A. M. D. G.

American Association of Jesuit Scientists

Eastern States Division

PROCEEDINGS

of the

Sixteenth Annual Meeting

August 15, 16 and 17, 1937

Fordham University, New York, N. Y.

Published at

LOYOLA COLLEGE

BALTIMORE, MARYLAND

VOL. XV OCTOBER, 1937 NO. 1

A. M. D. G.

American Association of Jesuit Scientists

Eastern States Division

PROCEEDINGS

of the

Sixteenth Annual Meeting

August 15, 16 and 17, 1937

Fordham University, New York, N. Y.

Published at

LOYOLA COLLEGE

BALTIMORE, MARYLAND

VOL. XV OCTOBER, 1937 NO. 1

CONTENTS

SCIENCE CONVENTION, FORDHAM UNIVERSITY, 1937

Bulletin of American Association of Jesuit Scientists

EASTERN STATES DIVISION

VOL. XV OCTOBER, 1937 No. 1

BOARD OF EDITORS

PROGRAM OF SECTIONAL MEETINGS

Monday, August 16, 9:00 A.M.—3:30 P.M.

Tuesday, August 17, 9:00 A.M.

BIOLOGY SECTION

Chairman's Address.....Rev. Arthur A. Coniff, S.J.

Meniere's Syndrome.....Rev. Clarence E. Shaffrey, S.J.

Nitrogen-fixing Bacteria.....Rev. Harold L. Freatman, S.J.

Development of Embryos from Isolated Blastomeres
Rev. Thomas N. Smith, S.J.

The Discovery of Sex in Paramecium.....Rev. Charles A. Berger, S.J.

Lymphatic-Venous Communications.....Mr. John J. O'Brien, S.J.

Making the Science of Living Things Live....Mr. Joseph P. Lynch, S.J.

CHEMISTRY SECTION

Chairman's Address.....Rev. Thomas B. Butler, S.J.

Micro Technique in Undergraduate Courses

A Micro Volumetric Dry Combustion Method for Carbon
Rev. Richard B. Schmitt, S.J.

The Precision of the Micro Determination of Carbon and Hydrogen
Rev. Francis W. Power, S.J.

A Substitute for the Volhard Method in the Determination of Chlorides.....Rev. T. Joseph Brown, S.J.

Some Views on Mineralogy.....Rev. Joseph J. Sullivan, S.J.

The Titre System of Stoichiometry.....Mr. Bernard A. Fiekers, S.J.

The Chemistry of Photoengraving.....Mr. John F. Carroll, S.J.

A Cultural Course in Chemistry.....Mr. Joseph A. Martus, S.J.

Outline of Photographic Chemistry.....Mr. Leo J. Guay, S.J.

Reports on Research - - Discussion on Recent Advances

MATHEMATICS SECTION

The Solar Eclipse.....Rev. Paul A. McNally, S.J.

Some Simple Applications of "Diaphantine Equations"
Rev. Edward C. Phillips, S.J.

Inversions in a Circle, and an Application in Mirrors
Rev. Philip H. McGrath, S.J.

Statistics—Their Aim and Value.....Mr. James J. Devlin, S.J.

A Few Problems in Probability.....Mr. William F. Burns, S.J.

PHYSICS SECTION

Some Interference Experiments.....Rev. Emeran J. Kolkmeyer, S.J.

The Effect of Occluded Gas on the Rigidity of a Metal
Rev. J. Joseph Lynch, S.J.

The Neutrino and the Problem of its Objective Reality
Rev. John S. O'Conor, S.J.

Gliding and Soaring.....Rev. Leo W. Welch, S.J.

Production of High Velocity Ions for Nuclear Disintegration

A. Van der Graaf Electrostatic Geneerator
Mr. John F. Fitzgerald, S.J.

B. Magnetic Resonance Accelerator
Mr. Laurence C. Langguth, S.J.

Advantage of the Historical Approach in the Study of Physics
Mr. James W. Ring, S.J.

Hamilton's Principle as a Physical Law
Rev. Joseph T. O'Callahan, S.J.

The Place of the Photon in Modern Physical Theory
Mr. Harry W. Ball, S.J.

An Introduction to Statistical Mechanics
Mr. Joseph F. Cohalan, S.J.

Statistical Mechanics and the Concept of Temperature
Mr. Theodore A. Zegers, S.J.

Statistical Mechanics and Entropy.....Mr. Simon C. Kirsch, S.J.

Equilibrium of Ionic Assembly.....Mr. Charles E. McCauley, S.J.

Rev. John O'Conor showed high speed motion pictures taken at Massachusetts Institute of Technology.

Rev. Paul McNally gave an illustrated lecture on the expedition of the Solar Eclipse at Canton Island, South Pacific.

FIRST GENERAL SESSION

The Sixteenth Annual Meeting of the American Association of Jesuit Scientists, Eastern States Division, was held at Fordham University, New York City, on August 15, 16, and 17, 1937. The first general session was held on Sunday evening, August 15, at 9:25, Rev. Charles A. Berger, S.J., President of the Association, presiding.

After the opening prayer, Rev. Robert I. Gannon, S.J., Rector of Fordham, delivered a brief address of welcome. Fr. Berger then announced that on the following evening there would be another motion picture entertainment, together with two reels of high speed pictures borrowed by Fr. O'Conor from M. I. T. and a lantern slide lecture by Fr. McNally on his recent eclipse expedition to the island of Canton in the Pacific.

The readings of the minutes was omitted, since they had been already published in the Bulletin. Fr. Berger then named the following committees:

Committee on Nominations: Fr. John S. O'Conor, S. J.
Fr. Joseph T. O'Callahan, S. J.
Fr. Francis W. Power, S.J.

Committee on Resolutions: Fr. Clarence E. Shaffrey, S. J.
Fr. Thomas J. Smith, S.J.
Mr. Leo J. Guay, S.J.

Fr. Charles A. Berger then delivered the Presidential Address.

After the Address, Fr. Schmitt begged the Secretaries of the Sections to collect the abstracts of paper delivered in their Sections, and give them to him for publication in the Bulletin. Fr. Power, Acting Treasurer, reported a surplus of one dollar. The question of joint or separate meetings for the Physics and Mathematics Sections was raised, but referred to themselves for decision. The meeting adjourned at 9:55 P. M.

PRESIDENTIAL ADDRESS

Living Units and Biological Units

Rev. Charles A. Berger, S.J.

Each of the natural sciences is engaged in a search for fundamental units in terms of which the phenomena of the sciences may find expression. Physics and chemistry have been brought into very close relationship by the realization that the fundamental units of these two sciences are the same. The situation in biology is very different. In the present state of this science the only reasonable opinion is that the fundamental *living unit* is the cell. This statement is meaningless unless the term *living unit* be defined. In this paper a *living unit* is taken as meaning a unit that has the following properties: growth by intussusception, development, reproduction, irritability, adaptation and maintenance of coordination. These properties furnish us with a norm for distinguishing the living from the non-living, and they supply scholastic philosophy with the data from which it draws the teleological argument for intrinsic finality in the organism.

Compared with other scientific units, the cell, the *living unit*, is a system of tremendous complexity. Being a complex unit it can be resolved into its component parts. We are not justified at present in considering the parts of a cell as *living units*. In themselves, and apart from the living system which is the cell, the parts of a cell do not satisfy the criteria laid down for distinguishing the living from the non-living. Some of the parts that make up the cell may show one or other of the properties of living things in an analogous fashion, just as certain non-living systems may have one or other property that is in a crude way analogous to some property of a living system. As an example of the latter, charcoal may be made to undergo a process similar to respiration. Certain biologists have taken respiration as the definition of life; yet charcoal has neither growth, reproduction, irritability nor any of the other properties of life, and no reasonable person would say that charcoal is alive. As an example of a component part of a cell which cannot properly be called a *living unit* we may consider the gene. Genes undoubtedly possess the properties of growth and reproduction. Very probably these two properties are identified in the gene in a growth power analogous to the growth of crystals. Yet genes have no power of adaptation. A mutated gene remains in its unadapted condition indefinitely or until a new mutation takes place, nor have we any evidence that genes possess irritability or any of the other properties common to all living cells. The 'progene' and the 'gene in the free state' are still figments of the imagination of C. C. Hurst. Such speculations, without the

saving qualities of a working hypothesis, serve no useful purpose in science.

The fundamental unit common to physics and chemistry furnishes an explanation of some of the phenomena of these sciences; the *living unit*, the cell, does nothing of the sort. Not only are all the essential properties of life present in the cell, but all the problems of biology are present in a one celled organism, unexplained by the fact that it is also the unit of life.

The biologist must therefore search for smaller units than the cell. Such units are necessarily only parts of the living system and cannot at present be properly considered as *living units* according to the commonly accepted definition of life, yet they are all important in our attempt to explain how living things function. To this class of units, smaller than the cell, I am applying the non-committal term *Biological Units*. Foremost among these *biological units* are chromosomes and genes and it is of these that I wish to sum up briefly our present knowledge, and to point out the direction being taken by present day research.

Most living cells are composed of a nucleus and cytoplasm. When a cell divides the nucleus gives rise to a number of small darkly staining bodies called chromosomes. These chromosomes line up in the equator of the cell, each one divides and the daughter halves move to opposite poles of the dividing cell where they reform into resting nuclei. It was long ago established that each species of organism has a definite and specific number of chromosomes. In general this number is constant for all the cells of any individual of the species. The specific number of chromosomes in the mosquito is six, in man it is forty-eight. Chromosomes have constant differences in size and shape and there are always two of any particular size and shape in every cell. For example, the six chromosomes of the mosquito are in the form of three pairs, the pairs differ from one another in size and shape but the two members of any one pair are identical, one being maternal in origin through the egg the other being paternal through the sperm.

During the maturation process of germ cells a division occurs in which the members of each pair of chromosomes do not divide but separate as whole chromosomes and go to different cells, in this way ripe germ cells contain only one half the specific number of chromosomes and when egg and sperm meet in fertilization the number characteristic of the species is restored. Corresponding members of the maternal set of chromosomes and of the paternal set again form pairs.

Boveri in a series of now classical experiments on dispermic eggs demonstrated that there is a qualitative as well as a quantitative difference between the chromosomes of different pairs, and showed that normal development is dependent on the presence in the fertilized egg of the proper number and kind of chromosomes. Part of

the cytoplasm of an egg may be removed and normal development will still take place, but if the chromosome complement be experimentally changed in any way normal development will not follow.

It has also been found that in a great number of organisms the sexes differ in a single pair of chromosomes called sex chromosomes. For example in many species the males have a pair of like sex chromosomes called X-chromosomes, and the females have a pair of unlike sex chromosomes, one an X like that of the male, the other a very different chromosome called the Y-chromosome. After reduction the ripe eggs carry either an X-chromosome, in which case they give rise to males, or a Y-chromosome, in which case they give rise to females.

With the rediscovery of Mendel's Laws of Heredity in 1900 the science of Genetics began and has since reached a very advanced stage of development. I must pass over all the interesting evidence that exists in the voluminous literature of Genetics and come to the unit of heredity, that '*something*' in the germ cell, responsible for the inheritance of a character, which Mendel called a *factor*, and which is now known as a *Gene*. Very early in the development of genetics it was suggested that the hereditary factors in the germ cells were probably contained within the chromosomes. As experimental data accumulated a perfect parallelism was found between the behavior of hereditary characters in their transmission from generation to generation and the behavior of the chromosomes. It was found that a certain class of characters exhibited a peculiar method of inheritance and did not give the ordinary Mendelian ratios; for example in some breeding experiments it was found that a mother transmitted a hereditary peculiarity to all of her sons but to none of her daughters, while the father transmitted his peculiarity to all of his daughters but to none of his sons. It was found that this method of transmission of sex-linked characters, as they are called, was an exact parallel to the method of distribution of the sex chromosomes from parent to progeny. Furthermore in a number of cases where abnormal transmission of characters occurred, a corresponding abnormality was found in the chromosome behavior. Evidence of this kind accumulated until at present there is no reasonable doubt but that the genes, the units of heredity, are situated in the chromosomes.

Demerec ('34) has defined a gene as a minute organic particle, capable of reproduction, located in a chromosome and responsible for the transmission of a hereditary characteristic. An organism like the fruit fly has several thousand genes in each of its cells. These genes are arranged in linear order within the chromosomes. Each gene has a definite location in a definite chromosome. By methods into which I cannot enter here, it has been possible to determine the relative position of known genes in the linear series and to construct genetic maps. The hereditary characters corresponding to the genes in any one chromosome are normally inherited together. However it has been

found possible by using X-rays to break a chromosome. The broken part may become attached to another chromosome, it may be lost or it may be turned around and reunited to the chromosome from which it came, in the latter case the genes in the inverted piece are in the reverse order in the linear series. Such experimentally induced modifications of the gene system, called inversions, deficiencies and translocations, were well established genetically, and in a few favorable cases, where the piece moved was large, they could be detected cytologically by microscopic examination of the chromosomes. However up to 1935 no visible differentiations could be observed along the length of a chromosome to correspond to the linear series of different organic substances, or genes, established by genetical evidence. This deficiency in the evidence was remedied in 1935 by a most significant discovery.

The salivary glands of the larvae of certain flies including the fruit fly were found to consist of a few extremely large cells. The chromosomes in these cells are about one hundred times the length and several thousand times the volume of ordinary chromosomes. These giant chromosomes have a definite and characteristic pattern of chromatic cross bands, disks and rows of granules, separated by clear achromatic segments. Here at last was visible evidence that a chromosome was composed of different materials strung together in a linear series. The pattern formed by the different bands was found to be constant for all the cells of a given individual and for all the individuals of a given species or mutant stock. The number of bands in the chromosomes of a single cell was found to be about three thousand, agreeing closely with the estimated number of genes. It was found that in stocks in which by X-ray treatment parts of chromosomes had been turned around (inversions) or dropped out (deficiencies), corresponding inversions or deficiencies of a certain number of bands had taken place in the giant chromosomes. From data of this nature it was possible to construct chromosome maps and to compare them with the genetic maps. Stocks with inversions, translocations and deficiencies that were known genetically were studied cytologically and in this way definite series of genes in the genetic map were correlated with definite series of bands in the cytological map.

For many cytogenetic problems the discovery of the giant chromosomes had an effect equivalent to the discovery of some method by which the magnifying power of a microscope could be increased one hundred times. The data revealed by the study of these chromosomes have been of great value to genetics by furnishing an additional, visible and convincing proof of the validity of the chromosome theory of heredity, but this new knowledge has not solved the problem of the gene and of the nature of the gene. We do not know whether the bands of the giant chromosomes or the clear segments between the bands represent genes; we do not know whether a band represents a

single gene grown to a tremendous size or several hundred similar genes of normal size in an aggregate. Nor can we forget that the whole gene complex is contained in the minute chromosomes of an ordinary somatic or germ cell.

It is gradually becoming clear to the biologist that he cannot solve the problem of the nature of the gene by biological methods alone. Indeed the first beginnings of the study of the molecular structure of chromosomes with the aid of biochemistry and molecular physics is now in progress, and the first crude model of a chemical chromosome has appeared in the literature. In this model the chromosome is conceived as composed of a sequence of long protein molecules linked together in a chain by the peptide linkage. A number of such protein chains are bound up in a bundle of rings of nucleic acid, and the whole structure receives its linear differentiation by the presence of a series of different side chains, formed of amino acid residues. In this view it is the chromosome that is the primary biological unit, the genes being secondary differentiations along the length of this unit. This chemical conception of a chromosome is supported by a most meager amount of evidence and is in all respects provisional and speculatory. It is introduced here only to bring out the trend in the latest research and the conviction dawning among cytologists that further progress in the analysis of such biological units as chromosomes and genes will come only by close cooperation with biochemists and molecular physicists.

MEMBERS IN ATTENDANCE

Fr. John S. O'Conor
Emeran J. Kolkmeyer
Henry M. Brock
Thomas J. Smith
Ferdinand W. Schoberg
Joseph P. Kelly
Joseph M. Kelly
Peter J. McKone
Francis B. Dutram
Joseph P. Delaney
Edward B. Berry

Mr. Charles E. McCauley
James W. Ring
John F. Fitzgerald
James K. Connolly
Joseph F. Cohalan
Theodore A. Zegers
Regis B. Winslow
Laurence C. Langguth
William F. Burns

Fr. Joseph T. O'Callahan
John P. Smith
Edward P. Phillips
George A. O'Donnell
Frederick W. Sohon
Paul A. McNally
Philip H. McGrath
W. Burke-Gaffney

Mr. James J. Devlin
Robert F. MacDonnell
Harry W. Ball
Anthony J. Eiardi
Eric O'Connor

Fr. Joseph Assmuth
Henry C. Avery
Charles Berger
Arthur A. Coniff
Joseph S. Didusch
Harold L. Freatman
David V. McCauley
Clarence E. Shaffrey
Francis J. Dore

Mr. John J. O'Brien
Joseph P. Lynch
Richard T. Zegers

Fr. T. Joseph Brown
Thomas B. Butler
Lawrence C. Gorman
Edward S. Hauber
Arthur J. Hohman
Joseph B. Muenzen
Francis W. Power
Richard B. Schmitt
Joseph J. Sullivan

Mr. John F. Carroll
Leo J. Guay
Joseph A. Martus
Edward G. McCawley
James H. Thiry

Fr. Edward Dooley
Joseph P. Kelly
Stephen L. J. O'Beirne
Joseph T. O'Callahan
Ferdinand Schoberg
John J. Toohey

FINAL GENERAL SESSION

The Final General Session convened in the Chemistry Lecture Room on Tuesday at 11:00 A. M.

The Secretaries of the Sections reported the results of elections as follows:

Biology
Chairman Fr. Harold L. Freatman, S.J.
Secretary Mr. John J. O'Brien, S.J.

Chemistry
Chairman Mr. Edward S. Hauber, S.J.
Secretary Mr. James T. Thiry, S.J.

Mathematics
Chairman Fr. Joseph T. O'Callahan, S.J.
Secretary Mr. Charles E. McCauley, S.J.

Physics
Chairman Fr. John S. O'Conor, S.J.
Secretar Mr. Theodore A. Zegers, S.J.

Fr. Clarence E. Shaffrey, Chairman of the Committee on Resolutions, read the following resolutions for approval:

1. Be it resolved that the American Association of Jesuit Scientists (Eastern States Division) express its appreciation and gratitude to Reverend Father Rector, Father Minister and the Community of Fordham University for their cordial reception and for the gracious hospitality shown it during the meeting.

2. Be it Resolved that we express our appreciation and gratitude to the various officers of the Association for the labor entailed in making this meeting a success.

3. Be it resolved that we express our appreciation to Father Schmitt, Editor-in-Chief of the Bulletin for his patient labor in making that publication so helpful to the Association, to Father Walter Miller for his assistance in this work and to the contributors.

4. Be it resolved that the Association give expression to its sorrow at the death of Father Henry McLaughlin whose splendid record of achievement and devotion to the cause of Science as teacher of Chemistry for twenty-six years is a lasting inspiration to the members of the Association.

5. Be it resolved that Secretary of the Association be instructed to send copies of these resolutions to Reverend Father Rector, Father Minister and to Father Joseph McLaughlin.

Committee on Resolutions,

Fr. Clarence E. Shaffrey,
Fr. Thomas J. Smith,
Mr. Leo J. Guay.

The Committee on Nominations proposed Fr. O'Donnell and Fr. T. J. Smith as Nominees for President and Mr. MacDonnell and Mr. Cohalan for Secretary. Fr. George A. O'Donnell and Mr. Joseph F. Cohalan were elected to office.

Fr. O'Donnell took the chair. Fr. Schmitt bespeaks cooperation on the publication of the Bulletin, and begs good attendance at the Indianapolis meeting of the A. A. A. S., suggesting the possibility of arranging a National Convention of Jesuit Scientists to signalize the fourth centenary of the Society.

Fr. Phillips describes the efforts being made by Superiors to train young men for the Scientific works of the Society.

Fr. Power announced that the group picture of the members would be taken immediately after the meeting on the steps of Freeman Hall.

Mr. Carroll moved that a Committee be designated to consider the possibility of sponsoring at the New York World Fair a display of Jesuit Scientific achievements. The motion was seconded and carried. The Executive Council will appoint the Committee.

The motion for adjournment was made and carried at 11:30 A. M.

MEETING OF EXECUTIVE COMMITTEE

The meeting was called to order at 11.45 A. M. in Freeman Hall by Father O'Donnell.

The candidates for membership in the association were approved. Their names are listed below. Father Richard B. Schmitt was re-appointed Editor-in-Chief of the Bulletin, and Father Francis W. Power was appointed Acting Treasurer. In accordance with the resolution adopted at the general meeting a committee was appointed to investigate the possibilities of an exhibit at the New York World's Fair. Father Francis W. Power was named Chairman. The other members are Father Michael J. Ahern, Father J. E. MacElwane, Father Bernard Hubbard, Father George A. O'Donnell (ex officio).

NEW MEMBERS

Ball, Harry W., Boston College
Barrett, Joseph L., Holy Cross College
Bauer, Mark, Woodstock College.
Carroll, Philip, Fordham University.
Deeley, James J., Boston College.
Dougherty, John J., St. Peter's College.
Kirsch, Simon C., St. Joseph's College.
Knowlan, Edward H., Holy Cross College.
MacDonnell, Robert F., Boston College.
Rocks, Thomas J., Woodstock College.
Thompson, Paul E., Holy Cross College.
Winslow, R. B., Loyola College.

BIOLOGY

MENIERE'S SYNDROME

(Abstract)

Rev. Clarence E. Shaffrey, S.J.

In January 1861 Prosper Meniere delivered a paper at the Imperial Academy of Medicine, entitled "Memoir Concerning Lesions of the Internal Ear Giving Rise to the Symptoms of Cerebral Apoplectiform Congestion." This paper was important in that it was the first time that the syndrome of deafness and tinnitus accompanied by attacks of vertigo, vomiting, nystagmus, etc., had been related to the internal ear, and too, it contained the description of an autopsy as a result of which generations of medical students have been taught that these attacks were due to hemorrhage into the labyrinth.

Meniere's disease is characterized by recurring attacks of dizziness in which objects rotate. The attacks of vertigo are accompanied with vomiting, nystagmus, tinnitus and often slight but transient unconsciousness. The attack is abrupt and the patient may fall but usually has time to steady himself. The vertigo passes off in a few minutes and the patient becomes pale and nauseated, a clammy sweat breaks out on the face, and vomiting may follow. The attacks come on at irregular intervals; sometimes weeks and months may elapse between attacks, while in other cases there may be several attacks in the same day.

In our 1936 meeting we discussed the reflex paths concerned in the maintenance of equilibrium, one of those being the vestibular path. The impulse originates in the cells of the crista of the semicircular canals within the petrous portion of the temporal bone. It is passed to the peripheral branches of the vestibular nerve and is carried to the vestibular ganglion, thence by way of the central branch of the vestibular portion of the 8th cranial, or auditory nerve, it leaves the bone through the internal meatus and passes to the vestibular nuclei which are located in the medulla oblongata beneath the floor of the 4th ventricle. From these nuclei connections are made with the 3rd, 4th and 6th cranial nerves, and with the superior colliculus, all having to do with visual impulses, and also with the ventral gray column of the spinal cord from which impulses pass to the musculature of the body, and too with the cerebellum which is a center for equilibratory impulses.

While the true pathology of Meniere's disease is not known, it is certain that certain abnormal conditions affecting the vestibular nerve in its course cause the attacks, and that these attacks subside after the nerve has been cut. Dr. William E. Dandy of Johns Hopkins has operated upon one hundred and seventy cases, eight of which were reviewed in the paper read before the biology section at this year's meeting. To relieve the condition the nerve is severed, and necessarily the attacks cease since the impulses causing the distress can no longer reach the central nervous system. For such cases as those reported by Dandy it would seem that nothing but surgical interference could reach the cause, in some cases aneurysm of an artery, or pressure of a tumor, or strangulation of the nerve by an artery, or an artery passing between the 7th and 8th nerves.

However a new concept has been developed in regard to the pathogenesis of the disease, due to the studies of Foldes who saw a similarity between these attacks and those of epilepsy, eclampsia, angina pectoris, etc., which seem to be due to a retention of water and minerals that is local and temporary, the attacks disappearing when the retained liquids disappear from the respective organs. For the treatment of this group of diseases an antiretentional therapy has been developed which employs a diet based on the fact that all food elements, such as proteins, carbohydrtaes, fats and water, minerals and vitamins influence the water and mineral metabolism. The author has treated four cases of Meniere's disease by an antiretentional diet to which were added phenobarbitol, quinine sulphate and the extract of nux vomica. There has been a complete disappearance of attacks effected in a few days, with no relapses observed so far. He attributed the results to the concerted action of the diet and the quinine sulphate, and not to the quinine sulphate alone.

Fursenburg became familiar with the fact that dizziness was a common symptom of patients suffering with cardiovascular renal disease, and he thought that the water balance might be at fault. He searched the literature and found Danish articles describing the successful treatment of Meniere's syndrome by dehydration and a low salt diet in one hundred and fifty cases of a series of one hundred and fifty seven. He then undertook to determine whether the electrolytes or the water in which they were excreted was the important factor. They concluded that sodium was the factor and that the removal of all sodium from the diet, and the addition of ammonium chloride would prevent the storage of sodium.

Fourteen cases were treated by Furstenburg, Lashmet and Lathrop, and it was found that elimination of sodium from the body gave complete relief, while the taking of sodium in any form precipitated an attack. In reporting his work Furstenburg outlined the medication and diet. The medication consisted in giving 3 gms. of

ammonium chloride at each meal. The diet is outlined in the Journal of the A.M.A. Vol. 108, No. 14, p. 1159.

A similar study has been made by Dr. Madeline R. Brown of Boston, and the Furstenburg diet and medication employed in twelve cases which are reported in the above number of the Journal, and in every case it was found that while the patient was faithful to the strict diet and medication the attacks did not occur, but when he became careless and took sodium salts in one form or another, as effervescent salts, baking powder, sodium bicarbonate, etc., the attacks returned, and by a return to the strict regime these patients were again free from attacks.

What are we to judge as to the pathology of Meniere's disease from the work of Dandy, Furstenburg and Brown? Certainly the conditions found by Dandy in his cases must be regarded as the unequivocal cause of the attacks which ceased after the vestibular portion of the eighth nerve had been severed. It will be interesting to watch for reports of cases in which the Furstenburg treatment has failed to bring relief. We are watching one case which seems to be failing to respond to the treatment, and it will be interesting to learn the findings if the case goes to operation.

NITROGEN FIXING BACTERIA

(Abstract)

Rev. Harold L. Freatman, S.J.

Nitrogen in gaseous or elementary form is of interest in bacteriology, because of its inert character, constituting it an excellent environment in studies of Anaerobiosis. The mechanism of its fixation is not well understood. Perhaps atmospheric nitrogen is forced to function as a hydrogen-acceptor. It is possible that atmospheric nitrogen itself must be activated. Two types of bacteria fix nitrogen, they are non-symbiotic and symbiotic, aerobic and anaerobic. Gautier and Drouin (1888-1892) and Bertholet 1893 believed fixation was the result of oxidation through the agency of protoplasm in a fashion analogous to fixation of N by oxidation of organic matter in moist air. Winogradsky 1894 worked with anaerobic Clostridium pasteurianum and concluded that nascent H by action of living protoplasm was caused to combine with the N to form ammonia. Beijerinck 1901 with aerobic forms as Azotobacter which do not produce free H, emphasized the inadequacy of the preceding. He believed fixation to be due to associated organisms which produce a soluble non-protein

N-Cpd., which is absorbed by Azotobacter. This contention was later disproved and Azotobacter was shown to fix atmospheric N independently and proof of a soluble N-Cpd was not forthcoming. The N-Cpds of the media found by Krzemieniewski 1908 and by Lipman 1904-5, were probably the results of excretion. Heinze 1904 believed salts of carbaminic acid were first formed and then amino-acids and proteins produced from these. He also suggested the possibility of the union of acetylene and N to form HCN—(omit potassium cyanide). Stoklasa 1907-08 concluded the first product to be HCN (omit potassium cyanide), which is synthesized promptly to protein.

Lipman suggested the first determinable product to be an amino-acid. Loew and Asa 1909 concluded it to be ammonium nitrite resulting from the reaction—N_2plus $2H_2O$ equals NH_4NO_2: But the answer is still forthcoming as to what are the first compounds produced in N fixation. It is probable that the assumption of the initial formation of ammonia or at least of some cpd. of N with H, is valid. Why? Because N-fixing bacteria are included, both the obligate aerobes and the obligate anaerobes. It is entirely practicable to catalyze the union of N and H in the laboratory (Haber process). Kostytschew and Ryskaltschuk 1926 found ammonia produced in cultures of Azotobacter. Myerhoff and Burk 1928 could not demonstrate it and believed the results of the previous due to excretion. Baumgärtel 1924, says "perhaps ammonia developed in accordance with the equation:— N_2 plus $3H_2O$ equals $2NH_3$ plus $3O_2$, as a first assimilation product. It would seem more probable either that the activated H is free H or H of organic cpds. It is interesting to note that Bacteria that fix nitrogen are included in two extremes of Oxygen relationships. Azotobacter and Rhizobrium are aerobic and produce relatively complete dissimilation of carbon cpds. forming CO_2 and H_2O as end products of carbohydrate utilization. Clostridium pasteurianum is at the other extreme, an obligate anaerobic form which produces butyric acid, H, and other intermediate products of carbon dissimilation together with CO_2. Burk 1927, urged the N-fixation may be a process which yields energy to the cell instead of using up energy from the exidation of carbon compounds. Meyerhoff 1925, found syntheses in the cell to be closely bound up with respiration and concluded that energy was obtained at the expense of carbohydrates. Winogradsky placed organisms capable of oxidizing ammonia to nitrous acid in genera Nitrisomonas and Nitrosococcus, but now they all are commonly grouped in Nitrosomonas. Nitrobacter which oxidizes nitrous acid to nitric acid is very refractory and difficult to study.

Apparently the first definite proof of the fixation of atmosphereic N by aerobic Bacteria was furnished by Beijerinck 1901. He described a new genus of Bacteria, Azotobacter, and named several species A. Chroococcum and A. Agile. At first he concluded the N to be

fixed as nitric acid, but later abandoned this idea. Later he and Van Delden concluded that Azotobacter fixed N only, when growing with other organisms especially Radiobacter. However, Gerlach and Vogel 1902, Lipman 1903, found Azotobacter itself able to fix nitrogen. A considerable number of other species have been described by other investigators, Beijerinck describing a more efficient species in nitrogen-fixation.

THE DISCOVERY OF SEX IN PARAMECIUM

(Abstract)

REV. CHARLES A. BERGER, S.J.

Paramecium is perhaps the best known and most studied of all one-celled animals, yet it was only in the past year that sex differentiation was discovered in this organism by Dr. T. M. Sonneborn of Johns Hopkins University.

If clones are started from exconjugants or exendomictics, all the members of such a clone are either of sex 1 or sex 2. This holds true as long as reproduction is by fission only. Members of a clone never conjugate among themselves but conjugate immediately when mixed with individuals from a clone of the other sex. The macronucleus seems to be responsible for this functional sex differentiation.

LYMPHATIC-VENOUS COMMUNICATIONS

(Abstract)

JOHN J. O'BRIEN, S.J.

It is universally recognized that the two main lymphatic ducts, the right lymphatic duct and the thoracic duct, enter the venous system at the angulus venosus or jugulo-subclavian angle. Are there additional, permanent lymphatic-venous connections in mammals, outside of these two main ducts?

The observation of Bartels and his co-workers (1), of Baum (2), Silvester (3), Job (4), Polonskaja (5), Teshima Goshu (6), Mahorner and co-workers (7), Williamson and co-workers (8), Rienhoff (9), of Chauke and co-workers (10) and others in this field, lead to the following conclusions.

1. The question of lymph-venous connections, outside of the main stems, has been substantiated in favor of the existence of these connections.
2. The denial of the existence of such connections rests on unconvincing arguments and evidence.
3. The results of the observations on the thyroid and thymus lymphatics are in a state of conflict.
4. The physiological significance of these additional connections has not been determined.

The work is supplemented by eight plates of drawings of the reported additional lymphatic-venous communications.

BIBLIOGRAPHY

1. Bartels, Paul
   Das Lymphgefässsystem. Jena. 1909.
2. Baum, Hermann
   Können Lymphgefässe direkt in Venen Einmünden? Anat. Anz. 39. 1911.
   a. Bolk, Göppert, Kallius, Lubosch
      Handbuch der vergleichenden Anatomie der Wirbeltiere. Band VI. Berlin. 1933.
   b. Helmann
      Möllendorffs Hdb. mikr. Anat. d. Mensch. VI. Berlin. 1930.
3. Silvester
   On the Presence of Permanent Communications between the Lymphatic and the Venous System at the Level of the Renal Veins in the Adult South American Monkeys. Am. J. Anat, vol. 12. 1912.
4. Job, Thesle
   The Adult Anatomy of the Lymphatic System in the Common Rat (Epimys norvegicus). Am. J. Anat. v. 9, no. 6. 1915.
   Lymphatico-venous communications in the common rat and their significance. Am. J. Anat. v. 24. 1918.
5. Polonskaja
   Ueber den Zusammenhang der Venen mit den Lymphgefässen der regio lumbalis bei menschlichen Neugeborenen. Anat. Anz. 78, 310-315. 1934.
6. Teshima Goshu
   Lymphatico-venöse Kommunikation zwischen dem Truncus lumbalis und der Vena Cava inferior beim Menschen. (Aus. d. Anat. Inst. zu Kyoto).
   Beiträge zur Anatomie des Lymphgefässystems der Wirbeltiere und das Menschen (Japaner). Fol. Anat. Jap. 13. 251-288. 1935.
7. Mahorner, Caylor, Schlotthauer, Pemberton.

Observations on the lymphatic connections of the thyroid glands in man. Anat. Rec. 36 (4) : 1927.

8. Williamson, Scott, Pearse
The anatomy (comparative and embryological) of the special thyroid system, showing its relation to the thymus, with some physiological and clinical considerations therefrom. Brit. J. Surg. 17. 1930.
9. Reinhoff, W.
The lymphatic vessels of the thyroid gland in the dog and in man. Arch. Surg. 23 (5) 783-804. 1931.
10. Chauke, Whitehead, Parker
Is there a closed lymphatic system connecting the thyroid and thymus gland. Surg. Gynecol. & Obstetr. 54 (6) 1932.

CHEMISTRY

MICRO TECHNIQUE IN UNDERGRADUATE COURSES

(Abstract)

REV. THOMAS B. BUTLER, S. J.

The history of micro chemistry was briefly reviewed. The inspiring works of Emich, Behrens, Feigl, Pregl, Fyleman and Bennedetti-Pichler have so developed micro technique and created such universal interest that attempts are now being made to introduce it into elementary undergraduate courses under the name of semimicro technique. If true micro technique be taken to mean the analysis of a quantity of material too small to be used by the standard micro methods, the semimicro analysis, as developed by Engelder is truly MACRO and can be said to be micro only inasmuch as spot reactions are used for confirmatory tests.

The advantages and difficulties of using semimicro technique were discussed and the probable effects on the future teaching of analytic chemistry were reviewed. The problems which confront the semimicro analyst are for the most part the same as those which confront the macro analyst such as pH control at the beginning of the Cu cation group, the satisfactory separation of the third group cations, etc. These problems were briefly reviewed. Independent of economy of materials, abolition of H_2S odors, and general refinement of technique, semimicro technique affords an opportunity for the expansion and more up-to-date revision of Qualitative Analytical courses. Many physico-chemical phenomena are encountered which need a few words of explanation in class, e. g. capillarity, flourescence, and color absorption. Since only 0.1 to 0.3 mg. ions are taken for analysis, W, Ti, U, Se, V, Zr, and perhaps even Au and Pt might well be included in the list of the so-called "more common ions". The speaker expressed his belief that these changes in elementary courses will be made in the near future when semimicro technique becomes the standard.

A VOLUMETRIC DRY COMBUSTION METHOD FOR CARBON

(Abstract)

Rev. Richard B. Schmitt, S. J.

In organic chemical research a simpler micro combustion method than the gravimetric precision method used at present, even if it allows the determination of carbon only, would be an extremely desirable research tool. Very often in such researches a high precision method is not required and the experimentor merely wants to know whether his work proceeded in the expected direction. A result, giving figures within rather liberal limits and of carbon only, would readily indicate whether the expenditure of further labor in form of purification procedures for the final precision analysis is warranted and justified. On the other hand, a result deviating grossly from the expected will indicate to the research worker the fallacy of his work and efforts otherwise wasted for purification and the wholly unwanted compound, can thus be directed into more constructive channels.

As a first step in devising a simple combustion method, it was thought to substitute the gravimetric determination of the carbon dioxide by a volumetric one, using the absorption and titration conditions as devised for small amounts of carbon dioxide by Lindner (Zeitschr. F. Anal. Chem., *72*, 143 (1927), and as applied by Lieb and Krainick in their wet combustion method (Mikrochemie, 9, 367, (1931). For the actual combustion the apparatus and procedure as described by Niederl and Roth (Ind. Eng. Chem., Anal. Ed., 6, 272, (1934) is used. To the capillary outlet of the combustion tube, which is filled according to Pregl, an anhydrone tube, provided with a stop-cock, is attached. To this anhydrone tube, for the absorption of water, a glass fritter gas inlet tube is attached and extends almost to the bottom of the titration flask. The capillary outlets of both the N/10 barium hydroxide solution and the N/20 hydrochloric acid solution extend through a four hole rubber stopper into the same titration vessel. An ascarite tube attached to the usual Mariotte flask provides for the outlet. The charging, the precipitation, as well as the final titration is carried out in the same titration vessel in a closed system, and hence atmospheric influences are totally eliminated. The actual combustion is performed in the usual manner, retaining all the advantageous features inherent to the micro combustion method such as: universal filling, complete pressure, and volume control.

The advantage of the method is the independence in regard to unfavorable climatic conditions, elimination of the absorption tubes with consequent saving of time and labor; its disadvantage is that only carbon can be determined.

THE PRECISION OF MICRO DETERMINATION OF CARBON AND HYDROGEN

(Abstract)

Rev. Francis W. Power, S. J.

A co-operative study is being made of the precision of the micro determination of carbon and hydrogen. This is done 1) by sending out pure compounds to about 20 experienced micro analysts in this country and abroad and getting their reports on duplicate determinations and 2) by studying the results of many pure compounds analyzed by two or three experienced analysts.

As far as the study has progressed it would seem that the standard deviation for the carbon analysis is about 3.5 parts per thousand and for hydrogen about 26 parts per thousand.

A thorough statistical analysis of the results obtained will be presented later in order to answer many of the practical questions that occur to workers in organic analysis.

SOME THOUGHTS ON MINERALOGY

(Abstract)

Rev. Joseph J. Sullivan, S. J.

In doing some work on Mineralogy this Summer, it occurred to the writer to list the minerals found in the States comprising the two Provinces. In all 90 minerals were found, containing thirty-four of the ninty-two elements, and representing every group in the Periodic System except that of the rare gases. Most of these minerals contained oxygen; half of them contained silicon; more than a third, aluminum; about a fourth, calcium and iron. The other elements were present in smaller quantities. Mimeographed copies of this list were distributed at the Meeting.

THE TITRE SYSTEM IN STOICHIOMETRY

(Abstract)

Bernard A. Fiekers, S. J.

The advantages and disadvantages of the Titre System relative to the Normality System were discussed, and the conclusion drawn that it is much more useful to employ the Titre System.

The advantages discussed were: (1) More intelligible to the student, (2) Concentrations are expressed in physical units which are readily converted into any desired units, (3) No ambiguity in concentration terms. (4) Uniform application to neutralization, precipitation, and oxidation-reduction analyses, (5) A standard procedure for all analytical stoichiometry, (6) Rapid application to any problem at hand by a single conversion of physical units of concentration to chemical equivalence with the aid of the equivalent factor, (7) Elimination of the "per accidens correct" answer on the part of the student, (8) Accords with the trend of the modern teacher to expose his mathematics by use of a factor when possible, (9) It is a bit and brace system for the student, the tire system being the brace into which the factor selected from the literature is inserted.

The disadvantages discussed were: (1) To anyone unfamiliar with the Titre System, a label marked T-0.0036 HCl is meaningless, (2) Inapplicability to certain problems on reactions of Standard Solutions with mixtures of unknowns; (3) In the Normality System, normality equals the reciprocal volume ($N=V^{-1}$) whereas in the Titre System the titre equals mass times reciprocal volume ($T=MV^{-1}$).

THE CHEMISTRY OF PHOTOENGRAVING

(Abstract)

JOHN F. CARROLL, S. J.

A proficient photo-engraver must likewise be a master photographer and a good chemist. For photo-engraving requires a knowledge of lens and cameras and exposures, of preparation, development and intensification of the wet plate, of the various ways in which a sheet of planished zinc or copper may be sensitized so as to furnish a metallic positive. The zinc half-tone is usually prepared by etching the zinc with nitric acid. The copper half-tone is frequently the result of applying as a mordant ferric chloride or is prepared by employing the copper positive as the anode in an electrolytic circuit, using ammonium and sodium chlorides as the electrolyte.

A CULTURAL COURSE IN CHEMISTRY

(Abstract)

JOSEPH A. MARTUS, S. J.

Present day chemical educators insist upon cultural course for one year chemistry students. Need of such a course arises from

type of student who is not preparing for further courses in chemistry. Objectives of course include a knowledge of scientific method, of applications to industrial and social life, of theories and laws of broader aspects of chemistry as pointing to a designer, preparation for cosmology. Contents of course combine a development of laws and theory with knowledge of influence of chemistry on daily life.

OUTLINE IN PHOTOCHEMISTRY

(Abstract)

LEO J. GUAY, S.J.

Under the following heads this paper attempted to explain briefly the chemistry of the various processes involved in the production of ordinary photographic images.

I. The Photographic Emulsion
   1. Minute crystalline silver halide grains suspended in gelatin.
   2. Gelatin and its influence on the sensitivity of the silver halides.
   3. Dyes and their influence on the color range of sensitivity.

II. The Exposure, or the Formation of the Latent Image
   1. Action of light on the silver halide grains—loosening of electrons from the halides and discharging of neighboring silver ions to form free silver atoms.
   2. The aggregation of the free silver atoms into minute nuclei which constitutes the latent image.

III. Development, or the Process of Converting the Latent Image into a Visible Image.
   A. Process.
      1. Immersion Phase.
      2. Reduction Phase—reduction of silver halide to silver.
      3. Precipitation Phase.
   B. The Developing Solution.
      1. Photographic Developers.
      2. Alkali and its function.
      3. Sulphite and its function.
      4. Soluble bromide and its function.

IV. Fixation, the Process of Making the Visible Image Permanent
   1. Removal of unaltered silver halide by converting into a soluble salt and dissolving.
   2. Fixing agents, potassium cyanide and sodium thiosulphate.
   3. Washing.

MATHEMATICS

DIOPHANTINE EQUATIONS

Rev. Edward C. Phillips, S.J.

This article will be printed in the following number of the Bulletin.

INVERSION IN A CIRCLE, AND AN APPLICATION IN MIRRORS

(Abstract)

Rev. Philip H. McGrath, S.J.

The meaning of inversion was explained and it was shown how in any curved mirror the positions of object and image are inverse to each other with respect to a circle whose center is at the principal focus and whose radius is equal to the focal length. Therefore the product of the distances of the object and the image from the focus is equal to the square of the focal length. ($o_F\, i_F = f^2$). Various theorems in inversion were pointed out and were explained with diagrams.

STATISTICS—THEIR AIM AND SCOPE

(Abstract)

Mr. James J. Devlin, S.J.

This paper consisted of a discussion of the five types of central tendency, the measures of dispersion, the normal curve, together with skewness and kurtosis.

PHYSICS

THE NEUTRINO AND THE PROBLEM OF ITS OBJECTIVE REALITY

(Abstract)

Rev. John S. O'Connor, S. J.

A brief review of the history of the discovery and study of the disintegration electrons from radioactive bodies was given.

From the energy balance (using the maximum of the beta spectra) of the branching products from Thorium C and from the calorimetric measurements of the total energy of disintegration of Radium E the difficulty of establishing even statistical conservation of energy for the beta decay processes which involve a continuous spectrum was made apparent. Pauli's suggestion of the neutrino as a means of accounting for the energy discrepancy was discussed in terms of the Fermi and "K.U." theories of beta distintegration and an outline of the experimental work done by the author at M.I.T. indicated at least a partial confirmation of the Konopinski-Uhlenbeck theory.

THE PRODUCTION OF HIGH VELOCITY IONS FOR NUCLEAR DISINTEGRATION

(Abstract)

Laurence C. Langguth, S.J.

B. The Magnetic Resonance Accelerator

The use of the high voltages described in the previous paper is subject to serious disadvantages. In an effort to avoid them, an apparatus effecting the multiple acceleration of ions by comparatively low voltages has been developed. The ions traverse spiral paths within semicircular electrodes, charged to oscillating potentials and set between the jaws of an electromagnet. Velocities equivalent to a potential drop of five million volts have been attained, with good focussing and satisfactory beam intensity. The apparatus proved to be reliable over a period of several years and is useful for nuclear disintegration.

NON-VANISHING JACOBIANS

(Abstract)

ANTHONY J. EIARDI, S.J.

Goursat's "Mathematical Analysis", vol. I, p. 45 sq., has a general theorem concerning a system of n equations, $F_i(x_1, x_2, \ldots, x_p; u_1, u_2, \ldots, u_n)=0$; $(i=1, 2 \ldots \ldots, n,)$ between the $n+p$ variables $u_1, u_2, \ldots, u_n; x_1, x_2, \ldots, x_p$, which can be solved for the u's provided certain conditions are fulfilled. When these n equations are satisfied for the values $x_1=x_1^o, \ldots, x_p=x_p^o, u_1=u_1^o, \ldots, u_n=u_n^o$; when the functions F_i are continuous and possess first partial derivatives which are continuous, in the neighborhood of this system of values; and, finally, when the determinant does not vanish for $x_i=x_i^o$, $u_k=u_k^o$ $(i=1, 2, \ldots, p; k=1, 2, \ldots, n)$: then there exists one and only one system of continuous functions which satisfy the original n equations.

In our discussion we did not prove this theorem for the general case. We demonstrated it for a system of three equations with six variables and applied the theorem to this system of equations

$$ax + fy + ez + au + fv + ew = o = F_1$$
$$fx + by + dz + fu + bv + dw = o = F_2$$
$$ex + dy + cz + eu + dv + cw = o = F_3$$

between the six variables u, v, w; x, y, z. Since all the conditions of the general theorem are fulfilled in this particular case, and, especially, the determinant or the Jacobian $J\left(\frac{F_1, F_2, F_3}{u_1\ v_1\ w}\right)$ does not vanish, a system of continuous functions $u = -x$, $v = -y$, $w = -z$ results.

THE PLACE OF THE PHOTON IN MODERN PHYSICAL THEORY

(Abstract)

HARRY W. BALL, S.J.

The wave theory of light is useful in describing many phenomena of light transmission, but fails to account for the photoemissive effect. To explain how a given number of electrons are emitted from an illuminated surface with their measured speed requires a new theory. The quantum theory fills the need. Photons, tiny bundles of energy, stream forth from the light source, and are absorbed by

the atoms in the illuminated surface. Then every atom "hit" emits an electron, and the electrons immediately come forth at their measured velocity, because the atom instantaneously gains all the energy of the photon.

Other modern problems have been solved by the quantum theory. Such is the problem arising from the variation of specific heat with temperature. The structure of the atom and the lines in the hydrogen spectrum have been explained by applying the quantum theory.

The wave theory and the quantum theory are complementary, each explaining what the other leaves unexplained about light and its propagation. The whole truth will perhaps find expression in some third theory, which will unite the partial truths of these two in an all-embracing explanation of the facts.

AN INTRODUCTION TO STATISTICAL MECHANICS

(Abstract)

JOSEPH F. COHALAN, S.J.

The present day meaning of the term Statistical Mechanics was explained, thus giving some indication of the distinction between statistical thermodynamics and the modern kinetic theory of matter.

The statistical formula most in use, that for the probability of any state

$$P_s = \left(\frac{I}{S}\right)^N g_1^{N_1} g_2^{N_2} g_3^{N_3} \cdots g_r^{N_r} \frac{N!}{N_1!\, N_2!\, N_3! \cdots N_r!}$$

was derived, and the main distinctions between the four types of statistics were indicated. These types of statistics are:

1) Boltzmann—Gibbs
2) Planck
3) Bose and Einstein
4) Fermi and Dirac

STATISTICAL MECHANICS AND THE CONCEPT OF TEMPERATURE

(Abstract)

THEODORE A. ZEGERS, S.J.

This paper carried the discussion of statistical mechanics from the equation for the probability of a given state:

$$\Gamma_s = \left(\frac{I}{S}\right)^n \quad \frac{N!}{N_I!} \frac{}{N_{II}!}$$

down to the equation for the energy per mole of a gas:

$$E = e^{\frac{\mu}{\theta}} \Sigma e_{nl} \cdot \frac{-\varepsilon_n}{\theta}$$

Applying this to the experiment in which two specimens of a gas are brought into contact so nothing but energy goes from one to the other; that is to say an experiment in which the two are brought to the same temperature, other conditions remaining constant, the θ of the above equation is identified as the temperature.

EQUILIBRIUM OF IONIC ASSEMBLIES

(Abstract)

CHARLES E. MCCAULEY, S.J.

The disposable constant μ of the distribution function of classical statistical mechanics $\exp\left(-\frac{\mu}{KT}\right) = \frac{1}{N}\sum_r \exp\left(-\frac{\varepsilon_r}{KT}\right)$ was proved to be identical with the second thermodynamic potential, the Free Energy, and a method was outlined for calculating μ for any single assemblage of ions or atoms. By combining equations for the various phases, a single equation could be obtained, expressing the conditions of equilibrium in terms of the fundamental constants of the system.

As an example, Saha's ionization formula was deduced, and a few applications made to astrophysics and the occlusion of gas by metals.

SCIENCE AND PHILOSOPHY

SOME PHILOSOPHICAL ASPECTS OF MULTI-DIMENSIONAL SPACE

(Abstract)

ROBERT B. MACDONNELL, S.J.

The paper discussed the philosophical possibility of having a multi-dimensional physical world. That argument against this possibility, which assumes such a space frame would be a real entity, is discarded as specious. Positive 'Proofs' of multi-dimensional space were evaluated, with the conclusion that its existence can not be proven even with probability, but at the same time it can not be rejected as metaphysically repugnant. The related question of Non-Euclidean geometry was treated. Here again neither internal nor external contradictions can be found.

In the discussion after the reading of the paper, Father O'Donnell mentioned the fact that an interpretation of the single integral leads to two dimensions, an interpretation of the double integral leads to three dimensions, of the triple integral to four dimensions, etc.

Father Sohon said that any contradiction between postulates and conclusions in non-Euclidean geometry would lead to a similar contradiction in Euclidean geometry. He also suggested that it may be possible to deduce from the chemical reactions of isomers an argument against the actual existence of multi-dimensional space.

HAMILTON'S PRINCIPLE AS A PHYSICAL LAW

(Abstract)

JOSEPH T. O'CALLAHAN, S.J.

For the scientist a physical law is some constant relation between phenomena. One must distinguish between the objective law, and the enunciation of the law whether expressed in statement from or by an equation. The complete enunciation includes both.

Hamilton's principle as a most general law of mechanics, was taken as an example, and its derivation outlined. This equation does not answer the questions, 'why' or 'how', but merely gives the quantitative measure of the relation.

Philosophy goes further, it tries to tell why such a constant relation exists. Taking all the data offered by the scientist it argues to a "determination" and an "inclinatio". Hence, though the scientific law is explicitly factual, Philosophy logically insists that inherent necessity is implied. Philosophy has the further task of deciding how these various inclinations are distinct from one another, and from the substance in which they inhere.

MEMBERSHIP OF ASSOCIATION

1937 - 1938

GENERAL OFFICERS

President

Rev. George A. O'Donnell, S.J., Boston College, Boston, Mass.

Secretary

Joseph F. Cohalan, S.J., Georgetown University, Washington, D. C.

Executive Council

Very Rev. Joseph A. Murphy, S.J., 501 E. Fordham Road, New York, N. Y.
Very Rev. James H. Dolan, S.J., Boston College, Chestnut Hill, Mass.
Rev. Harold L. Freatman, St. Joseph's College, Philadelphia, Pa.
Rev. Edward S. Hauber, Fordham University, New York, N. Y.
Rev. Joseph P. Kelly, Weston College, Weston, Mass.
Rev. Joseph T. O'Callahan, Weston College, Weston, Mass.
Rev. John S. O'Conor, Woodstock College, Woodstock, Md.
Joseph F. Cohalan, Georgetown University, Washington, D. C.

Editors of the Bulletin

Editor-in-Chief: Rev. Richard B. Schmitt, S. J.
Loyola College, 4501 N. Charles St., Baltimore, Md.
Associate Editors: Rev. Harold L. Freatman, S.J.
Rev. Edward S. Hauber, S.J.
Rev. Joseph P. Kelly, S.J.
Rev. Joseph T. O'Callahan, S.J.
Rev. John S. O'Conor, S.J.

Correspondents

Chicago Province: Rev. Victor C. Stechschulte, S.J.
Xavier University, Cincinnati, Ohio.
Missouri Province: Rev. Paul L. Carroll, S.J.
Marquette University, Milwaukee, Wisc.
New Orleans Province: Rev. George A. Francis, S.J.
Loyola University, New Orleans, La.
California Province: Carroll M. O'Sullivan, S.J.
Alma College, Alma, Calif.
Oregon Province: Rev. Leo J. Yeats, S.J.
Gonzaga University, Spokane, Wash.

SECTION OFFICERS AND MEMBERS

Note: The figures at the end of each entry indicate the year the member was admitted to the Association.

BIOLOGY SECTION

Officers

Chairman, Rev. Harold L. Freatman, St. Joseph's College.
Secretary, John J. O'Brien, Woodstock College.

Members

Anable, Rev. Edmund A., 1931, St. Andrew-on-Hudson.
Assmuth, Rev. Joseph, 1930, Fordham University.
Avery, Rev. Henry C., 1923.
Bauer, Mark, 1937, Woodstock College.
Berger, Rev. Charles A., 1926, Woodstock College.
Brown, J. Robert, 1934, Woodstock College.
Busam, Rev. Joseph F., 1923, Holy Cross College.
Callahan, Rev. Edward A., 1932, St. Robert's Hall.
Carroll, Philip B., 1937, Fordham University.
Coniff, Rev. Arthur A., 1928, Georgetown University.
Cronin, Thomas C., 1935, Canisius High School.
Deeley, James J., 1937, Boston College.
Didusch, Rev. Joseph S., 1922, Loyola College.
Dore, Rev. Francis J., 1922, Boston College.
Dougherty, John J., 1937, St. Peter's College.
Dubois, Rev. Evan C., 1924, Boston College.
Ewing, Rev. J. Franklin, 1933, Vienna, Austria.
Flood, Francis X., 1932, Woodstock College.
Freatman, Rev. Harold L., 1924, St. Joseph's College.
Frisch, Rev. John A., 1925, Canisius College.
Gookin, Rev. Vincent A., 1923, Baghdad, Iraq.
Harley, Rev. James L., 1927, Gonzaga High School.
Harrington, Gerard A., 1935, Weston College.
Hennessey, Gerald J., 1934, Weston College.
Keegan, Rev. Joseph G., 1930, St. Andra, Lavanttal, Karnten, Austria.
Kirchgessner, Rev. George J., 1925, Cagayan, Oriental Misamis, P.I.
Knowlan, Edward H., 1937, Holy Cross College.
Lynch, Joseph P., 1932, Woodstock College.
MacCormack, Rev. Anthony J., 1925, Weston College.
McCauley, Rev. David V., 1923, Georgetown University.
Murray, Joseph W., 1934, St. Joseph's College.
O'Brien, John J., 1934, Woodstock College.

Pfeiffer, Rev. Harold A., 1931, Woodstock College.
Reardon, Rev. Francis X., 1928, Ateneo de Manila.
Shaffrey, Rev. Clarence E., 1923, St. Joseph's College.
Smith, Rev. Thomas N., Woodstock College.
Stoffel, Joseph I., 1933, Woodstock College.
Walsh, Michael P., 1935, Fordham University.
Walter, Rev. William G., 1930, St. Peter's High School.
Wilkie, Francis X., 1934, Weston College.
Zegers, Richard T., 1934, Fordham University.

CHEMISTRY SECTION

Officers

Chairman, Rev. Edward S. Hauber, Fordham University.
Secretary, James H. Thiry, Gonzaga High School.

Members

Ahern, Rev. Michael J., 1922, Weston College.
Barrett, Joseph L., 1937, Holy Cross College.
Blatchford, Rev. John A., 1923, Winchester Park.
Brophy, Thomas A., 1932, Woodstock College.
Brosnan, Rev. John A., 1923, Woodstock College.
Brown, Rev. Thomas J., 1932, St. Joseph's College.
Butler, Rev. Thomas B., 1922, Weston College.
Carroll, Rev. Anthony G., 1929, Boston College.
Carroll, John F., 1933, Woodstock College.
Cheney, Edmund K., 1935, Baghdad, Iraq.
Cummings, William V., 1932, Woodstock College.
Doino, Rev. Francis D., 1930, Novaliches, P. I.
Ecker, Rev. Anthony I., 1931, 14 Cobb St., Boston, Mass.
Fiekers, Bernard A., 1933, Ignatiuskolleg, Valkenburg.
Gisel, Rev. Eugene A., 1925, Ateneo de Manila.
Gorman, Rev. Lawerence C., 1926, Loyola College.
Guay, Leo J., 1935, Weston College.
Haggerty, Gerard A., 1934, St. Joseph's High School.
Hauber, Rev. Edward S., 1929, Fordham University.
Hohman, Rev. Arthur J., 1922, St. Peter's College.
Hufnagel, Alvin A., 1933, Innsbruck, Tyrol, Austria.
Hutchinson, Gerald F., 1933, Weston College.
Kelleher, Rev. William L., 1932, Weston College.
Landrey, Rev. Gerald M., 1930, Holy Cross College.
Langguth, Rev. Aloysius B., 1924, Boston College.
Martus, Joseph A., 1934, Weston College.
McCawley, Edward G., 1934, Brooklyn Preparatory.

McCollough, Rev. Henry B., 1925, Ateneo de Manila.
McGuinn, Rev. Albert F., 1932, St. Robert's Hall.
Molloy, Rev. Joseph J., 1929, St. Ignatius, Inisfada.
Moynihan, Rev. Joseph C., 1930, 45 Cooper St., Boston, Mass.
Muenzen, Rev. Joseph B., 1923, Fordham University.
O'Byrne, Rev. Francis M., 1934, St. Andrew-on-Hudson.
Pallace, James J., 1934, Woodstock College.
Power, Rev. Francis W., 1924, Fordham University.
Quevedo, Anthony J., 1933, Woodstock College.
Schmitt, Rev. Richard B., 1922, Loyola College.
Sullivan, Rev. Joseph J., 1923, Holy Cross College.
Thiry, James H., 1935, Gonzaga High School.

MATHEMATICS SECTION

Officers

Chairman, Rev. Joseph T. O'Callahan, Weston College.
Secretary, Charles E. McCauley, Georgetown University.

Members

Ball, Harry W., 1937, Boston College.
Barry, Rev. Thomas D., 1926, Weston College.
Berry, Rev. Edward B., 1922, Georgetown Preparatory School.
Brock, Rev. Lawerence M., 1930, Campion Hall, No. Andover, Mass.
Carey, Philip A., 1934, Woodstock College.
Cohalan, Joseph F., 1934, Georgetown University.
Connolly, James K., 1933, Weston College.
Cusick, Rev. William H., 1928, Holy Cross College.
Dawson, Rev. James F., 1922, St. Joseph's College.
Depperman, Rev. Charles E., 1923, Manila Observatory.
Donohue, Joseph J., 1934, Weston College.
Doucette, Rev. Bernard F., 1925, Manila Observatory.
Duross, Rev. Thomas A., 1932, St. Joseph's High School.
Dooley, Joseph C., 1934, Weston College.
Dutram, Rev. Francis B., 1931, Holy Cross College.
Eiardi, Anthony J., 1935, Boston College.
Fey, Rev. Leo F., 1926, Fordham University.
Gallagher, Eugene B., 1934, Woodstock College.
George, Severin E., 1933, Woodstock College.
Gipprich, Rev. John L., 1922, Chaptico, Md.
Hennessey, James J., 1933, Ateneo de Manila.
Judah, Rev. Sidney J., 1934, St. Robert's Hall.
Kane, Rev. Matthew W., 1933, St. Andrew-on-Hudson.
Kelley, Rev. Joseph M., 1922, Loyola High School.

Love, Rev. Thomas J., 1923, Loyola College.
MacDonnell, Robert F., 1937, Boston College.
McCauley, Charles E., 1934, Georgetown University.
McCormick, Rev. James T., 1923, Weston College.
McDevitt, Edward L., 1933, Woodstock College.
McGrath, Rev. Philip H., 1932, Woodstock College.
McNally, Rev. Paul A., 1923, Georgetown University.
Merrick, Rev. Joseph P., 1923, Baghdad, Iraq.
Morgan, Carol H., 1933, Weston College.
Muldoon, Leo R., 1934, Weston College.
Murray, Rev. Joseph L., 1928, St. Robert's Hall.
Nuttall, Rev. Edmund J., 1925, Manila Observatory.
O'Brien, Kevin J., 1933, Woodstock College.
O'Callahan, Rev. Joseph T., 1929, Weston College.
O'Dennell, Rev. George A., 1923, Boston College.
Phillips, Rev. Edward C., 1922, Woodstock College.
Quigley, Rev. Thomas H., 1925, Loyola High School.
Repetti, Rev. William C., 1922, Manila Observatory.
Rocks, Thomas J., 1937, Woodstock College.
Rooney, Albert T., 1933, Woodstock College.
Schweder, William H., 1933, Woodstock College.
Smith, Rev. John P., 1923, St. Peter's College.
Sheehan, Rev. William D., 1928, Baghdad, Iraq.
Sohon, Rev. Frederick W., 1924, Georgetown University.
Sweeney, Rev. Joseph J., 1930, St. Robert's Hall.
Wessling, Rev. Henry J., 1923, Boston College High School.

THE PHILOSOPHY OF SCIENCE

Ahern, Rev. Michael J., 1922, Weston College.
Cotter, Rev. Anthony C., 1936, Weston College.
Coyne, Rev. Francis J., 1926, Boston College.
Dooley, Rev. Edward, 1936, Canisius College.
Eiardi, Anthony J., 1935, Boston College.
Glose, Rev. Joseph C., 1930, Woodstock College.
Kelly, Rev. Joseph P., 1931, Weston College.
Lynch, Rev. J. Joseph, 1925, Fordham University.
Murphy, Rev. John J., 1936, Boston College.
O'Beirne, Rev. Stephen L. J., 1936, Woodstock College.
O'Callahan, Rev. Joseph T., 1929, Weston College.
O'Conor, Rev. John S., 1928, Woodstock College.
Ring, James W., 1935, Boston College.
Schoberg, Rev. Ferdinand W., 1936, Georgetown University.
Sohon, Rev. Frederick W., 1924, Georgetown University.
Tobin, Rev. John A., 1923, Boston College.
Toohey, Rev. John J., 1934, Georgetown University.

PHYSICS SECTION

Officers

Chairman, Rev. John S. O'Conor, Woodstock College.
Secretary, Theodore A. Zegers, Fordham University.

Members

Berry, Rev. Edward B., 1922, Georgetown Preparatory.
Brock, Rev. Henry M., 1922, Weston College.
Brock, Rev. Lawrence M., 1930, Campion Hall, No. Andover, Mass.
Burns, William F., 1935, Weston College.
Cohalan, Joseph F., 1934, Georgetown University.
Connolly, James K., 1933, Weston College.
Crawford, Rev. William R., 1924, Shadowbrook, West Stockbridge, Mass.
Daley, Rev. Joseph J., 1930, Manresa Institute, South Norwalk, Conn.
Dawson, Rev. James F., 1923, St. Joseph's College.
Delaney, Rev. John P., 1923, Canisius College.
Depperman, Rev. Charles E., 1923, Manila Observatory.
Devlin, James J., 1934, Weston College.
Doherty, Rev. Joseph G., 1930, Cambridge University, England.
Dutram, Rev. Francis B., 1931, Holy Cross College.
Fitzgerald, John F., 1935, Holy Cross College.
Frohnhoefer, Rev. Frederick R., 1926, St. Francis Xavier High School.
George, Severin E., 1933, Woodstock College.
Guicheteau, Armand J., 1932, Woodstock College.
Hearn, Rev. Joseph R., 1925, St. Ignatius', Inisfada.
Hennessey, James J., 1933, Ateneo de Manila.
Heyden, Rev. Francis J., 1931, Woodstock College.
Kirsch, Simon C., 1937, St. Joseph's College.
Kolkmeyer, Rev. Emeran J., 1922, Georgetown University.
Langguth, Laurence C., 1935, Weston College.
Linehan, Rev. Daniel, 1931, Weston College.
Love, Rev. Thomas J., 1923, Loyola College.
Lynch, Rev. J. Joseph, 1925, Fordham University.
McDevitt, Edward L., 1933, Woodstock College.
McKone, Rev. Peter J., 1931, St. Robert's Hall.
McNally, Rev. Herbert P., 1922, Canisius High School.
Merrick, Rev. Joseph P., 1923, Baghdad, Iraq.
Miller, Rev. Walter J., 1931, Woodstock College.
Morgan, Carol H., 1933, Weston College.
Murray, Rev. Joseph L., 1928, St. Robert's Hall.
Nuttall, Rev. Edmund J., 1925, Manila Observatory.
O'Brien, Kevin J., 1933, Woodstock College.
O'Callahan, Rev. Joseph T., 1929, Weston College.

O'Conor, Rev. John S., 1928, Woodstock College.
Phalen, Robert P., 1935, Boston College High School.
Phillips, Rev. Edward C., 1922, Woodstock College.
Quigley, Rev. Thomas H., 1925, Loyola High School.
Rafferty, Rev. Patrick, 1922, Loyola High School.
Reardon, Timothy P., 1935, Woodstock College.
Reed, Francis W., 1932, Woodstock College.
Ring, James W., 1935, Boston College.
Schweder, William H., 1933, Woodstock College.
Sheehan, Rev. William D., 1928, Baghdad, Iraq.
Smith, Rev. John P., 1923, St. Peter's College.
Smith, Rev. Thomas J., 1925, Weston College.
Thoman, A. Robert, 1933, St. Ignatius', 84th St., New York, N. Y.
Tobin, Rev. John A., 1923, Boston College.
Tynan, Rev. John W., 1926, Fordham University.
Walsh, Rev. Lincoln J., 1931, Woodstock College.
Welch, Rev. Leo W., 1932, 14 Cobb St., Boston, Mass.
Winslow, Regis B., 1937, Loyola College.
Zegers, Theodore A., 1934, Fordham University.

N.B. If there are any errors or omissions in this list please notify the Editor.