A. M. D. G.

BULLETIN

of the

American Association of Jesuit Scientists

Eastern States Division

(*Founded* 1922)

PROCEEDINGS

OF THE

TWENTY-SECOND ANNUAL MEETING

September 2, 3, 4, 1947

Georgetown University, Washington, D. C.

Published at

CHEVERUS HIGH SCHOOL

Portland, Maine

Vol. XXV SEPTEMBER, 1947 No. 1

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Bulletin of American Association of Jesuit Scientists

EASTERN STATES DIVISION

VOL. XXV SEPTEMBER, 1947 No. 1

Convention of the American Association of Jesuit Scientists (Eastern States Division), held at Georgetown University, Washington, D. C., September 2, 3, 4, 1947.

Program

Twenty Second Annual Meeting

OF THE

AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

EASTERN STATES DIVISION

As guests of Georgetown University

September 2, 3, 4, 1947.

GENERAL MEETINGS

Tuesday, September 2, 1947, at 7:45 P.M., in Copley Lounge.

ADDRESS OF WELCOME Very Rev. Lawrence C. Gorman, S.T.

READING OF THE MINUTES

APPOINTMENT OF COMMITTEES

NEW BUSINESS

PRESIDENTIAL ADDRESS Rev. Frederick W. Sohoni, S.J.
Save the Pieces.

PHILOSOUHICAL PAPER Rev. Joseph P. Kelly, S.J.
Philosophical Trends in Modern Science.

Wednesday, September 3, 1947, at 24 hours G.C.T.
the members will be guests of Georgetown College Observatory.

Thursday, September 4, 1947, at 10 A.M. in Copley Lounge.

REPORTS OF SECRETARIES

REPORTS OF COMMITTEES

ELECTIONS OF OFFICERS

This group picture of the 22nd annual convention was taken by Mr. William Walsh of Georgetown University. Those who wish copies may obtain the mfor one dollar by writing Mr. Walsh at Georgetown or communicating with the EDITOR.

SECTIONAL MEETINGS

Sectional meetings begin Wednesday, September 3, at 9 A.M. and continue as each section may decide.

Biology Section

The Role of Physics in the Premedical Program.
Rev. Michael P. Walsh, S.J.

A Discussion of the Courses in the A.B. Premedical and B.S. Biology Program.
Rev. Joseph W. Murray, S.J.

Should the Course in College Physiology be Mammalian or General?
Mr. Walter J. Janer, S.J.

A Method of Staining by the Feulgen Reaction Before Sectioning.
Rev. Joseph E. Schuh, S.J.

Some Recent Advances in Vertebrate Embryology.
Mr. William D. Sullivan, S.J.

Chemistry Section

CHAIRMAN'S ADDRESS—The Chemistry Major Curriculum.
Rev. James J. Pallace

The High School Chemistry Club.
Rev. Alvin A. Hufnagel

Ateneo Chemistry Department during the Japanese Occupation.
Rev. Eugene A. Gisel

The Mechanism of Adsorption Indicators in Volumetric Analysis.
Mr. George L. Drury, S.J.

Chromatographic Adsorption Analysis.
Mr. Eugene C. Brissette, S.J.

Mathematics Section

DISCUSSION TOPIC—Coordination of Mathematics in Jesuit High Schools and Colleges.

CHAIRMAN'S INTRODUCTION Rev. Timothy Reardon, S.J.

Content and Arrangement of High School Curriculum.
Mr. Edward Messemer, S.J.

BORDERLINE SUBJECTS
Trigonometry, Analytical Geometry, Advanced Algebra.
Rev. Gerard Costello, S.J.

The College Curriculum—For Boston College.
Rev. Anthony Eiardi, S.J.—Rev. George O'Donnell, S.J.

The College Curriculum—For Georgetown University.
Rev. William Schweder, S.J.

Introduction of Abstract Algebra into the Jesuit College Curriculum
Mr. Frederick Koehler, S.J.

Physics Section

The Radial Dependence of the Tensor Force in the Deuteron.
Mr. William Guindon, S.J.

Permeability Tuning in Radio.
Rev. John A. Tobin, S.J.

Directional Antennas.
Mr. Charles G. Crowley, S.J.

Free Neutrons in the Atmsophere.
Mr. John Kinnier, S.J.

Stabilizing the Output of the D.C. Power Supplier.
Mr. Charles F. Turner, S.J.

Secretary's Report

FIRST GENERAL SESSION

The twenty-second Annual Meeting of the American Association of Jesuit Scientists (Eastern States Division) was held at Georgetown University, Washington, D.C., on September 2, 3 and 4, 1947. The first general session was called to order at 7:45 P.M. on September 2 by the Reverend Frederick W. Sohon, President of the Association, in the lounge of Copley Hall. The Very Reverend Lawrence C. Gorman, President of Georgetown University, extended a cordial welcome to the members of the Association.

The Secretary's Report of the minutes of the meeting held at Fordham University in 1946 was accepted as printed in the September 1946 issue of the Jesuit Science Bulletin.

Fr. Sohon then appointed the following committees:

COMMITTEE ON NOMINATIONS:
Rev. John S. O'Conor (*Chairman*)
Rev. John A. Frisch
Mr. William G. Guindon

COMMITTEE ON RESOLUTIONS:
Rev. George A. O'Donnell, (*Chairman*)
Rev. Eugene A. Gisel
Rev. John F. Caulfield

The Reverend President then announced that the meeting the following evening would take place at the Georgetown University Astronomical Observatory if a sufficient number of members were interested. The response was unanimously in favor of the proposal and the time was set for 8:30 the following evening.

The Reverend Joseph S. Didusch then took the chair, and the Presidential Address entitled "Save the Pieces" was delivered by Fr. Sohon. At the conclusion of the address Fr. Didusch expressed appreciation to Fr. Sohon in the name of the Association.

There followed a philosophical paper entitled "Scientific Ventures in Philosophy" by the Reverend Joseph P. Kelly. This paper was followed by a discussion from the floor.

The time for the meetings of the various sections was set for 9:15 the following morning. The motion for adjournment having been made, seconded and carried by the assembly, the meeting was adjourned at 9:00 P.M.

THE SECOND GENERAL SESSION

On the evening of September 3 the members of the Association attended "open house" at the Georgetown Astronomical Observatory in response to the invitation extended by the Reverend Francis J. Heyden, director of the observatory. The Reverend Paul A. McNally demonstrated the results of the Georgetown Observatory expedition to Brazil conducted this year under the auspices of the National Geographic Society. The facilities of the Observatory combined with Georgetown's hospitality made the evening both enjoyable and profitable.

THE FINAL GENERAL SESSION

The final general session was called to order by Father Sohon at 10:00 A.M. on September 4 in the lounge of Copley Hall. The results of the elections in the various sectional meetings was announced as follows:

BIOLOGY—*Chairman*, Rev. Anthony J. MacCormack
Secretary, Mr. William D. Sullivan

CHEMISTRY—*Chairman*, Rev. James J. Pallace
Secretary, Mr. Clarence C. Schubert

MATHEMATICS—*Chairman*, Rev. Anthony J. Eiardi
Secretary, Mr. Frederick C. Koehler

PHYSICS—*Chairman*, Rev. Thomas J. Smith
Secretary, Mr. John F. Devane

The Reverend George A. O'Donnell read the report of the Committee on Resolutions:

1. Be it resolved that the American Association of Jesuit Scientists (Eastern States Division) express its sincere gratitude to the Reverend Father Rector, Father Minister and the Community of Georgetown University for their cordial reception and gracious hospitality shown to the Association during its meeting.
2. Be it resolved that we express our heartfelt thanks to the various officers of the Association for their labor of love in making this meeting a success.
3. Be it resolved that we express our deep appreciation to Fr. Hutchinson, Editor-in-Chief of the Bulletin for his painstaking work in producing a bulletin that is at the same time an assistance and a credit to the Association.
4. Be it resolved that the Association express its profound regrets at the death of Father Clarence E. Shaffrey, S.J. Not only his outstanding achievements in behalf of our Association as one of our Founding Fathers and his continued interest in all its activities, but also his inspirational teaching especially in the field of premedical studies leave with us, his associates, a cherished memory of a vivid personality and a priestly scientist. R.I.P.

5. Be it resolved that the Association express its sorrow at the death of Father Thomas H. Quigley, S.J. whose magnificent record of devotion to the Association and its works is a source of inspiration to us all and a memorial more lasting than bronze to the Association itself. R.I.P.
6. Be it resolved that the Secretary of the Association be instructed to send a copy of these resolutions to the Reverend Father Rector and Father Minister of Georgetown University.

GEORGE A. O'DONNELL, S.J., *Chairman*
EUGENE A. GISEL, S.J.
JOHN F. CAULFIELD, S.J.
COMMITTEE ON RESOLUTIONS.

These resolutions were accepted as read with the further recommendation that the resolutions on Father Quigley and Father Shaffrey be sent to their respective Rectors.

The Committee on Nominations proposed the following names to the Association:

For President: FATHER BERNARD A. FIEKERS
FATHER JOHN A. TOBIN
FATHER JOSEPH F. BUSAM

For Secretary: MR. CHARLES G. CROWLEY
MR. JOHN H. KINNIER

Father Fiekers and Mr. Crowley were elected.

Father Gerald F. Hutchinson suggested that the twenty-fifth anniversary of the founding of the Association occurring this year should be observed by a commemorative issue of the Bulletin. The form of the issue should be decided by the members themselves, one suggestion being that it should consist of biographies and works of outstanding Jesuit Scientists both past and present. Father Hutchinson also reported that an index of the Bulletin since its inception was to be prepared this year. The task has already been begun by Father Fiekers. The request was made for copies of the rare early issues, and Fr. Joseph P. Kelly answered that the complete file was available in the Weston College library.

The meeting was adjourned at 11:00 A.M.

Respectfully submitted,
CHARLES G. CROWLEY, S.J.

Presidential Address

SAVE THE PIECES

Rev. Frederick W. Sohon, S.J.

It has undoubtedly happened to most of you at some time or other that you found that you could not understand the proof or the explanation that you found in your text. Naturally you consulted other texts, or other people, and finally found something that satisfied you or at least patched up something that would get you by the lecture that you had to give. But did you write it out? Opportunity was knocking at your door. When you encounter a boulder in your rut, you are being given a chance to get out of the rut. A less severe jolt that can stimulate you to an equal activity if you are really trying to be a good teacher, is to come up against an exposition that is logically excellent and to the point, but somehow or other does not go over well in class. In this case something is usually missing in the background of the students and this deficiency has to be made good by means of a supplementary explanation. But did you ever write out this supplementary explanation? I might mention in passing that a more difficult situation arises when there is an obstacle present in the mind of the student. Then the problem becomes one of discovering what his false notion is—if you can make any sense out of his confused and incoherent remarks—and of making a note of anticipating the misconception the next time you teach the course. But perhaps the note you made was only mental.

The emotional obstacle is perhaps the hardest one to remove. I refer to the fright that seizes upon the student at the appearance of a strange symbol, the automatic closing of his mind to all explanation when the student hears a new word. If you have taught mathematics you have encountered this situation. You expect to have to repeat definitions many times without the student paying heed to the essential words. The solution of this difficulty may require a complete change in the order of presentation. It was a problem for you that you may or may not have solved. In any case you will wish that you had written it out.

It is extremely valuable to write out the difficulties that you are unable to solve. While writing out the difficulty it is better to resist the temptation to continue to try to solve it. Try to make the difficulty as tough as possible, and get down on paper as fast as you can the arguments that disturb your mind. You may not succeed in

doing this. What is likely to happen is that the solution of the difficulty will come like a blinding flash while you are half through writing, and from then on you wonder what in the name of common sense you were thinking of. If you had gotten down your confused ideas on paper before you forgot them you would have some guide in understanding the difficulties of others. Try to get the difficulty down in writing before the solution dawns upon you. And I need not add that when you have the difficulty clearly expressed in writing; you have taken a long step toward its solution.

I have thus far been stressing the importance of making full notes (that will have a clear meaning even when they shall have grown cold) of some of the things that occur to every teacher who is trying to teach his class well. In the beginning you keep very close to your text, but difficulties such as I have just mentioned keep coming in on you. The notes that you have taken are a written record of your experience. The second time that you teach the subject you will be less timid in inserting illustrations and examples that have appealed to you, and in paraphrasing the printed word. Your best notes will not always be made in preparation for class. It is surprising what ideas you get when you are up in front of a class. You should also write down these inspirations after class, but before you have forgotten them. If you have made a careful set of notes as you taught your class last time, an important secondary effect will come about. The methods that you have devised for handling the tough spots will suggest an alternative method of handling other topics, topics that you were able to get by with in a mediocre, run of the mill fashion. What is happening is that you are replacing the person of the author of the text book as the actual teacher of your class. If you have not made notes such as I have been describing, you only save from your previous experience what you happen to remember. You might even simply become another reproduction of your text book in a more perishable form.

I have heard it said that a teacher is at his best the third time that he teaches a subject. You can see how it is possible for this to be true. If the teacher has been working as I have just indicated, he has now a polished set of notes with which he is completely satisfied. And if he judges that he already knows all that he needs to know about his subject, he has made a rut for himself that he can occupy for the rest of his life. But if he has attained intellectual maturity (so that he has learned to find things out for himself), he will sooner or later make the discovery that the investigation of an unsolved problem is far more fascinating than anything that he has dreamed of. In a spirit of adventure he will attack questions whose solution is not necessary for his ordinary class matter. If he writes these matters out and saves them, he can later weave them into his class notes—not with the intention of taking them up in his ordinary class—but

with the pretext that they might be useful for stimulating some student who is a little brighter than the average. I say that this reason is only a pretext, because the matter logically belongs there and needs no justification. His previous drudgery has begun to bear fruit. His set of notes has begun to grow past the stage in which it can be called a mere set of notes. He has now a book in the making.

This is the way books are written. You do not say "I am now going to write a book", and then sit down at a typewriter and pound the thing out like I am pounding out this paper. A book grows. It is the product of your intellectual activity over a number of years. Piece by piece you work out the details, with no intention in the beginning of writing a book at all. But if you have saved the pieces you have the makings of a book. and the assembly of the pieces you will find so entertaining that you will not mind the drudgery too much.

It is hard to imagine a man who is master of his subject not getting ideas of his own from time to time in the way in which I have described. If he, if you, would only write them out and save them, he and you would have the pieces needed for a book. The process of adolescence from a set of notes to a book produces growing pains. You are not sure whether this is exactly what is needed, or if it should be modified in some way. You need advice. You seek it. But no one is willing to read a word of what you have written. No one will give you any real help. You get discouraged and quit. But I tell you that all authors go through this, and what others have done you can do. You can get an audience for the best pieces of your labor by writing separate papers to be read at scientific meetings or to be published in scientific journals. And in passing I should like to ask all of you please not to destroy the buds of scholarship in our organization by refusing to read one another's manuscripts when you are requested to do it.

Finally there is the possibility of a joint authorship. Here both authors have been saving up separately their own pieces, but each feels that there are certain phases of the projected work that the other is more interested in, if not more competent to handle. Each can stimulate the other and assist with criticism. Joint authorship should be the easiest way to produce a book—a great book. I have often wondered why such cooperation is so rare in our society.

I know that few of you are planning to write a book at present. As I said, one does not in the beginning plan to write a book. But all of you have in your fingers the pieces out of which a book is made. These pieces with a little labor on your part will make scientific papers. These same pieces in course of time will grow into a book which will represent part of the ten talents that you return for the five talents that were given you. I beg you to save the pieces.

Science and Philosophy

TRENDS IN THE PHILOSOPHY OF SCIENCE

(Abstract)

JOSEPH P. KELLY, S.J.

The past twenty-five years have seen a noticeable increase in the literature dealing with the philosophical aspects of modern science and scientific discovery. Some authors have treated the broader relations of science and philosophy, e.g., Jeans and Eddington, while others have given attention to particular problems. Generally the initiative has come from inquiring minds of the scientists or from questions arising out of discovery and theory. Among the writers we might name: Planck, Einstein, Heisenberg, DeBroglie, Meyerson, Jeans, Compton, Poincare and many others.

Among the special topics under discussion we find: the problem of the origin of the world suggested by the law of Entropy and the laws of Radioactive Disintegration; the simultaneous presence of the wave and corpuscle aspects in the activity of material bodies seems to point to a fundamental dualism in matter; the Principle of Least Time from Snell's law indicates to Planck a teleological note in the interpretation of natural phenomena. We are all familiar with the widespread discussions on the Principle of Causality and the Principle of Indeterminism.

To conclude from these trends that the scientific world is turning philosophical would be rather premature. It does indicate that the mentality of the scientists has undergone a definite change with regard to philosophical interpretation of the universe. The very limitation of scientific knowledge compels them to seek a broader field, a metaphysics to supplement the meaning of cosmic problems derived experimental investigation and interpretation.

Biology

THE ROLE OF PHYSICS IN THE PREMEDICAL PROGRAM

(Abstract)

MICHEAL P. WALSH, S.J.

The relation of physics to medicine and biology was discussed in detail. The importance of the course in general physics to future physicians was particularly emphasized. Surveys conducted by various science groups, the attitude of medical associations, and a review of the literature on this subject were presented.

It was concluded that the general course in physics for premedical students should be as complete and thorough as that generally given to the pre-engineering and physics majors. The views of various authorities on a second year course in physics for premedical students were also discussed. Physics teachers can make the course more interesting and prove its usefulness to the premedical student by introducing at least occasionally applications of principles to the biological processes.

An organization that has been conducting a number of discussions on this subject and the entire premedical program is the Alpha Epsilon Delta Fraternity. The work, purpose, and journal of this fraternity for premedical students were mentioned.

This paper will appear in its entirety in a later issue of the Bulletin.

* * * *

FR. MURRAY proposed the following difficulty: "How would you be able to fit in the requisite mathematical courses that would furnish a background for the physics and physical chemistry when the student already carries 3 years of biology, 4 years of chemistry, and a year of physics." Furthermore at some of our colleges physics is taught to biology students in their first year when they do not have sufficient mathematics behind them.

FR. WALSH agreed that this is the major difficulty facing the physics teachers. But the mathematics necessary for the course in general physics should be taught in the high school. But where there is a conflict between a course like math and biology, he advised less biology and more math., physics or chemistry for the B.S. Biologists.

FR. WILKIE remarked that he has often heard it said that Medical Schools prefer the A.B. men to the B.S. men but would like to see some

authoritative endorsements of this opinion. He also wondered how biology could be cut down and physics courses increased. In answer it was pointed out that many premedical courses include courses that form a regular part of the curriculum of first year medical school. These courses might be dropped with no loss to the biology majors. Such courses are osteology and histological technique. Furthermore such courses take for granted that all biology majors are slated for medical school. What about the two-thirds who are biology majors and who for one reason or another do not enter medical schools. The most recent issue of the Scalpel treats very comprehensively the question of a liberal arts versus science training of premedical students. It is believed that in the near future a definite response will come from medical school officials and that in general they will insist more on a background of the humanities and philosophy in their applicants. At a recent meeting of medical school deans and premedical advisers it was very clear that all the deans who spoke emphasized the need for more cultural courses and less science in the premedical program.

Fr. Frisch inquired about the premedical fraternity—Alpha Epsilon Delta and asked about the necessary qualifications for opening a chapter. It was suggested that Fr. Walsh inquire further into this subject and publish the details in a later issue of the Bulletin. The relative merits of this fraternity and the Tri-Beta were discussed.

A DISCUSSION OF THE COURSES IN THE A.B. PREMEDICAL AND B.S. BIOLOGY PROGRAMS

(Abstract)

Joseph W. Murray, S.J.

The course in biology in many of our colleges in the past have been arranged primarily for future medical students. Courses in osteology, mammalian anatomy, and human embryology have been given. It was recommended that we concentrate on the pure biological sciences and emphasize the biological rather than the medical aspects of the science. The course in comparative anatomy was discussed in detail. It was suggested that in this course the embryology of the animals be given together with the morphology of the adult systems. In the discussion that followed it was observed that in most of our colleges the same courses are given. The arrangement of the first year course and the course in comparative anatomy vary very much in the different colleges.

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In reply to Fr. Murray's observation that our biology courses are aimed mainly at premedical students and in answer to his plea for enlightenment as to the requirements in biology courses at other colleges, the heads of departments outlined their various set-ups.

Fr. Frisch has no separate course for premeds. Four years of biology are broken down as follows:

First Year—Botany and Invertebrate Zool.
Second Year—Histology and Embryology
Third Year—Comparative Anatomy
Fourth Year—General Physiology and Genetics

Fr. Didush outlined the courses given at Loyola. General biology, comparative anatomy, histology and embryology are required for premedical students. Biochemistry which is required by some of the local medical schools prohibits the addition of other biology courses. The courses are not specifically designed for medical or dental students.

Fr. Wilkie outlined the courses given at Boston College. In first year biology one quarter is devoted to botany; one quarter is given to invertebrate zoology and the second semester is entirely devoted to vertebrate zoology. Histology and embryology, mammalian anatomy, genetics, general physiology and bacteriology are the other courses.

Fr. Busam has similar courses at Holy Cross for biology majors. Mammalian anatomy and histological technique are two other courses he offers.

Fr. Conniff and Fr. Murray outlined the courses given at Georgetown and St. Peter's.

Fr. Murray asked Fr. Frisch to elucidate on his method of teaching comparative anatomy. The essentials of vertebrate embryology must be given with each system. Fr. Frisch takes all the representative forms pari passu, i.e. treating each system in every animal at the same time. In this way he insisted one studies COMPARATIVE anatomy.

SHOULD THE COLLEGE COURSE IN PHYSIOLOGY BE GENERAL OR MAMMALIAN PHYSIOLOGY?

(Abstract)

Walker M. Janer, S.J.

In Physiology the tendency has been to stress the study of vertebrate or mammalian tissues. In spite of all the advances of Mammalian Physiology, the ultimate mechanisms underlying the activity of mammalian cells are but little understood.

A General Physiology must be a Cellular Physiology because the cell is the unit of living matter and one must begin with fundamentals before specialization can be managed with intelligent success.

Such a course has many advantages. It gives the student a Physio-

logical point of view i.e. a functional point of view where he thinks of the organism as doing something. It makes Biology an exact science and not merely an observational science for now the explanations of dynamic activities are sought in terms of the Physical, Chemical and Mathematical laws involved. The course is a real introduction to research and can serve as a stimulus by its content and method both in lecture and laboratory. It gives the student an opportunity to apply all the science, i.e. Chemistry, Physics and Mathematics, which he has learned. Acquaintance with scientific reading begins and curiosity the findings and methods of others is stirred.

The course will finally open up the field of Biology as a life's work and break away from the tradition that the Biology courses are only for Pre-Medical students.

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The question of a suitable laboratory manual was raised. MR. JANER uses a combination of Heilbrunn's, Mast's and Zoethout's manuals. It was suggested that there is no suitable one available and that each teacher would have to draw up his own from various published manuals.

MR. TUCKER remarked that Heilbrunn's notes are hardly adequate for a course.

FR. DEELEY remarked that Heilbrunn's textbook was difficult for college students and that it would be necessary to add to it from other sources.

FR. FRISCH thought that with a good reference library the course of general physiology as outlined by Heilbrunn serves as a wonderful introduction to writing biological reports and stimulates the seeds of research. It affords the students an opportunity to study living *things qua living*. It is certainly one course that would stimulate some students to embrace biological research as a future career.

A METHOD OF STAINING BY THE FEULGEN REACTION BEFORE SECTIONING

JOSEPH E. SCHUH, S.J.

Feulgen and Rossenbeck (1924) developed the *leuco-basic fuchsin* method (Feulgen reaction) as a microchemical test for thymonucleic acid in chromosomes. It is based on Schiff's aldehyde reaction. The aldehyde groups of the nucleic acid are liberated by mild hydrolysis in normal hydrochloric acid at 60° C. The resulting chemical reaction between the liberated aldehydes and the leuco-basic fuchsin gives a violet coloration to the chromosomes. (Darlington and LaCour).

This method has been used by cytologists as a chromosome stain in sections and smears of both plant and animal materials. It was also

used to stain *in toto* small organs of insects. The author has used it to stain onion root tips before embedding and sectioning with favorable results. It is recommended as a rapid method of preparing root tip slides. The schedule for onion root tips follows:

1. Cut the tips from vigorously growing roots. (4-5 mm. in length when roots are about 10 mm. long.)
2. Fix in "Craf" fixative (a modification of Navashin's), 12-24 hours.
3. Wash in water, 10 min.
4. Hyrolyse in N-HCl[1] at 60° C., 15 min.
   N.B.—This is the critical step. The time here varies for different materials and after different fixatives. With fixatives containing chromic acid maximum staining follows hydrolysis from 6 to 30 minutes; after non-chromic acid fixatives, from 4 to 8 minutes. (Darlington and LaCour).
5. Distilled water, 5 min.
6. Stain in leuco-basic fuchsin, 10 min.
7. SO_2 water, three changes, 5 min.
8. Alcohol series, 35%, 50%, 70%, 85%, 95%, 10 min. each.
9. Absolute alcohol, 10 min.
10. Absolute alcohol—Xylol (3:1), 5 min.
    (1:1), 5 min.
    (1:3), 5 min.
11. Xylol, 5 min.
12. Xylol—paraffin mixture (1:1), 1 hour.
13. Paraffin, 1 hour.
14. Embed in fresh paraffin.
15. Section at 10 micra and mount on slides. Leave to dry.
16. Xylol, 5 to 10 minutes, to dissolve paraffin ribbon.
17. Mount in Balsam.
    (If counterstain is desired.)
17. Absolute alcohol, 5 min.
18. Counterstain with Fast Green in 95% alcohol.
19. Dip in clear 95% alcohol to remove excess Fast Green.
20. Mount in Euparal or Diaphane.

FORMULAE

1. "Craf" fixative.

Solution A.	Chromic anhydride	1 gm.
	Glacial acetic acid	7 cc.
	Distilled water	92 cc.
Solution B.	Formalin	30 cc.
	Distilled water	70 cc.

Mix equal parts of A and B immediately before using.

2. Leuco-basic fuchsin (Feulgen stain).

Dissolve 1 gm. basic fuchsin by pouring 200 cc. of distilled water over it. Shake well and cool to 50° C.

Filter and add 20 cc. NHCl to filtrate. Cool to 25° C.

Add 1 gm. sodium bisulphite. Shake well and store in a tight stoppered bottle. The stain should be straw colored when ready to use.

N.B.—Store in the dark or in a brown bottle.

3. SO_2 Water.

Sodium bisulphite	1 gm.
NHCl	10 cc.
Distilled water	200 cc.

4. NHCl.

To 81.33 cc. HCl (mol. wt. 36.47, sp. gr. 1.18-1.19) add distilled water to make 1000 cc.

REFERENCES:

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Darlington, C. D. and LaCour, L. F. *The Handling of Chromosomes.* London, George Allen and Unwin Ltd. 1942.

SOME RECENT ADVANCES IN VERTEBRATE EMBRYOLOGY

(Abstract)

WILLIAM D. SULLIVAN, S.J.

Recent investigators in vertebrate embryology have discovered, by the use of vital stains, pictorial explanations of the metamorphosis of fertilized eggs from the completed blastula stage to the gastrula stage. Jane Oppenheimer in the Fundulus, Pasteel in the Turtle, van de Broek and others in the Amphibians and the Chick have found, immediately preceding the morphogenetical movements of gastrulation, a very similar pattern of the germ layers. The general picture portrayed by the vital stains in all the vertebrates, except the mammals, is as follows: a crescent shaped group of cells at the most anterior part of the picture, the prospective neural tissue; posterior to these cells are the chorda cells, surrounded on both sides by the axial mesoderm, with the endoderm at its posterior end. The prospective lateral mesoderm may be said to be the frame surrounding this entire picture. Though the general over-all picture is the same in all the animals, there are differences of minor importance. For example, the axial mesoderm in the Reptiles, though in contact with the lateral sides of the chorda, has its own wing-shaped formation which the others do not have. Also,

since the endoderm in the Chick is formed from the ectoderm by separating into the sub-germinal cavity, there is no portrayal of this particular tissue in the map of presumptive areas. It must be kept in mind that these pictures are not pictures of tissues, but rather cells which, after gastrulation, will be differentiated into tissues.

So far, there has been no success in portraying the map of presumptive areas in the mammals. The reason for this is that the entire development of the mammals takes place within the blastocoel cavity by a separation of cells from the ectoderm layer of cells surrounding the entire egg. The mammalian embryo is formed on the embryonic knob which hangs suspended within the blastocoel, attached at one end to the surface layer of ectoderm.

* * *

In the business session of the meeting the question of preparing Scholastics in biology was discussed. It was recommended that the chemical, physical, and mathematical preparation necessary should be brought to the attention of the Province Prefects of Studies by the heads of departments of biology. It was suggested that a questionnaire be drawn up and submitted to all members of the biology section of the Association concerning the preparation of Scholastics in philosophy and regency. Fr. Walsh agreed to do this during the year. It was resolved that this question would then be discussed in detail at the next meeting of the Association and that the results of this meeting be forwarded to the various Prefects of Studies.

The meeting closed with the election of new officers.

Chemistry

THE CHEMISTRY MAJOR CURRICULUM

(Abstract)

Rev. James T. Pallace, S.J.

At Canisius College a new chemistry major curriculum is being introduced this year. Physical Chemistry and Organic Chemistry are assigned to Junior year so that the entire Senior year may be devoted to electives. These electives are four advanced courses in each of the major branches, Inorganic, Analytical, Organic, and Physical Chemistry. The Inorganic and Organic courses are given during the first semester. In each course there will be one lecture period and one four hour laboratory period a week. Every chemistry major is required to take all four courses. Besides, there is a course in chemical literature, one period a week during the entire year.

FRESHMAN INORGANIC CHEMISTRY AND HIGH SCHOOL CHEMISTRY

Since many high school students now receive a good fundamental course in chemistry a number of schools are giving only one semester of inorganic chemistry in freshman year. A very animated and fruitful discussion of this problem was entered into by all those present. Since a new high school syllabus is being prepared for the Maryland Province High Schools it was suggested that, when the syllabus is completed, all the members be given an opportunity to see the syllabus and comment on it.

THE HIGH SCHOOL CHEMISTRY CLUB

Rev. Alvin A. Hufnagel, S.J.

The following topics were discussed:

1. The conditions required of students for entering the chemistry club.
2. The sanction for non-attendance at meetings.
3. The mortality i.e. the percentage of students who do not stick it out.
4. Experiments performed.

The audience participated in the discussion and contributed useful suggestions. It was agreed that better than average marks should be

demanded of members. The only sanction for non-attendance at meetings was continued payment of dues. About seventy-five percent of the students joining the club persevere. It was thought advisable to let the club members pick out some of their own experiments (within reason) besides those assigned by the teacher. Other useful suggestions to make the club a success included visits to industrial plants, movies on scientific and technical subjects, lectures from visiting teachers or research workers, occasional outings, etc.

THE MECHANISM OF ADSORPTION INDICATORS IN VOLUMETRIC ANALYSIS

(Abstract)

GEORGE L. DRURY, S.J.

A relatively new method of indicating the equivalence point in titrations involving precipitation reactions is discussed. There is a brief comparison of this method with the more familiar Mohr and Volhard methods, followed by a detailed explanation of the principle involved in the use of adsorption indicators. The paper concludes with a demonstration in which the principle governing this method is exemplified.

CHROMATOGRAPHIC ADSORPTION ANALYSIS

(Abstract)

EUGENE BRISSETTE, S.J.

This is a discussion of a modern method of analysis of wide and valuable use both in research and industry. A brief historical introduction deals with the discovery of the method and explains its terminology. Some applications of the analysis are enumerated and discussed along with the subject of apparatus and reagents. The procedures required for handling colorless compounds are taken up, and the paper concludes with an example cited from inorganic analysis (qualitative).

Mathematics

AN INTRODUCTORY COLLEGE COURSE IN ABSTRACT ALGEBRA

C. Frederick Koehler, S.J.

The frontiers of mathematical knowledge are being widened and deepened on all sides. Research is slow in analysis, more rapid in Number Theory and Geometry, but we must turn to Abstract Algebra to hope to be modern in the mathematical sense, for it is with the problems of Abstract Algebra that the modern mathematician is chiefly engaged.

A semester of full academic year of Abstract Algebra might be introduced for the reason that it is the parallel to Logic and Ontology. In junior and senior years of college one of the prime purposes is to teach a student how to think for himself. We present the material for thought in Philosophy and the formal process of thought in Logic. In the first three years a student has been given a plethora of mathematical material, but the logical process of constructing a proof by weighing assumptions, evaluating steps in the reasoning, and arriving eventually at a proof which is based on only the most necessary and fundamental statements has not been stressed. Certainly the manifold assumptions of the elementary Calculus, the succession of different and often unconnected facts of differential equations, and the startling operational methods of the vector do succeed in demonstrating how others have solved mathematical problems, but do not aim primarily at showing a student how to construct and criticize a proof for himself.

A graduate of one of our colleges upon entering advanced work must select for himself courses in Number Theory, Group Theory, Rings, Vector or Hilbert or Banach spaces and such topics. It is possible that one could listen to some or all of the courses and still miss the very essential connection between them, but it is this very connection with which Abstract Algebra deals since it aims at unifying all these topics by giving the common point of departure of all of them along with the particular point which differentiates them. We might also note the very fact that the student has been studying the Calculus and its applications for three years renders him quite ready for a different branch of mathematics and his experience with the Calculus coupled to his increase in intellectual maturity prepares him for the change.

We might develop the one semester course in Abstract Algebra in

the following outline, which is essentially that used in the book, "*A survey of Modern Algebra*", by Birkoff and MacLane.

1. We would introduce immediately the notion of an *Integral Domain* and from this the entire course is constructed. We state that an Integral Domain D is any set of elements for which are defined operations of addition and multiplication with the following properties:

   a. Each pair of elements in D determine uniquely a sum and a product in D such that the distributive law, the two associative laws, and the commutative laws hold.

   b. D contains distinct elements zero and one which act as identities for addition and multiplication.

   c. For each member a of D the equation $a + x = O$ has a solution in D.

   d. The cancellation law for multiplication is valid.

2. It is notable that this definition contains all of the basic assumptions of the entire course and in it we have no mention of division or subtraction.

3. Next we develop Integral Domains which are *ordered* viz. (satisfy the addition, multiplication and trichotomy laws for integers), and then *well-ordered*. We then show that the well-ordered Integral Domain completely classifies the integers.

4. We are now in a position to develop a few theorems of prime numbers which give us the *Euclidean Algorithm* and the *Fundamental Theorem of Arithmetic*.

5. To the familiar relationships of the ordinary simple equation we now add the concept of a given modulus and this allows us to treat *Congruence Equations* of a given modulus both singly and simultaneously.

6. At this point we introduce two of the most powerful tools in the whole of algebraic theory. We define a *Homomorphism* H to be any function which is defined through one set S and having values in another set S such that

   $$(x)H + (y)H = (x + y)H$$

   and that

   $$(xy)H = (x)H\ (y)H \quad \text{for all } x \text{ and } y \text{ in } S.$$

   We then state that an *Isomorphism* is nothing but a Homomorphism with the further requirement that the function defined must be such that it establishes a one-to-one correspondence between the two sets. Because these two tools are so simple and abstract in content they are applicable to the whole algebraic

gamut, and right at this point we can prove that there exists an Isomorphism between the integers and any well-ordered domain. Hence, from our point of departure, the Integral Domain, we have not only evolved the integers and classified them, but we have shown the relationship which exists intrinsically between them and any other collection of objects which satisfy the requirements of the Integral Domain.

7. By adding to our initial definition the notion of an inverse for any non-zero element, we have arrived at the concept of a *field*. We say that a field F is an integral domain which contains with any member $a \neq 0$ an inverse a^{-1} such that $a \cdot a^{-1} = 1$

8. By using *couples of integers* that is, couples in the strict technical sense, we can show that the rational numbers exist from only the operations of addition and multiplication. Then, by proving that the rational numbers form a field, we have developed division not as a definition but as a logical conclusion from the very existence of the rational number. Consequently, having division and integers, we have also fractions.

9. We advance the notion of a field just as we did that of an integral domain by considering fields that are *ordered*, *well-ordered* and *completely ordered*. That is, we say an ordered field is completely ordered if every subset of the field which has an upper bound has a least upper bound. It is from this last notion that we have the real numbers, for we postulate that the real numbers form a complete ordered field. For the benefit of the student at this point it would be helpful to show how this algebraic development differs from the analytical development of the Dedekind Cut. I do not claim that the algebraic development is the superior method, but I do think that it is by far the most rigorous and the most logical. Having then complete ordered fields, the theorems of Archemedies and Eudoxus follow as corollaries.

10. We now introduce polynomials and develop their theory by means of theorems which form analogues to those of the integers, viz. the Euclidean Algorithmn, the well-ordering principle, the fundamental theorem of arithmetic, etc.

11. *Complex numbers* are introduced as couples of real numbers just as rational numbers were introduced as couples of integers. This brings us to the point where we can show how the real numbers are a subfield of the complex numbers, and the rational numbers are a subfield of the real number field, and since we constructed the rationals from couples of integers we now are in possession of the ordinary aggregate of the numbers. The topics of vector spaces and quarternions are handled in the second part of the course.

12. By returning to the original definition of an integral domain and omitting three of its postulates we have a *Commutative Ring*, by excluding two of the postulates we have a *Commutative Ring with a unit*. By omitting four of the requirements for an integral domain we come to a *Group*, and hence to groups of transformations, Cayleys theorem, subgroups, cyclic subgroups, permutation groups, Lagranges theorem on cosets and then quite naturally to conjugate subgroups and automorphisms. And all of these topics can be extended in themselves and related with what has gone before by the method of the homomorphism and the isomorphism. This would complete all that could be discussed in the first term, and the second term should deal with such topics as:

1. Vector spaces and subspaces which are Euclidean, non-Euclidean, and ortho-normal.

2. The algebra of matrices, linear algebras, linear groups, rank and determinants.

The difference between this modern abstract algebra and the older Higher Algebra of such authors as "Boucher" is quite clear from the outline just presented. A rather important and pleasing factor about this course is this, that the only requirement in the way of a background that a student needs is the ordinary high school algebra. This last factor of background is clearly stated in the introduction to a "*Survey of Modern Algebra*" by Birkoff and MacLane. It is, of course, obvious that the more mathematics a student knows, the more he would appreciate this course, but the fact remains that high school algebra is all that is required to understand the theorems and to work the problems. This should be encouraging to anyone who might care to read privately on the topic.

A list of books suitable for one just beginning might be:

1. *A Survey of Modern Algebra.* Birkoff and MacLane—Macmillan.
2. *Modern Higher Algebra.* Albert—Univ. of Chicago Press.
3. *Introduction to Abstract Algebra.* MacDuffe—Wiley.

Physics

THE RADIAL DEPENDENCE OF THE TENSOR FORCE IN THE DEUTERON

(Abstract)

By William G. Guindon, S.J.

A phenomenological theory is developed, employing for the neutron-proton interaction potential

$$V = -[J_1(r) + \delta S_{12} J_2(r)]$$

where S_{12} indicates the tensor operator. In place of the general radial dependences, J_1 and J_2, square wells of depth V_0 determined by neutron-proton scattering experiments, and of radii r_0 and er_0, respectively are substituted to make the Schroedinger equation for the deuteron soluble. For a given choice of r_0 and er_0, it is possible to fit the experimental values of the mass, intrinsic angular momentum and magnetic momentum of the deuteron, neutron and proton. Then computation of the electric quadripole moment of the deuteron provides a value to be checked against the experimentally observed value. The results indicate that the "correct" interaction has $e \sim 1$ and $r_0 \sim 2.6 \times 10^{-13}$ cm.

PERMEABILITY TUNING OF RADIO RECEIVER AMPLIFIERS

(Abstract)

Rev. J. A. Tobin, S.J.

Radio transmitters produce electromagnetic radiation of high frequency. This radiated electrical energy is absorbed by the antenna of the receiver due to the fact that as the electro-magnetic flux of the wave cuts across the antenna conductors, it induces a voltage in the antenna system. In order to absorb as much of this electrical energy as possible, it is necessary to cause the antenna to resonate with the same frequency of the transmitting station. This process is selective and greater discrimination is achieved by the use of resonant circuits in the receiver itself which may be given suitable adjustment as a result of which all but the desired signal will be rejected. This latter process of varying circuits so as to obtain sharp resonance is called selective tuning.

The typical resonant circuit which would be found in a receiver is a combination of an inductance coil and a condenser which may be connected in series or in parallel or in a combination as the design of the receiver dictates. The inductive reactance of a coil and the capaci-

tive reactance of a condenser are oppositely affected by the frequency. By varying the capacitance of the circuit, it is possible to change the frequency of the circuit. The resonant frequency of this circuit can be changed also by varying the inductive reactance of the circuit, or even by varying both of them.

Designers of radios have generally elected to change the resonant frequency of the radio receiver by using a variable condenser. This has been justified in the fact that a condenser is easily adjusted.

Until recently, tuning was done by varying the capacitance: the last war introduced radio receivers that were tuned by varying the inductance in the circuit. This process was not new, but was considered impractical due to the mechanical construction of the gang-operated tuners and the variance in the magnetic properties in the cores. This process is called permeability tuning and this paper presented some results of permeability tuning as regards receivers.

When broadcast receivers were designed a few years ago, the custom was to tune the circuit with a variable condenser, and to use a coil in such a way that the inductance would have a value so that the circuit could be tuned to the lowest end of the broadcast band using the greatest value of the condenser. In this circuit, the selectivity is greatest at this low frequency. If we decrease the capacity of the condenser, we tune the circuit to a higher frequency. The selectivity at this end of the broadcast band is extremely broad. While it may be true that the inductance remains constant, still losses increase with frequency, and that means that the L/R ratio decreases. This difficulty was one of the reasons for abandoning this design and turning to the superheterdyne method.

A circuit that is to be tuned by varying the inductance is designed in the opposite manner. The inductance of the coil and the size of the fixed capacity are chosen with emphasis on the higher end of the broadcast band. The inductance will be smaller than that used in the previous system. Hence, the resistance will be smaller. The capacitance of the condenser will be higher than the least value that would be used if the tuning were to be accomplished by using a variable condenser.

The inductance is increased by inserting a core into the coil. This gives a lowered frequency, but also an increased effective high frequency resistance. But the L/R ratio remains substantially the same, because the increase due to the core begins to be offset by the decreased high frequency resistance of the winding due to decreasing frequency.

The highest frequency will be given when the core is withdrawn. In this case the permeability is equal to one. As the core is inserted, the lines of force grow more and more concentrated in the core. The average effective permeability of the medium within the coil is in-

creased, with a corresponding increase in induction. The largest value of induction and tuned to the lowest frequency is when the core is completely inserted within the coil. For this reason this method is described as "Permeability Tuning".

Everyone can easily conceive the method of tuning by ferromagnetic cores. This idea has been frequently applied to resonant circuits. To counteract losses which are inherent in cores, they are presently being made of very finely pulverized iron dust. When prepared correctly, these cores have low losses due to eddy currents and are not affected due to effect caused by laminations.

The permeability of polyiron remains constant from 50 to 2,000,000 cycles. Ferrocart, a compound used in Europe, also manifests good results. The technique of manufacturing of good quality cores is still quite new and it is expected that the future will bring forth many and better ones.

In the unit used, we had two coils: one, a radio frequency tuner; the other, an oscillator tuner. The cores were moved in and out of the coils simultaneously. The radio frequency coil had 150 turns of number 38 wire. Its diameter was .64 centimeters. The oscillator tuner was .64 centimeters in diameter and had 50 turns of number 24 wire. The cores were made of powdered iron. Their diameters were .60 centimeters for the radio frequency coil and .60 centimeters for the oscillator coil. They were both of the same length—50 centimeters. The cores were moved in and out of the coils.

DIRECTIONAL ANTENNAS

(Abstract)

CHARLES G. CROWLEY, S.J.

The directional properties of any antenna array are highly complicated functions of the number of elements it contains and their self and mutual impedances. The impedances, in turn, are functions of the dimensions of the elements, their spacing, their height above the ground, and the mutual phase relations of their currents. The many variables in the mathematical expressions for the resultant field of antenna arrays show that practically any form of radiation pattern may be obtained.

In the experiments described here, only one of the three elements in the array is driven. The other two, the so-called parasitic elements are so designed as to increase the effectiveness of transmission in one direction, one performing this function as director, the other as reflector. The director and reflector are considered as two similar horizontal antennas, separated by a definite fraction of a wave-length.

After the proper inter-element spacing has been determined, the reactances of the director and reflector must be varied through length adjustment until the phase relations of the radiated field of the driven element and the reradiated fields of the parasites are such as to produce reenforcement in the direction desired and complete or partial annulment in other directions.

The field patterns obtained by experiment with this antenna array consisted of one major lobe and several scarcely significant minor lobes opposite to it and adjacent on either side. This effect coincided with the theory that parasitic arrays with a single driven element should have an unidirectional characteristic.

FREE NEUTRONS IN THE ATMOSPHERE

(Abstract)

JOHN KINNIER, S.J.

In the study of shower production by Cosmic Rays many of the particles have been identified as electrons while about one percent of the observed tracks appear to be due to heavier particles. The existence of such heavy particles is evidenced by the more intense ionization which they produce. A simultaneous evaluation of their energy and ion density indicates that these heavy particles are protons. Presumably these protons are evaporated out of nuclei by the high energy constituents of cosmic rays in which case one would also expect an approximately equal number of neutrons to be produced. In passing through matter the protons loose their energy very rapidly by producing intense ionization and consequently are stopped after a short time. Neutrons on the other hand experience numerous elastic and inelastic collisions with nitrogen and other nuclei of the atmosphere before they are finally slowed down and absorbed.

Since neutrons are uncharged particles they are not easily detected by ordinary methods. However, neutrons can be detected by the artificial radioactivity they excite in nuclei which have absorbed them. Neutron counters have been constructed by filling conventional cosmic ray counters with boron trifluoride. A slow neutron entering such a counter produces an alpha-particle by the disintegration of the boron nucleus. This alpha-particle will produce a large amount of ionization in the counter as compared to that produced by beta rays or gamma ray secondaries. By suitably adjusting the counter voltage it is possible to record only the larger pulses of ionization produced by the alpha-particle and exclude beta or gamma ray counts.

Some experiments have been made in order to determine the energy distribution of neutrons in the atmosphere. This was accomplished by alternately shielding the counter with a sheath of cadmium and boron. Cadmium by reason of its extremely large capture cross section for

thermal neutrons will effectively exclude them from the counter while at the same time will not disturb the passage of neutrons whose energies are one volt or more. Because of the interrelation of counter efficiency and the absorption characteristics of boron, a counter protected by a boron sheath will be shielded from neutrons of all energies. Thus the difference in counting rate with and without these shields should yield a measure of the total number of neutrons and the number of thermal neutrons. Actual measurements with such counters have been made up to an altitude of 34,00 feet and have shown that the counting rates of all three vary as does the total ionization produced by cosmic rays.

STABILIZING THE OUTPUT OF D. C. POWER SUPPLIES

(Abstract)

CHARLES F. TURNER, S.J.

There are two methods of stabilizing the output voltage of a D. C. power supplies. For the low current applications the VR series tubes may be used with the proper series limiting resistor. This is determined by the particular tube and application. For voltage requirements higher than the rated value of one tube two or more must be used in a series circuit, with the proper limiting resistor. For current requirements higher than the rated value of tube two or more must be used in parallel. This however is not recommended because one tube may "start" before the others and thus prevent the others from taking their share of the load. This will damage the first tube.

For higher orders of current and voltage the electronic method is recommended. This type has excellent regulation as well as manual control over the output voltage. In this type a high gain voltage amplifier with sharp cut-off characteristics such as the 6SJ7 is used as a control tube and is connected so that a small change in the input voltage to the regulator causes a change in grid bias and thus a corresponding change in plate current. The plate current is drawn through a resistor, the voltage drop across the same resistor being used to bias another tube called the Regulator Tube. For very high current demands two or more regulator tubes may be used in parallel without the "starting" difficulty causing trouble.

LIST OF MEMBERS OF THE AMERICAN ASSOCIATION OF JESUIT SCIENTISTS (Eastern Section)

(Those in attendance at the convention held at Georgetown, Sept. 2-4, 1947, are marked with an asterisk).

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Fordham

EDWARD B. BERRY
Fordham

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Due to obvious difficulties in obtaining a proper Membership List during the past two years the following method was adopted. The Executive Committee at its meeting September 4th, 1947, voted to membership all those who attended the meetings in 1946 and 1947. It is a list of these names which is published here. It was not the intention of the Committee to exclude from membership those whose present work, or other reason, prohibited them from attending these meeting, if they desire to maintain active membership. The EDITOR will be pleased to receive any such names, or others which may, unfortunately, be omitted.