of the bombarding particles. At any rate atomic energy is an established fact. It may be that Divine Providence has kept it in reserve for the needs of mankind and in due time will furnish the key.

The Cyclotomic Hyperbola

(Abstract.)

By Rev. Henry Wessling, S.J.

Let O be the middle point of a fixed segment AB of a straight line XX′; and let YY′ be a straight line through O and perpendicular to XX′. With any point whatever on the line YY′ as a center draw a circle; then the hyperbola whose equation, referred to XX′, YY′ as co-ordinates axes, is

$$Y^2 - 3X^2 - 2KX + K^2 = 0,$$

where 2K is the length of the segment AB, has the property of trisecting the arc subtended by the chord AB, and also of trisecting the entire circle.

This hyperbola has its left hand vertex at the point A and its right hand focus at the point B. Its asymptotes make with the axis of X angles of plus and minus 60 degrees.

Since it is possible by simple geometric constructions to determine the point P on YY′ from which the segment AB will subtend any arbitrary angle, this hyperbola may be used as a geometric means of trisecting any angle. It should, however, be noted that the hyperbola itself cannot be fully constructed by the use of ruler and compass alone.

There was also exhibited at the meeting a very simple mechanical device, constructed by Father Wessling, for trisecting an angle. It is hoped that Father Wessling will publish before long a detailed account of this instrument in one of our Mathematical Journals.

New Physical Discoveries and Matter and Form

Synopsis of Lecture by C. E. Deppermann, S.J.

The electron theory seems to make the following statements at least plausible:—

There exist the ultimate units—the negative electron and the positive electron (or proton), of equal electric charge though opposite sign, but with unequal mass.

The atom consists of an inner nucleus of closely bound positive and negative electrons and outer shells of negative electrons. The proof is based on experiments by Rutherford on alpha-particle deflections, and by J. J. Thomson on scattered radiation. Again, when completed, the inner shells of various atoms are similarly constructed, while the number of electrons in outer shells progresses periodically according to Mendeleef's table. Hence radiation from inner shell electrons should only increase steadily in frequency with increasing atomic number of the element and should show no periodicity, and

should come from the atom whether chemically combined or simple. External properties of the atoms, depending on outermost shell, should vary periodically as atomic number of element rises, and the outer shell electrons should be the controlling factor in chemical combination, which thus becomes an accidental not a substantial change. Experiment indeed shows external properties to be periodic, especially valency, atomic volume, ionic volume, elasticity, boiling point, etc. An alkali ion behaves like an inert gas chemically and spectrally, an alkali-earth ion like an alkali, a doubly-ionized alkali-earth like an inert gas, etc. Discovery of isotopes and isobars also agrees with electron theory. Furthermore, Bragg's work on X-ray analysis of crystals indicates that elements are formally in the compound crystal; again the X-ray spectrum of the compound is that of the separate elements.

Hence conclusions:—(a) Argument for substantial changes in inorganic matter seems weakened, the atom itself being probably but a conglomeration of positive and negative electrons formally present, affinity being due to electro-magnetic or electro-static external fields of said atoms, and chemical combination being like an accidental union of two magnets.

(b) Theory of matter and form itself is not weakened; for the positive and negative electrons have essentially charges of opposite nature, they have different active and passive properties, and appear to possess finite diameters. Hence we can postulate quanity in the philosophic sense, with principle of parts and principle of union; and from all these facts argue to two fundamental substantial principles, essentially and really distinct, one active and one passive, i.e. to matter and form.

An Aspect of Zero Velocity

By Joseph P. Kelly, S.J.

In this paper was treated the limiting case of a projectile, whose angle of range was 90° with the horizontal. In a rectangular system of co-ordinates, the axis of "y" represents the path of the object; the axis of "x" represents the horizontal. The slope of the line representing upward motion is positive infinity; the slope for downward motion negative infinity. Just before the projectile reaches its highest point, the slope of its path is positive infinity. Immediately after it begins its downward motion, the slope is negative infinity. We say that the object at its highest point is at zero velocity. Hence it would seem that in passing through this highest point, whose velocity is zero, its slope changes from positive infinity to negative infinity, or passes through 180°.

A New Kinemacolor Process

By L. D. S.

For a paper presented to the Physics Section, the above title may be somewhat misleading, since the novelty of the process is chemical rather than physical. The purpose of the paper is to acquaint the members with the existence of the process and the address of its inventor and owner, who assured the writer that he would be glad to discuss the process with any of our men, and to conduct them personally through his plant. He may be found at 562 Fifth Avenue, New York City. No new physical principle is involved—the process being an ingenious adaptation of the subtractive method of Color Photography. Two exposures are made simultaneously (by mirror or prism suitably placed in camera) through screens of complementary color—red and blue-green. The resultant negatives are then printed (apparently simultaneously) on the front and rear surfaces of a doubly coated positive film, whose emulsion on the red negative side (i. e., the side in contact with the negative taken through the red screen) has been treated with a blue-green dye, while that on the reverse has been treated with a red dye. The red negative then produces a blue green positive on one side of the finished film, and the blue-green negative, a red positive on the other side. (i. e., In the so-called red positive, printed from the blue-green negative, parts in the original, blue-green, will be perfectly transparent, the rest of the film being red; while in the blue-green positive, parts of the original which were red will appear as transparent patches, the rest of the film being blue-green.) The superposition of the two positives gives a picture in very natural colors. The superposition, however, in the Brewster process consists in printing the red and blue-green positives on opposite sides of the same film—thus avoiding any superposition of films as in other processes. Another feature of the process is that the dyes used have a hardening effect on the film, and increase its life far above the life of the ordinary black and white film.

Some Astronomical and Other Tests of Einstein's Theory

(Abstract)

By Rev. E. C. Phillips, S.J.

After pointing out a number of slips and inconsistencies in the interesting four-reel moving picture exposition of Einstein's Theory, Father Phillips considered the three chief kinds of tests which may be applied to this as to any other theory; namely, the intrinsic or *a priori* test consisting in a critical examination of the assumptions, propositions and conclusions of the theory; the extrinsic test of authority or the attitude taken towards the theory by men eminent in

the domain of science and philosophy, and the *a posteriori* test consisting in the observation and measurement of critical physical phenomena for the purpose of seeing whether these take place in the manner and to the degree required by the theory. As to the value of such tests it was noted that whilst their satisfactory fulfilment gives high probability to a theory, it does not constitute an apodictic proof of its truth unless the observed facts be such as can be explained by that theory and by no other probable theory.

The actual content and necessary conclusions of Einstein's Theory, as distinguished from the bizarre and unwarranted cosmological interpretations affected by those Relativists who long to mystify or amaze their audience, seem to include nothing that is clearly inadmissable on *apriori* grounds; hence the first test may be said to have been satisfactorily met. As to the second test, there has not been any universal acceptance of the theory by the scientists of the world; there are many, especially in America and France, who still remain unpersuaded of its validity. Finally, as to the *a posteriori* test, the theory is certainly not the only one compatible with the critical physical phenomena adduced in its support: in fact, whilst it satisfactorily accords with the actual bending of light rays passing near the edge of the sun as observed in recent total eclipses, its accord with the anomalous movement of the planet Mercury is far from exact and the predicted shifting of spectral lines by a gravitational field has not been even approximately verified. The Theory therefore still stands as an hypothesis without any peremptory experimental verification.

Summary of Vice-Presidential Address—Chemistry Section

Dyes and Dyeing

By GEORGE L. COYLE, S.J.

Since 1856, when Perkin's discovery of mauve changed the whole dye industry, the coal tar colors have been developed so vastly that there are in the United States alone industries with a capital of over three billion dollars, employing over two million hands, whose operation depends on successful production of dyes, and their practical application to textile fibres. Our question is—why do dyes adhere to fabrics so as to resist exposure to light, washing, ironing, perspiration, fumes in air, etc.? Why do they stick?

The various classes of fibres may be reduced to two: vegetable and animal, and their different behavior towards dyes is due principally to their chemical composition and properties. Vegetable fibres, represented by cotton, are celloses, inert, neither acid or basic, whereas the animal fibres, represented by wool or silk, are ampho-

terio, both basic and acid, and so capable of direct union with acid or basic dyes.

Classes of dyes, *Basic*, because of amido groups, of technical importance because of their brilliancy, applied directly to wool and silk, but needing an acid mordant to fix them on cotton or linen. *Acid*, chiefly sodium salts of sulphuric or carbosylic acids or nitro compounds, used only in acid bath, gradually supplanting basic colors because of ease of application and brilliant shades, not used for cotton. *Mordant*, form colored compounds only in conjunction with metallic salts, mostly used for cotton; on wool the shades obtained are superior in fastness to all the old dyewoods except logwood: *Direct Cotton*, which dye cotton as well as wool and silks without a mordant: *Sulphur* or *Thiogene*, formed by fusing aromatic amines with sulphur and sodium sulphide, their exact composition can not be determined as they are all insoluble in water and cannot be purified by recrystallization, generally turn brighter and richer in tone on keeping, owing to oxidation: *Vat Colors*, which first must be reduced and then absorbed by the fibre where the color is developed by subsequent oxidation. *Developed Dyes* includes insoluble colors which are developed on the fibre by the interaction of substances necessary for their preparation.

Theories of Dyeing. Where such diversity of fibres and dyes exists it is not strange that there are many theories as to the nature of process by which color becomes fixed on fibre in an insoluble form. *Mechanical Theory (Hallot)*—Heat of dye bath opens pores of fibres, particles of dye enter and are deposited, on removal from bath, pores contract and dyes are retained. Some dyes have particles too large to enter pores, or if they entered, contraction on cooling was insufficient to retain—not admitted at present.

Chemical Theory (Bergmann). Dyeing an interaction between dyestuff and fibre, persists to this day and much to be said in its favor, dyestuffs must have an acid or basic character before they can act as dyes, fibres of animal origin are amphoteric so that they can unite with either an acid or base to form a salt. Cotton is devoid of acid and basic properties, hence its inertness to colors unless made basic or acid by mordants, Weber's experiments with double dyeing of same piece of wool. The great difficulty with this theory is that it fails to explain unexhausted dye bath. It remains, however, the best explanation of acid and basic dyeing.

Solution Theory (Witt). Dye is supposed to exist in fibre in a state of solution, color acquired by fibre in bath is not that of solid dye but that of solution, some fibres need mordants because solubility of dyestuff in the fibre substance is too small to permit of effective dyeing, it is less than the solubility of the dye in water. In case of mordant dyeing, the mordant is dissolved in the fibre and this solution reacts with the color to form an insoluble compound.

Absorption Theory. Holds that the surface of the fibres plays the most important part in affecting the rate and degree of absorption of a dye by a fibre and that in the case of mordants it is the mordant itself that undergoes the absorption.

Electrical Theory. Explains the attraction of dyestuffs to fibre by the difference of potential between dye and fibre.

Colloid Theory. (Has been receiving much attention in late years.) All dyeing processes are colloidal phenomena and all dyes probably exist in the colloidal form. The substances employed as mordants are all of a colloidal nature, these substances are necessary to combine with dyes of low molecular weight so as to form a more highly colloidal compound capable of being fixed on textile fibres, the process is simply a precipitation of colloidal substances on or in the fibre, applies only to cotton dyeing, as wool and silk need no mordant.

This brief review shows that all the theories have a certain amount of experimental evidence cited in support of them, but they are more or less antagonistic in character and no one of them will explain all the phenomena of textile dyeing. If one considers dyeing as a simple operation, it is necessary at present, to adopt one theory to explain the dyeing of one fibre and a different theory to explain a second type. The theories are as yet only partial explanations of certain cases of dyeing. The general theory has not yet been advanced.

Ionization Experimentally Demonstrated

By T. J. Brown, S.J.

The object of the paper was to set forth a plan for the review of the principles of Ionization after the laboratory work on the subject has been completed. Two or more experiments which the student has finished in the laboratory are reviewed by additional questions and then he is given a problem to solve.

The interaction between ammonium thiocyanate and ferric chloride was explained and principles which can be drawn from the experiment were enumerated. The same was done for the experiment showing the displacement of ionic equilibria by means of cupric bromide. The problem suggested with these two experiments required the explanation of the fact that the odor of acetic acid is observed rather than the odor of hydrochloric acid when normal solutions of sodium acetate and sodium chloride are acted upon by normal sulphuric acid. The solution of the problem was given. Other experiments and problems were indicated from which the instructor could select for the accomplishment of the plan.

"Ionic Equibrium in Basic Analysis"

By T. J. BUTLER, S.J.

This paper was a discussion of the two methods in vogue, of teaching Qualitative Analysis from the ionic viewpoint or treating the reactions simply as molecular changes. From the two explanations of a typical example (the non-precipitation of magnesium hydroxide by ammonium hydroxide in the presence of an ammonium salt), the ionic explanation was shown to be more exact and to give the student a clear grasp of the reactions involved. It was also pointed out that the ionic explanation could be more readily determined by the student left to his own resources.

The ionic explanations have the further advantage of more frequently reviewing many fundamental principles learned in General Chemistry. It also prepares the student for such explanations as that of the choice and use of indicators in Quantitative Analysis and the saponification of esters in Organic Chemistry.

The Chemical Defense of the Animal Body

By GEORGE J. SHIPLE, S.J.

The animal organism employs a series of delicate and complicated chemical reactions to protect itself against a large variety of organic poisons. It must either *oxidize* the toxic substance completely or else so modify it that the toxicity is at least diminished, and the solubility is increased to facilitate rapid elimination by way of the urine. In perhaps the majority of cases oxidation is at least partially successful. Frequently *reduction* is used as a reaction supplementary to and sometimes independent of oxidation.

Poisons of the nature of straight chain fatty acids are generally oxidized more or less completely. The same is true of especially primary alcohols, for example ethyl alcohol which is burned to CO_2 and H_2O, while methyl alcohol is oxidized to formic acid. A benzene ring as a rule prevents complete oxidation, in which case a *synthetic* type of reaction is employed. Here the body combines the foreign molecule with some other molecule or radical which it has at its disposal. This includes several of the amino acids, especially glycocoll, glutamine, cysteine and ornitnine; also sulphuric acid and glycuronic acid. Methylation, acetylation and uramino acid formation are also types of conjugation.

In our investigation work at Fordham University we showed that the human body, in detoxicating benzoic acid by combining it with glycocoll, actually synthesizes the glycocoll, obtaining the nitrogen for the purpose from that faction which would otherwise appear in the urine as urea. Likewise we proved that in detoxicating

phenylacetic acid the human body obtains the nitrogen for the glutamine from the same source scl. from the urea fraction.

The Vice-Presidential address of the Biology Section was delivered by Fr. Joseph S. Didusch, S.J. It consisted of an illustrated lecture on "Recent Discoveries of Pre-Historic Human Remains." His first topic was the Boskop Man. The completely fossilized skull of this primitive type was discovered about ten years ago at Boskop in the Transvaal. The skull is very imperfect, almost the entire face and much of the jaw being lost. It is one of the largest skulls on record, its brain capacity being estimated at 1,950 cc. In parts it is nearly three times as thick as that of the average European. Special interest attaches to the skull, inasmuch as the stunted Bushmen of today are thought to be the direct descendants of the large-brained race represented by the Boskop Man. This is one of the few, if not the only instance of degenerative descent from the primitive type.

The Man of Patagonia received but passing comment. The circumstances of the discovery which was announced on February 27th, of the current year, were such as to cast suspicion on the character of the skull as a pre-historic type, and a recent unconfirmed report has it that the supposed skull is nothing more than a piece of rock.

Of timely interest was the discussion of Homo Rhodesiensis. This remarkable skull, almost perfect, was unearthed two years ago in The Broken Hill Mine of Northern Rhodesia. Its outstanding features are the large supra-orbital ridges, the broad flat nose, the large oral cavity with a correspondingly great and well-proportioned palate, and the teeth. The molars, like in modern man, have undergone reduction and the left pre-molar shows unmistakable signs of caries. Though its place in geological time has not yet been fixed, there seems to be sufficient evidence to warrant the opinion that this human skull belongs to a race of negroes that existed in the eleventh or twelfth century of the present era. With the photographs and illustrations made by Doctor Arthur Smith Woodward, the noted English geologist, to whose keeping the skull has been confided, were presented the hitherto unpublished restorations of Dr. Adolph H. Schultz of Zurich, and James F. Didusch, working conjointly at the Carnegie Laboratory of Embryology, Johns Hopkins Medical School.

Instinct and Intelligence in the Albino Rat

(Digest)

By R. J. McWilliams, S.J.

One criterion of intelligence is the kind of social life found in a population. Among albino rats the highest form of community life is the family. A study of the behavior of the diverse members of this union shows that the family is based on instinct. The terms

"father," "mother," "brother" and "sister" as we understand them of humans are only analagously applicable to the albino parents and offspring. Family life ceases when the nursing instinct of the mother vanishes and the young become self-dependent. After that none of the members ever manifest any mutual love or respect, any recognition of relationship. The union has no life long permanence precisely because it is instinctive and not intelligent.

Moreover, if apart from social life we observe and test by positive and negative experiments the conduct of different individuals we find that in the simplest situations where every facility is given for the execution of an act requiring the minimum of intelligence or inventiveness the albino is ridiculously impotent. On the other hand these rats in certain tests do positively futile things often to their own disadvantage and act thus repeatedly and invariably.

Examples of unerring and protective instinct occur in the building of the nest, in reaction toward the natural enemy, in matters of diet, etc. While the animal is therefore not a mere reflex machine, there is not either in its behavior any evidence of intelligence. Hence evolutionists can find no confirmation for their theory in the results of a critical study of the conduct of albino rats.

Biological Radiography

D. V. McCauley, S.J.

The object of this paper is to outline but briefly some of the most interesting phases of the work accomplished during the past year by the members of the Fordham University Mendel Club under the guidance of Father G. A. Caballero, the Club's able Director. Many and various were the avenues of Biological research followed by the members of the Club, but the pursuit which particularly appealed to the writer was the radiographic picturization of the circulatory system in the albino rat and the rabbit.

The advantages obtainable from the actual photography of the circulatory system are immediately evident to all who have endeavored to study or teach the same from the diagrams and sketches found in text-books and charts. All realize only too well the enormous possibility of error in such diagrams. Of course the chance of error in depicting the larger branches is not as great as in the smaller ones. But when we come to the sketching of the minute arteries, veins and especially the capillaries, even though the artist may be guided by a wonderfully clear idea of the details, yet he invariably gives evidence of having yielded to that peculiar force we call the personal equation.

With these difficulties in view, Father Caballero conceived the notion of photographing the circulatory system and directed the

execution of this idea in a most self-sacrificing manner. Thanks to the energy of the Director and the hearty interest of the members assigned to this work it was completed early enough to have a detailed account of the technique inserted in the 1923 issue of the Mendel Club's Biological Bulletin. (N. B. This technique was outlined in the original paper but as all the members of the "Biological Section" now have copies of the Bulletin it would be useless to repeat the procedure here.)

It will not be out of place to close with a few remarks on the principal difficulties encountered. The first regarded the selection of the substance to be injected into the circulatory system with an opacity sufficient to insure a good X-ray picture. All of the ordinary media were tried but for one reason or another all failed to stand the test. Father Caballero then suggested the use of liquid metallic mercury and the value of this counsel is evident from the clear details of the pictures published in the Club's Bulletin. The next great difficulty concerned the quantity of mercury which had to be injected into the specimens. In this regard the vigilant care of the experimenters deserves special commendation because the injection of the slightest excess of the heavy mercury would certainly have led to the failure of the work, and almost imperceptible variations in the size of the specimens demanded the utmost watchfulness in the process of injection. That this care was rewarded is clear from the plates in the last issue of the Bulletin.