A. M. D. G.

BULLETIN

of the

American Association of Jesuit Scientists

(Eastern Section)

For Private Circulation

LOYOLA COLLEGE
BALTIMORE, MARYLAND

VOL. VIII DECEMBER 1930 NO. 2

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EASTERN STATES DIVISION

VOLUME VIII   DECEMBER 1930.   NO. 2

EDITORIAL

The deeds of distinguished men are often the fruit of years of unceasing toil and achieved only after patient and untiring effort. The many unsuccessful attempts, the hours of labor hidden in the laboratory or observatory, the failures in experimental work are not heralded before the world. These ceaseless efforts are at times rewarded by world-wide recognition after sacrifices and devotion to a cause or a scientific problem. There are others among the vast army of workers in science, whose names are forgotten, whose innumerable hours of drudgery are not recorded in the annals of fame, though they have given their best to scientific education and the search of the unknown. Indomitable stalwarts such as these will find an ideal, an inspiration in the accomplishments of such scientists as Father Hagen and Father Algue. We are grateful that their work was successful, that the one has given to navigation the barociclonometer and the other his results on variable stars to the astronomers. We a e grateful too, that the Society of Jesus is still alive to the traditions of scientific research and we may add their names to the illustrious names of Fathers Secchi, Grimaldi, Kircher, Perry, Wassman and Ricci.

With humble recognition

of their untiring devotion

to the cause of science

this number of the bulletin

is dedicated

to the memory of

Rev. John G. Hagen, S. J.,

Astronomer

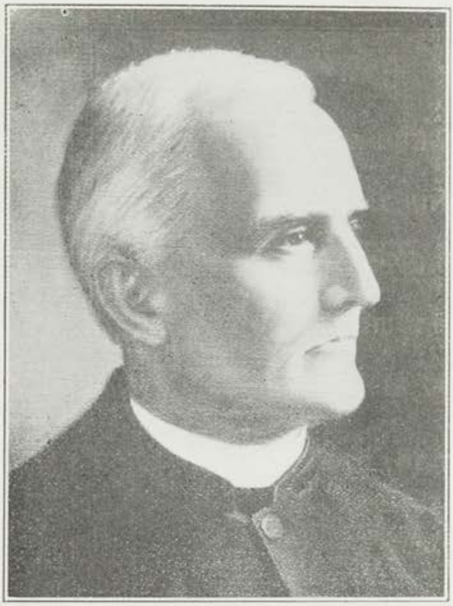
and

Rev. Jose Algue, S. J.,

Meteorologist

REV. JOHN G. HAGEN, S. J.

ASTRONOMER



Quam sordida mihi tellus, cum coelos aspicio!
St. Ignatius Loyola.

Father John G. Hagen, Director of the Vatican Observatory and at one time Director of the astronomical observatory at Georgetown University, Washington, D. C., died Saturday September 6th in Rome following an attack of nephritis.

Father Hagen was born March 6th, 1847, at Bregenz, Australia. After completing his earlier education in the schools of his native town, the young man with his two brothers, continued his studies at the Jesuit College at Feldkirch, Austria. He entered the novitiate at the age of sixteen, and after completing studies at Münster and Bonn, he was ordained to the priesthood at Ditton Hall, England, on February 25th, 1878. Two years after his ordination Father Hagen came to the United States and taught at Canisius College, Buffalo, New York, and at Sacred Heart College, Prairie du Chien, Wisconsin. Father Hagen arrived at Georgetown University as director of its astronomical observatory December 7th, 1888. He immediately set about the installation of equipment that would permit him to prosecute the researches he had begun on variable stars, a study which has immortalized his name in the astronomical world. The first important contribution from Father Hagen's pen appeared in 1891, in the form of the first volume of that gigantic work, entitled "*Synopsis of Higher Mathematics.*" Three more volumes followed in rapid succession. This work merited the applause of the entire mathematical world.

Father Hagen prosecuted numerous other important scientific works particularly on variable stars. A letter from Rome dated the Feast of the Annunciation, 1906, brought him word that the Holy Father had appointed him to the directorship of the Vatican Observatory. Several years ago, the Pope awarded Father Hagen a gold medal as one of the most meritorious members of the Pontifical Academy of Sciences.

At the time of his death many tributes were accorded him, and we quote one here: With the death of the Rev. John G. Hagen, S. J. the astronomical fraternity of the world loses a member whom it held in the highest esteem. Father Hagen had a wide acquaintance among the fellows of his science both in Europe and America. They knew well the value of his work; they loved the man himself for his fine personal qualitites. The venerable Jesuit, sitting night after night at the eyepiece of his telescope, was an inspiration to the younger members of the profession. Though he was in his eighty-fourth year when he died, his enthusiam never flagged. David B. Pickering, president of the American Association of Variable Star Observers, who visited him at the observatory four years ago, found him still striving to solve the mysteries of space with a persistence that would appall most men of half his years. At the Vatican he continued the work on variable stars which had engrossed him at Georgetown. His atlas of variables is used by astronomers the world over.

REV. JOSE ALGUE, S. J.

METEOROLOGIST

Celsa sedet Aeolus arce
Sceptra tenens, mollitque animos et temperat iras.
Ni faciat, maria ac tellus coelumque profundum
Quippe ferant rapidi secum verratque per auras.

Aen. Lib. I, 56.

Father Jose Algue, Director of the Manila Observatory from 1898 to 1925, died on May 27th, at Tortosa College, residence of the Fathers in charge of the Ebro Observatory, Spain. He was seventy-four years old, spent fifty-nine years in the Society and thirty-one of these in the Philippine Islands. The name of Father Algue will be handed down to posterity because of his invention of the barociclonometer, an instrument which locates the centre of a typhoon and points out the probable direction or path of the tropical storm. The use of this instrument has saved hundreds of lives and millions of dollars worth of property. This instrument combined with Father Faura's barometer, became the two best known contributions of the Philippines to meteorologists of this part of the world.

Since his invention of this instrument, which was first announced in 1904, his fame as a scientist became known all over the world. The first official recognition of the value of this instrument was given by the United States Navy which adopted this barociclonometer, without any changes, as part of the ship's apparatus. Father Faura's barometer has also been adopted by the United States Navy and is in general use throughout the Orient.

Born in the town of Manresa, Spain, on December 28, 1856, Father Algue's first studies were at Barcelona, and later he went to France; where he joined the Society of Jesus on July 17, 1871. He then spent several years in the little Republic of Andorra, where he studied philosophy. Several years after his ordination to the priesthood in 1894, he was sent to the Philippines. After staying two years in Manila, he left for Georgetown University, Washington, D. C., where he met Father John G. Hagen, and with him studied Astronomy and Meteorology. He returned to the Islands in 1898, and on Father Faura's death that year, he was appointed Director of the Manila Observatory, now known also as the Weather Bureau, a post which he held for twenty-seven years. In 1925 he departed for Spain due to failing health and to cataracts of the eyes.

In 1900, Father Algue gave to the world the first complete and reliable data on weather and typhoons in the Philippines, in his two-volume book *"El Archipielago Filipino."* After the U. S. Government took over the Philippine Islands, a commission of the Geodetic Survey was sent from Washington to survey the Islands. At the Manila Observatory were thirty-six maps of the various parts of the Philippines, which were made under the direction of the Jesuit Fathers. After two years of investigation, the commission accepted thirty-three of these maps as correct. This incident was told to the writer by Capt. Alvin Lustig, who served on this survey commission from Washington. In 1904 Father Algue headed the delegation of the weather bureau to the St. Louis Fair, and the following year he represented the Philippines at the International Conference at Innsbruck, Austria. In his leisure moments he made a fine collection of the flora and fauna of the Islands and also contributed many specimens to the Museum at the Ateneo de Manila.

Father Algue was an accomplished scientist, a man of solid piety, very humble, exceptionally thoughtful and kind to others and possessing a charming disposition. He was ever ready with a smile and an interesting anecdote. May his labors be an inspiration to the present and future generation.

CHEMISTRY

DYNAMIC MODELS OF MOLECULES.

Rev. J. J. Sullivan, S. J.

At the Fall meeting of the American Chemical Society in Cincinnati, an interesting paper was read before the Organic Chemistry Section on Molecular Models. The paper was presented by Dr. Donald Andrews of the Chemistry Department of Johns Hopkins University, summarizing work done during the summer at the General Motors Laboratory in Detroit. It seems a far cry from anti-knock studies in motors due to different kinds of gasolines, to the mechanism of vibration inside a hexane molecule. But, neither did Langmuir's work on high vacua appear very practical before the incandescent lamp blossomed forth as the fruit of this abstruse research.

From purely theoretical reasoning and the study of subatomic data available, Dr. Andrews calculated the ratio of nuclear mass to valence energy for several organic molecules. For instance in Carbon Tetrachloride, a carbon nucleus grips four chlorine nuclei by four valence bonds. These bonds represent vibrational paths along which the chlorine nuclei oscillate towards and away from the carbon nucleus. Such oscillations involve both kinetic and potential energy, and it would appear that an accurate value of this energy (call it valence energy) can be had from spectroscopic studies (particularly of the Raman lines in the extreme infra-red) and from other like data. Thus it is possible to find the ratio of the mass of the nucleus to the valence energy. And so it is possible to magnify this ratio to visible dimensions in a macroscopic model made of steel balls and springs. Here the ratio of mass to elastic energy in the springs would be the same as the ratio of mass of the chlorine nucleus (or carbon nucleus) to the elastic energy of the valence bond. Such dynamic models could be built not merely for Carbon Tetrachloride, but for any compound with whose structure and energy relations we are familiar, such as cyclohexane, benzene, toluene, etc.

Such was the reasoning of Dr. Andrews. And, in the laboratories of the General Motors he had probably the best mechanics available to make these oscillating models of molecules from steel balls and steel springs with almost mathematical precision.

In fact it was found that such a model, when agitated mechanically on a specially devised machine, vibrates with the different types of motion which are characteristic of the motions of the atoms in the real molecule, as revealed by their Raman spectra. Increasing the vibrational energy from zero to a high maximum, it was possible to observe these changes of motion and note the frequencies where the changes occurred. These frequencies of motion in the dynamic model, when converted into wave numbers correspond, term by term with the lines in the Raman spectrum for several examples observed. Thus, it would appear that a study of the mechanical model can throw considerable light on the behavior of the actual molecule.

For Cyclohexane, the agreement between the mechanical spectrum (if such it can be called) and the optical spectrum observed was almost perfect. The same was true of Carbon Tetrachloride. The surprise of the demonstration appeared to be the refusal of the Benzene model to vibrate along predicted lines when constructed after the Kekule formula. However, almost complete agreement was obtained when the steel balls and springs were tied together as suggested by the centric formula of Armstrong-Baeyer.

And so, someday, such models may show us the explanation of motor-knocks, when isomers of hexane occur in gasoline.

ORGANIC MICROANALYSIS.

REV. R. B. SCHMITT, S. J.

In the field of quantitative analysis, microanalysis is making rapid progress particularly in the research laboratories of Austria, Germany and England. Only a few universities in our own country have given us improved methods in microanalysis. This method in analytical chemistry will no doubt be the standard method of analysis in the near future, particularly in the study of biochemistry in considering the functions of enzymes, vitamines and hormones. Quantitative organic microanalysis has done much to alleviate all infantile ailments and has been the cause of the decrease of infant mortality. At the research laboratory of the Johns Hopkins Hospital the regular routine is to make seven quantitative analyses from 1 cc. (16 minims) of infantile blood. This work was done under the direction of Dr. Leonor Michaelis, of the University of Berlin. Frequent articles on recent advance of this phase of quantitative analysis appear in "Zeitschrift fur Elektrochemie und angewandte physikalische Chemie," and now there is a journal exclusively devoted to this subject: "Die Mikrochemie."

The results of the reseach of Dr. Fritz Pregl, of the University of Graz, and his co-workers have received world-wide recognition. These methods are simple and reliable; his work in organic microanalysis is the result of over ten thousand experiments. A few of the outstanding methods are here enumerated.

Up to recent times a reliable set of analytical data for carbon compounds containing several elements was hardly possible unless 0.5 to 1 gm. of the material was available. Now by Prof. Pregl's methods 12 to 15 mgm. are quite sufficient and if a few more milligrammes are available, a molecule weight determination can also be made. The practical ideal sample for microanalysis is from 3 to 5 mgm. The essential apparatus for this work is a micro analytical balance with an accuracy of $\pm$ 0.001 mgm; its sensitiveness would therefore amount to 1 ten-millionth, which is 10^{-7}.

In the determination of carbon and hydrogen of course the greatest care must be exercised in the proper set-up of the apparatus, and this is fully described in every detail of Professor Pregl's recent publication. The combustion tube besides the usual copper oxide contains also silver wool, lead peroxide and lead chromate. The absorption apparatus consists of Flaschenträger's tubes and also a Mariotte flask. The accurate results of a sample of alizarine are remarkable and prove the reliability of the method: theory 69.98% carbon, actually found 69.99% carbon; theory 3.36% hydrogen, and found 3.29 hydrogen.

Gas volumetric determination of nitrogen in small amounts of organic material is done in the two standard ways, i. e. the Micro-Dumas method and the Micro-Kjeldahl method. Again we find the results exceptionally accurate: in a sample of nitrobezene which has a theoretical percentage composition of nitrogen of 11.41, the actual result by the Micro-Dumas method gave 11.46%.

The sulphur and halogen determinations by the microanalytical methods are new processes and most ingeneous; the details are too complicated to be given here. In determining halogens, one difficulty was that on acidfying an alkline sulphite solution with nitric acid, adding silver nitrate and heating on a waterbath, an opalescence is produced which was thought to be silver halide, but after long investigation was found to be finely divided sulphur. In the new process the sulphides are oxidised with perhydrol in an alkaline solution and on adding nitric acid and silver nitrate the solution remains perfectly clear even after prolonged heating.

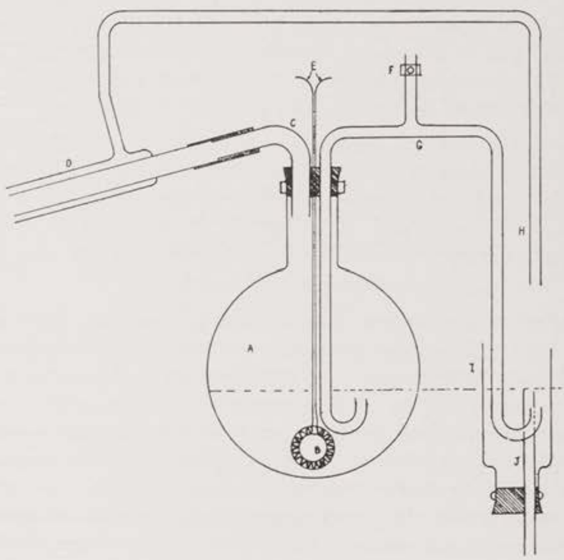
Dr. E. Egenberger empioys a new method for the determination of sulphur. He rinses the contents of the combustion tube into the precipitation test-tube with 50% aqueous alcohol, adds 2 cc. N barium chloride and 2 cc. of an aqueous celluloid sol; the barium sulphate which is precipitated is carried down when the sol coagulates. After warming to 40 degrees C., the precipitate can be filtered and ignited in a Gooch crucible, the celluloid being burnt. The results are excellent, for in a sample of sulphonal the theoretical percentage of sulphur is 28.09; by this method 28.06 was found.

Other microanalytical methods given by Prof. Pregl and his co-workers include phosphorous and arsenic in organic substances; organic radicals such as: carboxyl, methoxyl, ethoxyl, methyl and acetyl groups.

CONTINUOUS WATER STILL.

Rev. A. B. Langguth, S. J.

In the last issue a continuous water still, underfed and gas heated was described. It was thought well to describe the other still, which was electrically heated and fed by means of a siphon.



In the figure "*A*" is a two liter Pyrex Balloon Flask. "*C*" is a ⅝ o. d. glass tube connecting with the condenser "*D*" which was of the kind that has stoppers to seal the condenser tube to the jacket. The 10 mm. condenser tube was removed and a ¾ o. d. combustion tube was inserted in its place and the joint closed up by pieces of large diameter rubber tubing. In the beginning the ordinary size 10 mm. condenser tube was used, but there was very much back pressure, which drove the water from "*A*" into the reservoir "*I*". After the larger diameter tube was used this difficulty disappeared. The overflow from the condenser goes through "*H*" into the reservoir "*I*", which is made from an 8 ounce salt-mouth bottle by cutting off the bottom with a hot wire, whence the excess water spills through "*J*" into the waste.

The heating coil "*B*" is a 625 watts nichrome coil with Edison screw base, such as is used in the ordinary type of portable heater supplied for room use. Lead wires "*E*" were screwed to the coil and run through needle holes in the rubber stopper and were then connected with a wall plug. The siphon "*G*" is substantially the same as one described by H. L. Maxwell, Jour. Ind. & Eng. Chem. Vol. 20. 1928, page 871 in an article—*A Continuous Extraction Apparatus*. The siphon is started by applying suction through the pinch-cock "*F*". The ends of the siphon are turned up to prevent bubbles of air from getting into the line. In the still pictured the siphon was constructed of glass tubes, a glass T-tube and rubber connections, with a six inch rubber tube at the side outlet of the T-tube, while the pinch-cock was at the end of the rubber tube. This long rubber tube served to collect any air which got into the siphon, which held as long as three weeks before the air had to be withdrawn.

This still worked very satisfactorily, yielding a little less than a liter an hour. Owing to the source of the heat it would be prohibitive except in a place where electricity is quite cheap. It has this advantage that it is self-purging no residue gathering in the boiling chamber and the water in it was always as clear as that entering through "*H*", so that is was not necessary to take it apart for cleaning during the whole time of its operation.

QUININE TERCENTENARY.

"The Hormone," Holy Cross College.

At St. Louis, Mo., on the thirty-first of October and the first of November this year, scientists from all parts of the world will observe the tercentary of the first use of quinine. President A. R. Van Linge of the Niederlandsche Kininefabrick at Amsterdam, Holland, and Dr. M. Kerbosch, director of the government cinchona plantation in Java, who directs the production of virtually the world's supply of the bark from which quinine is extracted, will be the speakers.

It is related that a Spanish Jesuit Missionary in Peru when suffering from a severe fever was cured by eating some bark of a particular tree administered by a Peruvian native. The earliest authenticated medical use of quinine is found in the year 1638, when the Countess of Chincon was cured of an attack of fever by its use. The tree from which the bark was obtained was later named Cinchona in her honor by Linnaeus. The Jesuit Barnabé de Cobo first transported the bark out of Peru, from Lima to Spain and afterwards to Rome. The Jesuits disseminated both the bark and a knowledge of its usefulness, hence the name Jesuits, Bark of Jesuits, Powder. Its name is derived from the Spanish *quina* meaning bark.

It is alleged that it cured Louis XIV when still dauphin, having been administered by a Father Tafur who learned of its therapeutic value from the Jesuits.

Shortly after it was introduced into Europe its use was viciously attacked by leading pharmacists and doctors who laid at its door all sorts of ill effects, which were later on disproved .

The alkaloid itself is rarely used but is usually given in the form of the sulphate $(C_{20}H_{24}O_2N_2)_2.H_2SO_4.7H_2O$, which upon exposure to the air loses five molecules of water and then remains stable. It is exceedingly bitter to the taste. Its physiological action was studied extensively by Professor Binz of Bonn.

It is a bactericide killing many bacteria in 0.2% solution but is more definitely poisonous to the malarial parasite. It is often said that it is foolish to take quinine for anything but malaria, nevertheless, it is well known that it acts as a tonic to the stomach and also acts as an antipyretic. It has no antipyretic effect on normal temperature but will lower abnormal temperatures. It probably does this on account of its action on the oxygen compound of hemoglobin which it stabilizes thereby preventing them from giving up their oxygen readily and consequently lowering the rate of metabolism. In large doses it lowers blood pressure. It is not only a specific for malaria but also a prophylactic against it. Some people suffer from quinine idiosyncrasy which causes a deafness and ringing in the ears. This may be overcome by taking ten minims of Hydrobromic acid with the ordinary dose of quinine.

From the work of Skraup, Konigs, Teekles, Kerner and Rabe in the chemical field the constitution of quinine is fairly well established as a derivative of quinoline. In addition to the work of the above mentioned investigators there has been an immense amount of work done on the physiological chemistry of quinine.

Considering the number of lives saved and the amelioration of suffering due to malaria fever it is fitting that the tercentenary of the first use of quinine should be properly celebrated.

BIOLOGY

VALUE OF THE COURSE IN TECHNIQUE.

Rev. C. E. Shaffrey, S. J.

It has been our custom for years to have the students prepare several blocks of tissue for sectioning, then make the sections and stain a set of fifty slides for the laboratory. Unstained slides are distributed to the students, each receiving a section of each block of tissue prepared, so that he has a fairly complete set of slides for the study of histology. Having seen the tissue removed in a dissection of the animal and then having carried that tissue through the various solutions for fixing, dehydrating and infiltrating, and then cutting sections of that tissue on the microtome and then staining it and examining it under the microscope, he is able to understand the structure he sees since he knows all that has happened to the tissue before he came to examine it. The student who began the study of histology by examining and drawing a picture of the section presented to him can recall his distress in trying to understand the specimen before him. All his work in the dark is obviated by the course in technique.

While technique work simplifies the course in histology it is no less necessary for the proper understanding of the course in embryology. This fact was well proved by the medical student who had finished his Freshman year in medicine which he began with no knowledge of embryology. The students had been provided with total mounts and serial sections of chick embryos but they had no idea how these mounts had been prepared and the whole matter was cleared up for this student when visiting our laboratory at a time when the students were preparing their own sets of total mounts and serial sections. Many an obscure point became clear in a few minutes and he was able to appreciate the value of the course much better than the students who were doing the work.

Our method of preparing the chick and pig embryos was given in the bulletin two years ago, and though our method of preparing histology slides may be familiar to most of you, I am going to insert it here for the benefit of the newcomers who may not have used it. This method has the advantage of giving nice thin sections since the celloidin block is imbedded in paraffin and then the sections cut on the rotary microtome. There is very little tearing of the sections which so often happens in the straight paraffin method, and the sections are very much thinner than can be usually procured by the straight celloidin method. This combination method has been welcomed by a professor of histology in one of the neighboring medical schools, and it occurred to me that it might be just as welcome to some of our men who have not run across it before. The blocks, that is the celloidin blocks imbedded in paraffin can be filed away and used again as long as three or four years after their preparation. Try the method, meet your difficulties, and then let us help you out, or better, if you are passing our way drop into the laboratory where our time will be yours.

Combination Method of Preparing Tissues for Sectioning.

1. Place the fresh tissue in the solution preferred.
2. If necessary wash in running water over night.
3. If tissues are delicate place in 50 per cent and then into 70 per-cent alcohol for an hour each. Then into 80 per cent alc. 95 per cent alc. for 12 hrs. each. Then in abs. alc. for 12 hrs. Then abs. alc. and other for 12 hrs.
4. Thin celloidin for 3 days; thick celloidin 3 days.
5. Drain off superfluous celloidin and wash in mixture of abs. alc. and ether. Drop into chloroform and leave not longer than 6 hrs.
6. Xylol, 1 hr.
7. Xylol-paraffin, semisaturated solution, 12 hrs.
8. Xylol-paraffin, saturated solution, 12 hrs.
9. Place in 52° paraffin in oven at 60° C. for 12 hrs.
10. Imbed in paraffin.
11. Cut sections 10 to 12 microns thick on a rotary microtome.
12. Mount on slides from warm water and place in paraffin oven for 12 hrs.
13. Allow the slides to cool for about an hour after removing them from the oven.
14. Stain by the method preferred.

N. B. If it is desired to use the celloidin method only, from No. 7 block the tissue in celloidin and preserve in 80 per cent alcohol. This block must be cut on the sliding microtome.

Method of General Staining.

1. Place the slide in xylol to remove paraffin, 3 min.
2. Place the slide in absolute alcohol to remove xylol.
3. 95 per cent alcohol, 3 min.
4. 80 per cent alcohol, 3 min.
5. Wash in water until water flows in thin film from slide.
6. Delafield's haematoxyln, 3 min.
7. Wash in water.
8. Eosin, 2 min.
9. Wash in water.
10. 80 per cent alcohol, 3 min.

11. 95 per cent alcohol, 3 min.
12. Absolute alcohol, 3 min.
13. Carbol-xylol, 2 min.
14. Mount in balsam.

N. B. If you are staining sections which have gone through the celloidin method only, preserve the sections in 80 per cent alcohol and then begin the staining process at No. 5 and go through to mounting as usual.

ILLUSTRATED LECTURES IN HISTOLOGY AND EMBRYOLOGY.

REV. C. E. SHAFFREY, S. J.

In the past two or three years here at St. Joseph's we have been using opaque projection to a very great extent in the teaching of Histology and Embryology because it is far more satisfactory than lantern slides and the pictures are so easily prepared. Then too, the drawings in these two subjects would require so much time if they were put on the board that it would practically be impossible to use more than one or two for a lecture. The illustrations are taken from the text-books and are mounted on a white card-board with a glazed surface. The cards measure about 7 X 9 inches. This size does very well for the ordinary projector and it is large enough to allow several cuts to be mounted on the same card. Cards may be secured with one or with both sides glazed but the former is more satisfactory as it would not be well to put pictures on both sides of the card, for the lower surface is often soiled by the shifting of the cards in the projector.

These cards can be filed away in manila envelopes and these marked so that they can be readily picked out. Colored illustrations, especially in histology, give an opportunity to the student to see the sections of tissues and organs just as they will appear under the microscope, and the professor is saved much time in demonstrating important features to the entire class rather than having to point them out to each individual. Sabotta's atlas of histology is the best of its kind and little else would be needed for a complete course.

Our own laboratory is now supplied with abundant illustrations for every course and the task of putting drawings on the board has disappeared. The matter to be studied is first covered in lecture and then a summary made by means of the illustrations. The method is a wonderful help to the student and a great labor-saver for the teacher, and the cards are so easily prepared by mounting the pictures with home-made flour paste that several hundred could be prepared in a day.

BIOLOGICAL CHARTS AND LECTURES

Fordham University. November 6, 1930

To the Editor of the Bulletin of the Jesuit Scientists:

I should like to recommend to biology teachers both for high schools and colleges the charts prepared by Professor R. Weber. All the biological charts in use today are prepared from specimens that are for the most part foreign to this country. It is true that the differences are slight but there are differences.

We have used Prof. Weber's chart of "Rana pipiens" with unusual success. The details are exact and the color scheme contrasting. Up to the appearance of this chart we had to use charts of "Rana temporaria and R. esculenta." Another chart of Weber's is "Cell Types." This one contains representative drawings of nearly every cell structure. This chart is also scientifically exact. Prof. Weber has in process of preparation a chart of "Squalus acanthias." The success of his previous charts seems sufficient to praise this new chart in advance.

Due to actual class experience, the scientific precision of the drawings, and, especially in the case of individual animals, the American species, I feel confident that all our schools would profit in using these charts. Professor Weber's address is: 325 East 194 St., New York City.

Dr. George C. Roemmert of the University of Munich, Germany is visiting in this country for the purpose of delivering lectures on his research in microscopy.

Professor Roemmert has delivered three lectures here at Fordham with great success. His work consists in projecting on the screen with remarkable clarity, microcopical water-animals and plants. In this manner the living functions of the smaller animalcules may be viewed by an entire class. This sounds like ordinary work but Dr. Roemmert has devised methods and technic that are new and known only to him. Not only does the teacher learn this method but the students are extremely interested. Age and scientific training does not enter into the audiences enjoyment as, the first lecture given at Fordham was for graduate students, the second for college students and the third for high school students and all showed great interest and attention during the talk.

I heartily recommend to our schools the lecture and assure you of the great advantage of having heard and seen Dr. Roemmert's work. Dr. Roemmert's address is: 528 West 114th St., N. Y. C. Anyone interested may communicate directly with me for references of a more detailed nature.

Sincerely,

Joseph Assmuth, S. J.

Fordham University — Head of the Department of Biology.

PHYSICS

A USEFUL APPLICATION OF THE STROBOSCOPE.

Rev. J. A. Blatchford, S. J.

During the setting up and adjusting of the sound-disc attachment to the moving picture equipment at Weston College ,it becomes very desirable to have a speed indicator of some sort so as to be able to tell at a glance whether the turntable was revolving at the correct speed or not. We found that the usual mechanical contrivance for this purpose had two disadvantages, first that it was necessary to wait a part of a minute at least, to get any reading at all and secondly that it changed the speed at which the turntable revolved because the motor, originally designed to operate the projector only, was already overloaded due to the extra duty imposed on it of turning the sound-on-disc attachment also.

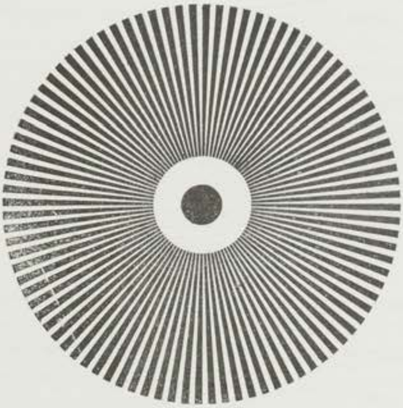


Figure 1

At this juncture the electrician of Holy Cross College, who helped materially in setting up the sound outfit, suggested the use of a stroboscope. This turned out to be very satisfactory and as it is quite possible that it could have other fields of usefulness especially in Physics, a few words as to its contruction may not be out of place. The theory of the stroboscope is well known to all Physics teachers and is briefly described in most textbooks of that science. As the instrument itself however, is rarely mentioned in the ordinary catalogs of Physical Apparatus it is quite possible that some of our teachers have never seen any type of stroboscope whatever.

In the form supplied by the Victor Talking Machine Company of Camden, New Jersey, it is a circular disk of stout cardboard (see Fig. 1) having on one face a number of sectors alternately black and white. There is a hole in the center the same size as the one in the usual victrola record. When revolving at a certain speed these sectors appear to be stationary. The number of sectors varies with the speed desired and the illuminant by which the disk is viewed. The illuminant must be of an intermittent character. The ordinary tungsten lamp lighted on sixty cycle alternating current is quite satisfactory. The usual orthophonic victrola record of today is made to revolve at a speed of seventy-eight revolutions per minute. It takes one hundred and eighty-four sectors, ninety-two black and ninety two white ones to produce this result with sixty cycle current. A very serviceable substitute can be made in about half an hour by inking in every other sector of a sheet of the usual polar coordinate paper. This has one hundred and eighty triangles giving ninety black and ninety white sectors and will appear stationary at a speed of eighty revolutions per minute.

The problem on our hands was to find the correct number of sectors to indicate a speed of thirty-three and one third revolutions per minute. The computation is quite simple as will be seen from the following explanation. In every cycle there are two instants when the current flowing through the lamp is zero. If the source of the current is sixty cycles per second then there will be one hundred and twenty changes in brilliancy of the light every second. Since there are sixty seconds in a minute there will be sixty times one hundred and twenty or seventy-two hundred fluctuations of the light per minute. During every one of these instants it is required that a neighboring black and white sector should move into the place occupied by the black and white sector ahead of it the instant before. As this motion takes place when the light is at its lowest intensity, the eye does not perceive it and the sectors of the disk appear to remain stationary. If now we divide the total number of fluctuations in the source of the light (seventy-two hundred in our case) by the speed we are after (thirty-three and one third revolutions per minute) we will find the number of divisions required. The number turns out to be discouragingly large—about two hundred and sixteen divisions—and as each of these divisions must contain a black sector as well as a white one, it will be seen that there are really four hundred and thirty-two divisions in all to be made. This number is somewhat appalling and it is no small feat in itself to divide the disk accuately into so many parts. Once accomplished however, it need never be done again as it can be reproduced photographically with considerable ease. The advantage of twenty-five cycle light as supplied in Buffalo is quite appreciable as only ninety black and ninety white sectors would be required.

To simplify the construction, however, the following modification was tried. A strip of gummed white paper (sold at all stationery stores under the name of passepartout) was cut exactly equal in length to the periphery of the turntable and then divided by the aid of graph or cross-section paper into the required number of equal parts. This strip with its four hundred and thirty-two stripes was pasted on the edge of the turntable and found to be quite as satisfactory as the disk. Experiments then followed in pasting strips on various wheels of the projector that moved faster and consequently required fewer bands but none turned out as well as the first attempt. The wider bands were much harder to see—perhaps because there were fewer of them. Various types of lamps were also tried to improve the contrast between the moving sectors. Heavy duty projection lamps gave the poorest results due no doubt to the fact the filament, being very thick, remained hot enough to give an appreciable amount of light between the alternations of the current. The thin filament lamps were much better. Best of all however, was the non-glow lamp suggested by Father Brock, S. J., professor of Physics at Weston College. This lamp gave a contrast between the sectors as good as the stationary disk itself.

LABORATORY TESTS ON COLOR PLATES.

Rev. J. P. Delaney, S. J.

A set of color plates experimented upon at Canisius College were viewed with interest at the Holy Cross meeting. The plates were simply prepared, and they greatly facilitate the lecture room explanation of the autochrome process of color photography. Two of the plates show in colors the spectra of various gases, the other two plates show in true color, and magnified, the starch grain layer that is the essential element of the autochrome process.

The plates used were the Agfa, five by seven. To obtain microphotographs in true color of the starch grain layer, a small unexposed color plate was immersed in hypo until the silver had completely dissolved. It was then dried and placed on the table of the micro-camera. Under magnification 300x and 600x the starch grains were photographed on the five by seven color plates. The uniform size of the grains and the even distribution of the three colors, without over-lapping, make an interesting study.

The spectrographs taken on the color plates beautifully emphasize the limitations of the most successful process of color photography. Various light sources were photographed, the tungsten filament, and tubes containing argon, neon, mercury, hydrogen, carbon dioxide, etc. The spectrograms are very beautiful, but of course no three color process can truthfully reproduce the spectrum.

SEISMOLOGY

NEW GALITZIN INSTALLED AT CANISIUS.

REV. J. P. DELANEY, S. J.

On last May 20th the newly installed Galitzin-Wilip vertical component seismograph began operation at Canisius College. Appropriate ceremonies marked the event. Before an assembly of the faculty and student body and in the presence of representatives of the Buffalo Ad Club, donors of the new instrument, four illustrated essays on the science of seismology were read by students of the B. S. course. The President of the Ad Club made a brief presentation address and the Director of the Obesrvatory and Rev. Father Rector responded.

The installation of the new instrument had been completed in record time. Within two weeks after its long trip from Dorpat, Esthonia, the delicate mechanism was completely assembled, calibrated, bolted to its pier, and put into service. The vault had been renovated previously and new piers had been prepared. Fortunately there was no misfit to delay the final work.

The new Galitzin, with its galvanometer and recording drum, is mounted in the same vault with the old 80 kg. Wiechert that has served for twenty years. The same clock, a Spindler-Hoyer observatory clock to good constancy, counts off the seconds for both seismographs. A recently installed Silver-Marshall Arlington receiver, immediately under the clock, unfailingly gives the clock correction twice each day. The pier on which the new instrument is mounted extends twenty feet below the floor to a good foundation of cherty limestone, and a three inch air space all around separates the pier from the building thus insulating the instrument from building vibrations. No galvanometer lamp was ordered with the seismograph, as it was thought that a simple lamp could be built for the purpose with a saving of twenty-five dollars. Besides saving the twenty-five, the home-built lamp has eliminated difficulties that several stations have met with the regulation lamp. A fifteen volt single filament lamp is used, powered at half the rated voltage from a small bell transformer. Each minute a telegraph relay shunted across the clock contact opens the low voltage circuit and eclipses the light for one second. The hours is indicated by an eclipse of four seconds.

The new seismograph has functioned very well during its first four months. At first the pendulum was quite unstable under adjustment for long period, and it had to be tightened to a period slightly less than ten seconds. With this shortened period it functioned well for three months, and then the period was again lengthened to 11.5, the period of the galvanometer. So far, with this lengthened period, stability has been maintained. Two sources of trouble had given grave concern before the installation, the adverse effects of local traffic and the temperature inconstancy of the seismograph vault. But to date no difficulties have materialized from these sources. The vault is only two hundred feet from Main Street, but the heavy interuban street cars, trucks and busses, and endless auto traffic have produced no noticeable effect on the records. The microseisms, those gentle and regular pulsations of Mother Earth, are as regular and unbroken at noon-day as they are in the quiet of midnight. The vault temperature often varies by several degrees due to the presence of steam pipes, but the excellent temperature compensation on the instrument has effectually checked any adverse effect due to these temperature variations. The new instrument has given excellent records of earthquakes near the antipodes, and it is the writer's conviction that Canisius College possesses the finest seismograph on the American continent. It is to be regretted that the maker, Hugo Masing, has recently passed to his reward.

A subsequent paper will discuss the reasons for the selection of the Galitzin-Wilip over othr types of seismographs, and for the choice of the vertical component instrument over the horizontal. A description will be given of four distinct improvemenas in the new Galitzin-Wilip not found in older instruments of the same type, and a report will be made on the laboratory-constructed seismometer that afforded some interesting experiments before the arrival of the new instrument.

It might be noted in conclusion that the Dominion Observatory, Ottawa, has made a study of the recent Grand Banks earthquake and has published a list of thirty-two stations that submitted grams and data for the investigation. The Canisius College station is first on the list. While the average deviation from the mean of the various stations, computing the time of origin, O, amounted to ten seconds, the deviation of the Canisius record was only four seconds.

A NOTE ON SEISMOLOGY

REV. W. C. REPETTI, S. J.

From the Manila Observatory, Manila, P. I., we received the following: "I am enclosing a copy of a letter which I found recently while going over old correspondence of the Observatory. It was written by John Milne to someone here, but as the envelope had been destroyed I do not know the person. I am sure it will be of interest to the seismologists, because John Milne is sometimes spoken of as the Father of Modern Seismology. It seems to me that it will be of some interest even to non-seismologists. It shows how young Seismology really is."

Imperial University.

Tokio June 11th 1895.

My Dear Sir,

I thank you for your note of April 13 and also for the three reports. I am very sorry to say that I lost all that you sent me in previous years. My next address is Geological Society, Burlington House, London. I am glad to tell you that it is now an established fact that all larger earthquakes can be recorded at any point upon the earth's surface. In October at 3 stations I recorded the Argentine shock, and the Argentine Republic is practically the antipodes of Japan. The instruments I use in Japan and made here with its................and column costs 70 yen= 7 pounds (see Seis. Journal, Vol. III).

I am already promised support in England to establish say 12 or 15 similar instruments in different parts of the world, the chief object being to determine the velocity of propagation which reaches 10 or 12 km. per second. Therefore as this is twice as quick as motion can be transmitted through glass or steel, we conclude that it comes *through* the earth. Therefore what is the earth made of or what is it rigidity?

These instruments also give a continuous photographic record of microseismic motion and diurnal waves. It seems to me that seismology is on the verge of exploring a new field.

With kind regards,

Believe me to remain

Dear Sir

Yours Faithfully

John Milne.

MATHEMATICS

THE GEOMETRY OF EXTENDED REALITY.

REV. F. W. SOHON, S. J.

The arithmetization of geomerty, or the revaluation of geometrical concepts in terms of the purely ordinal concepts of a complex number system is to be regarded as an existence theorem, and has for its purpose the lifting of an abstract science from the host of irrelevant considerations that naturally attend a science garnered from our experience with extended bodies. Logically sound notion of continuity in the mathematical sense has been successfully obtained from the sections of a class of relations between the finite integers, the latter being knowable as the cardinal numbers of groups of the thinker's own thoughts. With this logically valid example before his eyes, the methematician generalizes and bolts the door against philosophical spectres by defining his abstract geometry to be the apostatic consideration of relational fields. An apostatic consideration is one in which the extensions of universal concepts are emphasized rather than their comprehensions. The apostatic consideration is opposed to the symbolic or algebraic treatment in which the comprehensions of the same concepts are emphasized. The concepts that have been developed in arithmetized geometry, which is itself but a particular application of abstract geometry, are to a certain extent isomorphous with concepts abstracted from experience with extended reality for the reason that the arithmetical continuum was originally patterned after extended reality, even though the spirit outran the flesh and the prototype was improved uoon. In other words the geometry of extended reality is another application of abstract geometry, and we may hope to clarify our concepts in the latter application, by a comparison with arithmetized geometry. In particular, the precise difficulties that are supposed to beset physical continuity are for the most part fallacies of such a nature that if they had any weight at all they could be urged against artithmetical continuity with equal force. Urged against the latter their absurdity is patent, and as the proposed difficulties are purely ordinal we legitimately infer that they are equally absurd when urged against a science isomorphous with arithmetized geometry. Thus the arithmetical continuum, by solving the difficulties against continuity in general has cleared up this question in the geometry of extended reality.

The present paper applies this argument to clear the mathematical fallacies, and then proceeds to answer the remaining philosophical difficulty against physical continuity.

A fundmental difficulty lies in the paucity of terms, so that we have a terminology that is equivocal, and the matter has become more muddled by attempting to analyze concepts conveyed by such terms. For instance, we may abstract from everything a body has except its extension and consider only what extension a body has, and what extension another body must have to fill its place exactly. Some call the concept space. Some form the concept of the absence of extension connoting the capability of receiving an extended body and call that space. Both concepts are clear and useful, and both need names. We shall call the first abstract extension and the second space. If we form the concepts first and name them afterwards the matter usually clears. If we reverse the process the reverse usually results.

An independent quantitative determinant of a body is called a dimension. If we wish to exclude time and mass the word spatial can be inserted, but nothing is gained thereby. The intellect may ignore a dimension, may assert a dimension, may deny a dimension. But in the case of a denial, something postive is either asserted or connoted. Ignoring dimensions, the concepts length, area are formed. Ignoring the shape of abstracted extension we get volume. We do not get any useful concept by ignoring all the dimensions of a body, so that there are three geometrical abstractions. Simultaneous assertion and denial of extension gives the concept of an extremity. In this concept extension with a cessation of extension is asserted. The extremity of abstract extension is a face, the extremity of a face is an edge, the extremity of an edge a vertex. The extremities are really but inadequately identified with the extended reality of which they are the extremities. It should be noted that an extremity has a positive and a negative side both in the mathematical and in the philosophical sense.

The adequate separation, at least mentally, of an extended reality into two and only two parts is called a dichotomy. As actualization does not change the metaphysical nature of a possible, no help is obtained from distinguishing actual and possible dichotomies. As a trichotomy is nothing but two dichotomies, the possibility of division rests on the possibility of the dichotomy, and where the dichotomy is impossible the entity is indivisible. The result of a dichotomy is the definition of parts, and at the extremity of a part where the extension of one part ceases we have an internal face. But the parts do not have a common face, for the negative side of one face corresponds to the positive side of the other. A face is something real, but the parts cannot have any reality in common since the distinction is by hypothesis adequate. There are then two contiguous internal faces with nothing between them. This nothing between the faces is pictured by the imagination as an exceedingly thin lamination. It has been found convenient to hypostatize this negation as the subject of impotant ordinal properties. It might have been dispensed with, with a corresponding increase in the complexity of goemetrical terminology. As the concept is found to be serviceable, let us call it a septum. A septum is the negation of extension combined with the assertion of position. The extension that is denied is an extension of the entity of the septum. It does not deny the extension of some other entity that continues through the septum. The septum is intrinsically inextended, but it denotes a position, and a position implies possible extension of some other entity, so that the septum is extrinsically extended in as much as it implies the extension of another entity. The septums are, of course, the surface, the line, and the point, and these together with space itself, because they are all intrinsically negations, are pure concepts.

The question that now arises is whether the mathematical notions are also valid for elements obtained in this way. Can a line be considered a continuous class of points? By this we mean of course, that there will always be a point between any arbitrarily chosen two, and if the points be in any way sorted into two classes one of which wholly precedes the other, then there will be one and only one point all of whose predecessors fall in one class, and all of whose successors fall in the other. This is supposed to be contradictory because it involves an infinite multitude, because it does not provide immediate successors still worse because it does not provide immediate predecessors, and intrinsically absurd because it is an attempt to make extension out of inextension.

It will be seen, then, that the objections are for the most part founded on assumptions that we have shown to be false in our discussion of the arithemetical continuum. The cardinal power of the points is not philosophically infinite, but the philosophically finite mathematically transfinite cardinal power 2^n. which we have already shown to exist. The proof is of course the one to one correspondence between the points and the lengths of the segments. The demand for consecutive elements comes from the imagination, which is only capable of building with blocks of appreciable size. All of our thoughts have each a finite duration, so that except the first and last each has an immediate successor and an immediate predecessor. Assuming that every temporal succession is ordinarily similiar to the succession of our thoughts and correlating space and time by means of motion, it naturally follows that either space is discontinuous or motion is impossible. But the correct solution is that not every succession is ordinally similar to the succession of our own thoughts.

Confusion is increased by an equivocal concept of order. It is argued that if there is no last position before a given position, the latter becomes inaccessible, because one would never cease going through the never ending series of its predecessors. There are three orders involved, a temporal order, a local order, and a catalogue order. Now just as the tallest man is not always the wisest, so a conclusion from one order may be quite different from a conclusion based on another. An endless catalogue may converge in space and in time, and so be cardinally and ordinally transfinite yet locally and temporally be numerically finite. And because there can be collections cardinally and ordinally longer than endless collections, as we showed in a previous paper, there is no difficulty in passing entirely through such a collection when it is contained within the compass of a little locality, and where the motion is such as to correlate time with location and not time with the catalogue number. The difficulties thus far considered are purely mathematical and their solution is purely mathematical and will be found in the paper on *Cardinal Number and its Generalization* "Vol. VII, No. 3, and on "*Arithmetical Continuity*" Vol. VII, No. 4. In the apparent creation of extension out of inextension alone there appears to be room for philosophical speculation.

It is argued that no aggregation of zeros can make a finite, and no matter how many points are put together, they will all coalesce and form one and the same point. This is quite true. But it does not follow that a line cannot be defined as a continuous class of points. It only follows that a line cannot be defined as a class of consecutive points. A point, though a pure concept, finds the reason for its existence in the position that it denotes. To put two points together involves moving one point. But if this is attempted the position is left behind and only the negation is moved. It is no longer the same point. Points are therefore essentially immobile as far as their system is concerned, and must be handled in situ. Now since the points of a line are ordinally similar to the real numbers, and the real numbers form an arithmetical continuum, it is reasonable to conclude that the class of points will also posses ordinal continuity. But extension cannot come from inextension. This is true. So what we obtain is a continuous negation of extension. But every point is extrinsically extension. since it denotes a position, and a position implies a possible extension. Hence we obtain a continuous negation of extension connoting the possible presence of an extended body. In this way the concept of space arises from its elements.

To obtain real extension, we need an entity that asserts extension on both sides of the septum. This entity has a definite cross sectional area, the area of the extended body. Its dimension perpendicular to this is not mentioned, is not known, and is not important, except that it is by definition not zero. Let us call this concept a continuant. The continuant is by definition intrinsically extended. The continuant is only studied as it passes through the septum. Hence the continuant is extrinsically inextended since it implies and is associated with an inextended septum. It is defined to be the exact opposite of the septum, and continuant and septum will be correlatives in an extended body. We then have a continuant of extension between any arbitrarily chosen two, and if the body is adequately divided into two parts one of which wholly precedes the other, then there will always be a continuant associated with the septum joining the parts. We do not therefore build up extension out of inextension, but we find continuants of extension between continuants of extension until the whole thing is one continuous extended entity.

Against this solution it may be argued that it fails when applied to time and to motion and hence in the last analysis the continuant must be really indivisible. The sum total of all actuality is the temporally inextended, indivisible now. Extended duration must be made out of inextended instants. But we think that the same distinction still applies. We assert that it is not only unnecessary to deprive the continuant of extension, but it is actually a misrepresentation to confuse it with the septum. The continuant alone has reality, the septum is a pure concept. Actuality has duration, and while for purposes of marking time, for mathematical purposes we may picture the present as a durationless septum separating the past from the future, this is a mere dichotomy of the time extension that should not be mistaken for the duration that continues through the septum. It is not actuality that is durationless but our cross section of actuality We should sot think of duration as made up of durationless instants, but we find duration continuing through durationless instants that have been introduced by us for the purpose of marking time.

BOOKS

The books mentioned in this column are recommended by our Science Professors as suitable for the Science Libraries.

Text-book of Anatomy and Physiology, 7th edition, Kimber & Gray
MacMillan Co., N. Y.

Study Guide Text-book in Anatomy and Physiology, Gray
MacMillan Co., N. Y.

Laboratory Manual in College Physiology, Hickman
MacMillan Co., N. Y.

Bacteriology, Revised Edition, Buchanan
MacMillan Co., N. Y.

A Text-book of Histology, Maximow
W. B. Saunders Co., Philadelphia, Pa.

Physico Chemical Methods, Reilly, Rae, Wheeler
Van Nostrand Co., N. Y.

Atoms, Molecules and Quanta, Ruark, Urey
McGraw, Hill Book Co., N. Y.

Volumetric Analysis, 2 Vols. Kolthoff
John Wiley & Sons., N. Y.

Handbook of Chemical Microscopy, Chamot, Mason
John Wiley & Sons., N. Y.

The Fundamentals of Chemical Thermo-Dynamics, Butler
MacMillan Co., N. Y.

Hydrogen Ions, Britton
Van Nostrand Co., N. Y.

The Concise Summary of Organic Chemistry, Constable
E. P. Dutton & Co., N. Y.

Chemistry and Technology of Diazo Compounds, Cain
Arnold & Co., London.

History of Manufacture in United States, Clark
McGraw, Hill Book Co., N. Y.

Two Thousand Years of Science, Harvey Gibson
MacMillan Co., N. Y.

Wave Mechanics, De Broglie; E. P. Dutton & Co., N. Y.

Wave Mechanics, Sommerfield; E. P. Dutton & Co., N. Y.

Electricity and Magnetism, Culver
MacMillan Co., N. Y.

Introduction to Theoretical Physics, Page
Van Nostrand, Co., N. Y.

The Physical Principles of the Quantum Theory, Heisenberg
University of Chicago Press, Chicago, Ill.

Modern Physics, Wulf, S. J., E. P. Dutton Co., N. Y.

BOOK REVIEWS.

T. D. Barry, S. J.

A SOURCE BOOK IN MATHEMATICS, by David Eugene Smith (McGraw—Hill Book Company. $5.00.)

This is the second in a series of "*Source Books in the History of the Sciences*", under the general editorship of Gregory D. Walcott. The first volume "*A Source Book in Astronomy*", by Harlow Shapely and Helen E. Howarth, appeared last year. The present volume, edited by the well-known professor of Mathematics at Columbia University, is prepared along the same general lines as the other. The purpose of the book is to supply teachers and students with a selection of excerpts from the works of the makers of the science of Mathematics. According to the general plan of the series, the material is limited to the works published between the invention of printing in the fifteenth century and the beginning of the twentieth century. This necessarily excludes the work of the early Greek Mathematicians and others who have really laid the foundations of the science, but there is still enough material left to make up a book of nearly 700 pages. The sources written in languages other than English have been translated to the vernacular. The volume is divided into five parts, as follows: I. The Field of Number; II. The Field of Algebra; III. The Field of Geometry; IV. The Field of Probability; V. The Field of the Calculus, Functions, Quaternions. Among the selections given are: Dedekind on Irrational Numbers, Wallis on Imaginary Numbers, Euler on the Use of e to represent 2.718........, Napier on the Table of Logarithms, d'Ocagne on Nomography, Cardan on the Cubic Equation, Fermat on the Equation $x^n + y^n = z^n$, Newton on the Binomial Theorem for Fractional and Negative Exponents, Horner on Numercial Higher Equations, Desargues on the 4-rayed Pencil, The First Use of π for the Circle Ratio, Descartes on Analytic Geometry, De Moivre's Formula, two selections from Clavius on Prosthaphaeresis, Cremona on Geometric Transformations of Plane Figures, Mobius, Cayley, Cauchy and others on Higher Space, Legendre on Least Squares, Newton on Fluxions, Leibniz on the Calculus, Euler on Differential Equations of the Second Order, Bossel on his Functions, Nobias on the Barycentric Calculus. The book is strongly recommended to our teachers of Mathematics; it is invaluable in a study of the history of the science, and gives access to the original works of the great mathematicians of the past.

BARLOW'S TABLES OF SQUARES, CUBES, SQUARE ROOTS, CUBE ROOTS, etc, Edited by L. J. Comrie. (London: E. & F. Spon. $1.90.)

A very handy book for those who have much computation to do, and especially adapted for the use of calculating machines, as would be expected from such an ardent advocate of the use of such machines as Dr. Comrie, who has recently taken charge of H. M. Nautical Almanac Office at London. For each number form 1 to 100 are given the square, cube fourth power, square and cube root, factorial, reciprocal of both the number and its square root. The same data, with the exception of the factorial, are given for the numbers between 100 and 1000. The next section, for numbers between 1000 and 10000, gives n^2, n^3, the square root, cube root and reciprocal of n, and the square root of 10n. Additional tables at the end of the volume give the 4th to the 10th powers of numbers from 1 to 100, and the 11th to the 20th powers of numbers from 1 to 10. A short table gives the coefficients of the terms in the expansion of binomials from the first to the 12th powers. The value of π and e and of several of their more common powers and roots are given to 15 decimal places. Tabular differences are given throughout the book for some of the functions of n, as an aid to interpolation. The book may be ordered form G. E. Stechert, 31 East 10th Street, N. Y .

NEWS ITEMS

HOLY CROSS COLLEGE. The faculty and students of the department of chemistry will conduct a seminar in the recent advances in chemistry during the scholastic year from November 14, 1930 to April 24, 1931. The topics discussed cover many phases of progress in chemistry.

The Scientific Society at Holy Cross College is presenting this year a symposium on radio.

The program of talks is as follows.

1. General View of Subject.
2. Description of Vacuum Tube; 2 electrode, 3 electrode
   Its construction
   Explanation by electron theory of thermionic emission.
   Use of grid
   Brief references to its use as Detector and Amplifier.
3. Tuning.
   Inductance and Capacitance and their control of tuning.
4. Use of Tube as Detector.
5. Radio Amplification and use of the tube.
   3 general methods of coupling tube, and characteristics of each.
6. Audio Amplification.
   Difference between Radio and Audio Amplification.
   Advantages of each
   Methods of coupling and their characteristics
7. Parts of Receiving Set.
   What they look like and the function of each
   Description of several types with diagrams
8. Sound Speakers.
   Magnetic Principle, Various types.
9. Radio Transmitters.
10. Wave Transmission.
11. Television.

Arrangments have been made with Professor H. Newell of Worcester Polytechnic Institute to give the talks on Radio Transmitters and Transmission. Professor Newell is connected with the radio station WTAG of Worcester. We also hope to have Father Henry Brock, of Weston give a lecture on Television and Mr. O'Callahan, of Boston College has promised to speak on Radio Amplification.

The Scientific Society is composed chiefly of Juniors and Seniors who are interested in Science. The Society was instituted in 1908 by Father Henry Brock, and has been active ever since.

BOSTON COLLEGE. In the department of physics there are three hundred and twenty-five students. Of the four hundred and sixty-one students in Freshman Class, thirty-six are in the B. S. course.

BOSTON COLLEGE HIGH SCHOOL. A new fourth year mathematics course has been introduced, in which a full year is given to trigonometry, supplemented by those parts of algebra of which a review is deemed advisable for present and future needs. It was deemed inadvisable to drop a study of quadratics from the algebra course, as suggested at the last convention. Graphs, series and proportion are no longer being taught in this course. We hope to have explanations of these decisions appear as articles in this Bulletin in the near future.

Rev. Joseph J. Daley is continuing his research work in low frequency (i. e. audio) amplification.

FORDHAM UNIVERSITY. The faculty of the chemistry department for 1930—1931 is as follows: Rev. Francis W. Power, S.J., Head of the Department; Dr. Anthony M. Ambrose, Assistant to Dr. Sherwin; Dr. George Bacharach, Organic Chemistry and Organic Chemical Research; Dr. Francis J. Brogan, General Chemistry; Mr. William J. Conway, General Chemistry; Mr. Daniel J. Fitzpatrick, Assistant to Dr. Hynes; Dr. Walter A. Hynes, Qualitative Analysis; Mr. Nicholas Mellilo, Assistant to Dr. Bacharach; Dr. Francis S. Quinlan, General Chemistry; Mr. Claude R. Schwob, Assistant to Dr. Bacharach; Dr. Carl P. Sherwin, Physiological Chemistry and Physiological Chemistry Research; and Dr. Leo K. Yanowski, Quantitative Analysis.

Thirteen graduate students are in course for their Ph.D., in Organic Chemistry. Seven graduate students are in course for their Ph.D., in Physiological Chemistry. Seven graduate students are in course for their M.S., in Organic Chemistry.

Since the completion of the new Physics Building the Chemistry Department occupies the entire Medical School Building. The old Chemistry Office has been made into a Chemistry Library and the Physics Office is now being used as a Chemistry Office. Two new tables are being installed in the two amphitheaters.

LOYOLA COLLEGE. Baltimore, Md. The following Professional Chemists will lecture to the Loyola Chemist's Club during the scholastic year: Dr. F. O. Rice, Johns Hopkins University; Dr. F. W. Germuth, Bureau of Standards; Dr. S. T. Helms, Emerson Drug Co., Dr. Neil E. Gordon, Johns Hopkins University; Mr. H. A. Thoman, Copper Smelting and Rolling Co., Mr. W. F. Barnwell, Air Reduction Sales Co., and Mr. J. Mathews, Crucible Steel Corporation.

The students will conduct a seminar in chemistry on Wednesday afternoons from November 12, 1930 to May 20, 1931.

Rev. John A. Frisch is Head of the Department of Biology.

The Physics Department has added many new books to its library.

CANISIUS COLLEGE. The latest model of Galitzin Seismograph has been installed. Cf., the article in this issue of the Bulletin.

CANISIUS HIGH SCHOOL. On October 14, Professor Saunders of Alfred University gave a lecture on "Liquid Air" to the student-body.

GEORGETOWN UNIVERSITY. CHEMISTRY DEPARTMENT. Mr. Francis P. Wilson, M. S., Mr. Arthur A. Espenshield, M.S., and Mr. John Q. Connolly, M.S., are graduate students and in course for the Ph.D. degree. Mr. John T. Mountain is in course for his M.S. degree. At the first meeting of the Chemists' Club, Dr. M. X. Sullivan, Chief Chemist of the Public Health Service, gave an address: "The Romance of Chemistry in our Daily Lives." The Chemistry Teachers Association of the District of Columbia held their first meeting of the year at Georgetown on November 20th. The speakers were Rev. George L. Coyle of Georgetown University and Dr. Harrison E. Howe, editor of "The Journal of Industrial and Engineering Chemistry." The president of the association is Dr. Joseph A. Muldoon of Georgetown.

DEPARTMENT OF SEISMOLOGY. Mr. F. H. Wopert is a graduate student in seismology and is in course for his M.S. degree. The Russian Government has requested fifteen copies of "Memoranda and Tables," to faciliate the determination of constants of the Galitzin instruments. Rev. F. W. Sohon was recently elected a member of the American Geophysical Union. Earthquake recordings for October: thirty-seven earthquakes without distinct phases and eight with distinct phases. All were reported in full. A printing frame, thirty-six by twelve inches was constructed for making contact prints from seismograph records.

OBSERVATORY. Preparations are being made to make extensive observations of Eros, in January of the coming year. For this purpose, the twelve inch equatorial is being fitted with a photographic corrector. Father P. McNally represented Georgetown at the Harvard Observatory Conference on variable stars. Mr. P. Fitzgerald has been assigned to private study at the Observatory.

WESTON COLLEGE. During the summer months the Chemistry Department has been entirely renovated.

WOODSTOCK COLLEGE. In the Biology Department, Father F .X. Reardon has introduced a new text-book, "Backgrounds in Biology," by Giesen and Malumphy, published by Bruce Publishing Co. The book is well adapted for local conditions, which call for a lecture course in the principles of biology to serve as a foundation for psychology. The authors, a present and a past professor at Holy Cross College, deserve great credit for this publication. Father Reardon has a set of slides made from the illustrations in the text and the negatives may be loaned if anyone wishes to have a similar set.

MANILA, Philippine Islands. Rev. James B. Mahoney, Professor of Physics in the Ateneo de Manila for the past five years, has been appointed Rector of the College of San Jose, Manila; to this college is attached the Jesuit Observatory and the Philippine Weather Bureau.

ENGLAND. Professor Edmond Taylor Whittaker, Professor of Mathematics and Dean of the Faculty of Arts at Edinburgh, and formerly President of the Mathematical Association and Astronomer Royal of Ireland was recently received into the Church by Father Albert Gille, S.J.

CHINA. The cornerstone of the Jesuit Museum of Natural History at the Aurora University was solemnly laid by the Rev. Yves Henry, S.J., Superior of Zikawei, Shanghai. The new institution will house the scientific treasurers gathered by the Jesuit Fathers during one hundred years of activity in China and numerous recent collections.

The Rev. Teilhard de Chardin, S. J., accompanied the transasiatic Citroen Expedition as geological expert. According to present plans the caravan will go as far as West China and thence return to Peping. From there it will proceed to Indo-China. Father Teilhard, who is attached to the Jesuit Museum—Laboratory at Tientsin, last year journeyed through Shansi in his capacity at counsellor to the geological service of the Chinese Government.