S. J. B.

A. M. D. G.

BULLETIN

of the

American Association of Jesuit Scientists

(Eastern Section)

For Private Circulation

LOYOLA COLLEGE

BALTIMORE, MARYLAND

VOL. IX DECEMBER, 1931 NO. 2

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EASTERN STATES DIVISION

Vol. IX December 1931 No. 2

EDITORIAL

The experimental sciences of our day are the orderly arrangements of the facts accumulated by the toil of thousands of scientific men. If one were to live two centuries, he could not discover even a small fraction of what has been found out by the hosts of those who have labored in the various sciences for generations. The facts and experimental data of biology, chemistry, mathematics and physics are so numerous, that we as Professors, have scarcely time to read all the journals and literature of our particular branch of science. Much less, have we the opportunity to investigate and thoroughly scrutinize the theories that are accruing from these facts.

One of the helps we have to keep us informed of the tremendous strides of our own particular work in science, is the annual convention. Here we have an opportunity to gather much information in a short time. The eighty-second meeting of the American Chemical Society was held in Buffalo, New York, during the first week of September. There were two thousand and fifty-seven chemists registered from all the States in the Union, and thirty-eight from foreign countries. Four hundred and ten papers were presented by nineteen divisions. The first general meeting offered a symposium on: "New Research Tools". The first four speakers were concerned with: "Dipole Moments", "Molecular Beams", "Raman Spectra", and "Molecular Spectra". This was the first of eight symposia held during the course of the meeting. The divisions and sections of particular interest to Ours were Physical and Inorganic Chemistry, Analytical Chemistry, Organic Chemistry, Colloid Chemistry and Chemical Education. These sections offered more than one hundred and forty papers which dealt with many new facts, theories, research problems and results. The subjects treated in these sections are too numerous to mention.

The leading investigators of the sciences are in universities, research institutions and industrial laboratories. These are the men who constitute the major portion of the members of well organized conventions. One of the great privileges and advantages of these meetings is to come in close contact with the great and outstanding persons of their profession. They are pleased to answer questions and invite discussion; after the first meeting, they always greet you cordially and will remember the queries put to them sometime before; also they will consider any suggestions made. You have the advantage of talking to the author of the text-book that you might be using in your work in the lecture-room or laboratory. You may have doubts about some of the statements made in the book. Here is the opportunity to ask for explanations. Perhaps you read an article in one of the scientific journals that needs further comment.

The enormous amount of research problems that are in progress in our universities and industrial laboratories are overwhelming; at these conventions a clear exposition is made of the successes and failures in experimental efforts. Finally, self interest and self improvement, the desire to become a better teacher, to know the latest advancements, to learn new methods that are helpful in lecturing, to exchange ideas with others who are engaged in the same type of endeavor,—these are some of the advantages of attending annual conventions.

The Faraday Centennial

The year 1931 marks the centennial celebration of the discovery of the principle of electro-magnetic induction, by the great Michael Faraday. The world is celebrating not only this discovery, but also the tremendous stimulus it created in the field of electro-magnetism.

Faraday's first work on electro-magnetic induction was in September 1821, when he showed he could produce continuous rotation of a wire with an electric current round a magnet and of a magnet round a wire. Herein was the realization that an electric current and a magnet act upon one another with forces which would create continuous rotation. But the problem of converting magnetism into electricity was not solved until August 29, 1831, the centenary of which we are now celebrating.

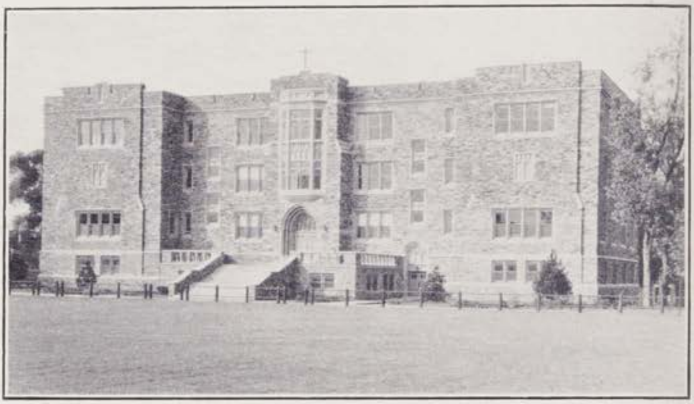
Faraday's experimental researches exerted a tremendous influence on the works of all other physicists. The effect of his discovery can be seen in the investigations of Gauss on terrestrial magnetism, in Mossoth's researches on dialectrics, in Oersted's work on dia-magnetic phenomena, in Maxwell's theory on the pressure of light, in Hertz's experiments, and later in Marconi's researches on wireless telegraphy. It influenced Ampere's theory on the structure of magnets, Stephan's investigations on electrodynamic and diamagnetic induction, and Boltzman's researches on the dialectric constants of gases and sulfur.

Faraday's discovery modified the living conditions of every civilized country. It is the foundation of electric light, power transmission and transportation systems, it paved the way for the invention of the telegraph, telephone and radio. His discovery makes possible the production of aluminum and copper.

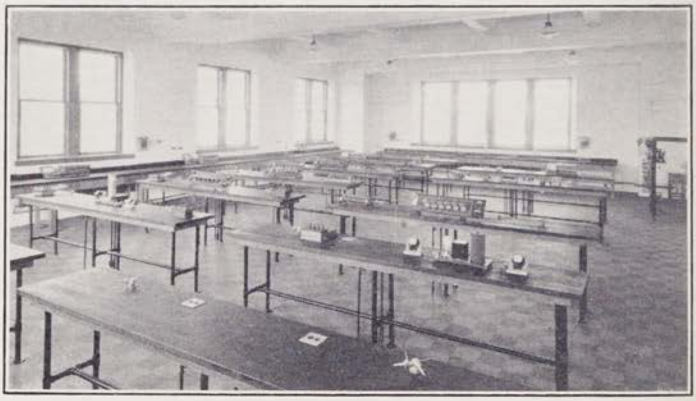
It is small wonder, then, that the world is celebrating the centenary of the discovery of a great principle by the great physicist and chemist—Michael Faraday.

REV. JOSEPH J. SULLIVAN, S.J.

Fordham University



Physics Building



Electrical Laboratory

THE NEW PHYSICS BUILDING AT FORDHAM UNIVERSITY

The new Physics Building is a four story Collegiate Gothic structure with provision for a fifth story to be added later should research facilities require such expansion. The building is 172 feet long and 64 feet wide. It is constructed in the form of the letter H, although the wings are not symmetrical—one wing being 64′ by 40′ and the other 60′ by 36′. The hyphen of the H is 96 feet long and 50 feet wide.

The first floor of the building is devoted to the shops; the second to lecture rooms; the third to offices and the fourth to laboratories.

On the first floor we have a machine shop, a generator room, an X-Ray room, a photographic dark room, a radio room, lavatories, a store room, a receiving room and a Heat Laboratory 64 by 60 feet.

The second floor has two large lecture rooms, each occupying two floors and accommodating 300 and 160 persons. The former was built extra large for meetings, conventions, etc. These rooms are of the amphitheater type and beneath them are two other lecture rooms seating 55 and 45 respectively. Two smaller rooms in the front of the building hold 33 apiece. These latter four rooms are used chiefly for quiz groups. On this floor running the length of the hyphen of the H, at the back of the building is a large room devoted to demonstration apparatus. This room has an entrance from both lecture halls as well as from the corridor leading to the other four rooms, enabling the demonstration apparatus, with which it is well equipped, to be handily wheeled to any lecture room (on especially designed carriages.)

The third floor is devoted to the offices, a library, four research rooms (the latter measure 16 by 20 feet), a teachers' room and the upper halves of the two large lecture rooms.

The entire fourth floor is given over to laboratories. The larger wing contains the Mechanics Laboratory; the smaller the Electrical Laboratory. In the central section of the building and immediately adjoining each of these laboratories is its respective stock room. A corridor joins the two laboratories and divides the hyphen into two parts. In the rear half there is an individual research room and a large laboratory of twenty light tight compartments used mainly for photometry and spectrometry. In the front section another large research room and a general Light Laboratory are located. The latter is equipped with optical benches and tables of appropriate design.

Some special features of the building are the following: In the lecture rooms daylight screens have been built into the lecture desks to be raised when needed and all projection is done from behind the desk. A projection galvanometer replaces the old wall type of demonstration meter. Throughout the building metallic inserts have been conveniently spaced about the walls in order that objects may be mounted thereon without damage to the plaster. In the demonstration room desks similar to those in the class rooms are used for preliminary tests. There is also a special Geophysics Laboratory in which the seismic records are filed and most of the seismological work done. All floors are served by a full-size, automatic elevator for passengers and for freight.

The desks in the lecture rooms are 20′ by 3′ by 3′. At one end is a large concealed sink. Sockets for supporting upright rods are placed at intervals across the top. In the center the daylight screen raises with its supporting rods. Several outlets for gas and electricity are placed in the rear. Voltages at 6, 12, 110 D. C. and 110, 220 A. C. are furnished. (Incidentally, these same water, gas and electrical faculties are obtainable in each research room.) Beneath the desks are exhaust pumps operated by external switches and carriages for projection lanterns, etc.

REV. J. JOSEPH LYNCH, S.J.

ASTRONOMY

ECLIPSES OF THE SUN

Part I. Their Explanation and History

Rev. T. D. Barry, S.J.

On January 24, 1925 occurred an event in the field of Astronomy which excited a tremendous amount of popular interest in this country, especially in the northeastern section. It was an event which was heralded for weeks ahead of time in the newspapers, which devoted columns and even pages to advertising it, an event which, it was estimated, was witnessed by over 10,000,000 people, and which, on the following day, stole the front pages from the murder trials and international complications. For on that day the sun was eclipsed by the moon, whose shadow swept across the northeastern portion of the United States, shrouding in darkness cities such as Buffalo, Poughkeepsie, New Haven and even the northern portion of New York City. The interest in the eclipse was such that Mayor Lovelace of Poughkeepsie ordered all the church bells of the city to be rung, lest the citizens miss the great display. Nearly half of New York State, most of Connecticut and Rhode Island, as well as portions of Pennsylvania and New Jersey were included in the path of the shadow. On August 31, 1932, New England will be visited by another eclipse of the sun, and although the duration of the eclipse will not be equal to that of 1925 and no great centers of population will be included in its path, it should not be devoid of interest. For this reason, it would be well to offer this article on the general subject of eclipses of the sun, and in a future article to give special reference to next year's spectacle.

What is an eclipse? It is known to all that just as the earth travels around the sun in the course of a year, so also the moon journeys around the earth in approximately 29.5 days. Occasionally the path of the moon in its circuit around the earth causes it to pass between the earth and sun, shutting off the light of the latter, the result being an eclipse of the sun, total or partial depending on whether the moon cuts off all or only part of the sun's light. Such a phenomenon can happen obviously only at the time of new moon. On the other hand, when the moon reaches the other end of its orbit, it may get on the same line with the sun and the earth, and, since its only illumination is that which it obtains from the sunlight falling on it, that light is shut off through the intervention of the earth, resulting in a total or partial eclipse of the moon, depending on whether all or only part of the light is withheld from it. Further discussion of eclipses of the moon is beyond the scope of this paper.

The earth, as was mentioned above, moves around the sun once a year, in a plane called the ecliptic. This plane makes an angle of about 23°27′ with the plane passing through the equator of the earth. The moon's revolution around the earth takes place in another plane, which does not coincide with that of the ecliptic, but makes with it an angle which has a mean value of approximately 50°8′. It is evident that if the two planes coincided an eclipse of the sun would be a monthly event and would probably cause about as much excitement as new moon does. As things are arranged, however, certain conditions must be fulfilled in order to make an eclipse possible. The intersections of the moon's orbit with the ecliptic are called the nodes, the one at which the moon passes from the southern side to the northern side of the ecliptic being called the ascending node, the other being the descending node. Since the sun moves only slightly from the plane of the ecliptic, an eclipse of the sun can take place only when it is very close to one of the nodes at the same time that the moon is crossing the ecliptic at the same node. The distance of the sun from the node conditions the possibility of the eclipse and determines whether the eclipse shall be total or partial only. Certain values of this distance are called the ecliptic limits. If the sun is more than 18°31′ from the node an eclipse is impossible. If the distance is less than 15°21′ an eclipse, at least partial, must take place. Between those limits an eclipse may or may not take place. For a total eclipse the limits are considerably smaller. If the distance of the sun from the moon's node is greater than 11°50′, a total eclipse is out of the question, although there is the possibility of a partial eclipse. If the distance is less than 9°55′ a total eclipse is inevitable. Between those limits a total eclipse may or may not take place. The reason for the uncertainty rests in the fact that the sun and the moon are at varying distances from the earth with resulting variations in diameter, and in the fact that the inclination of the moon's orbit varies 11′ on either side of the mean value of 5°8′ mentioned above. Mathematical computation may be resorted to in order to remove the doubt. Usually however recourse is had to the Saros.

The old Chaldeans, being for the most part herdsmen, used to spend the night hours in the study of the heavens. One result of their observations was the discovery that eclipses repeat themselves at intervals. This interval is known as the Saros, and has been evaluated at 18 years, 10 or 11 days (depending on whether 5 or 4 leap years occur during the interval), 7 hours and 42 minutes, which is equivalent to 233 returns of the moon to the same node. At the end of this period an eclipse will repeat itself under nearly the same circumstances, although due to the fact that the Saros differs from an integral number of days by approximately one-third of a day, it takes that much longer for the moon to reach the node, and consequently the eclipse will be seen from a part of the earth differing in longitude by about 120° to the westward from the preceding eclipse in the series. If an eclipse takes place at the descending node, the next in the series will take place at the same node, but the latitude of the eclipse path will be farther south. The opposite is true if they take place at the ascending node, so that a series of eclipses does not last indefinitely. In the first eclipse of a descending node series the path crosses near the north pole, then at intervals equal to the Saros others will occur, the path being farther south in each case, until finally one happens near the south pole which will be the last of the series. By that time other series will have started. Each series comprises from 68 to 75 eclipses. The first few will be partial, until the shadow gets down to a point where it is intercepted by the earth. Then will begin a series of total or annular eclipses, followed by several partial eclipses as the shadow passes beyond the south pole of the earth. The total number of partial eclipses at the beginning and end of a series is about 25.

The diameter of the sun is about 864,000 miles, while that of the moon is about 2150 miles. Consequently the shadow cast by the moon has the form of a cone whose elements are tangents to the limbs, or edges, of the moon and the sun. The height of this shadow is very nearly equal to the distance of the moon from the earth, but because of the fact that the orbits of the earth around the sun and of the moon around the earth are not circular but elliptical the distances vary and with the distances the length of the shadow. Thus the distance of the sun from the earth changes between 91,500,000 and 94,400,000 miles, while that of the moon varies between 253,000 and 221,500 miles. These distances are measured between the centers of the bodies in question and must be diminished by 4,000 miles to get the distances to the surface of the earth. The length of the moon's shadow varies between 235,700 and 228,120 miles. When the length of the shadow is greater than the distance from the moon to the surface of the earth, the apex of the cone lies beneath the surface and a total eclipse of the sun results. The intersection of the earth's surface with the cone causes a circular or elliptical shadow to lie on the surface. Since the moon travels across the heavens from west to east with a speed about thirteen times as great as that of the sun, this shadow moves across the earth from west to east, giving the path of the total eclipse. At all points within this path the surface of the sun is completely hidden behind the moon. At points on either side of the path, only part of the sun is obscured, being less the farther the point is from the path of totality. At such places the eclipse is called partial. A partial eclipse is also had when the direction of the shadow does not take it directly toward the earth, but close enough to allow part of the sun to be obscured by the moon. This phenomenon occurred three times during the present year (1931). On April 17-18, the shadow passed to the northwest of the earth, but close enough to have a partial eclipse visible in the vicinity of the north pole and over a large portion of Asia. On September 12, the shadow passed to the northeast and at such a distance from the earth that the eclipse was visible as partial at only a very small area, comprising the easternmost tip of Siberia, Bering Sea, and the western part of Alaska. On October

11, on the other hand, the shadow passed to the south of the earth, the eclipse being visible as partial at the south pole and in the southern half of South America. The first of these eclipses occurred with the moon at the ascending node, that is, passing from the southern to the northern side of the ecliptic, consequently the eclipses of that series are moving northward, and the series is near the end. The October eclipse occurred at the descending node, so that that series is also practically at an end. The September eclipse, however, occurred at descending node, but was visible in the northern hemisphere, so that a similar small partial eclipse may be expected in September, 1949, but at a location 120° to the westward, therefore in Eastern Europe or western Siberia.

In case the moon is at a great distance from the earth when the sun is near, the length of the shadow cone will be shorter and may not reach the surface of the earth. In that case the moon will not be large enough to cover the sun's disc completely and the excess of the sun's disc will appear as a ring of flame around the moon. This ring will be visible along a path corresponding to the path of totality for a total eclipse. In this case the eclipse is called annular. At points not on the path of the annualar phase, the eclipse will be visible as partial. This occurred on November 1, 1929, when the phenomenon was visible along a path starting south of Newfoundland, crossing the Atlantic Ocean and equatorial Africa, and ending in the Indian Ocean.

An intermediate case is also possible, because of the fact that the central point of the earth's disc as seen from the moon is 4,000 miles nearer than the edge. If the length of the shadow is such that the apex of the cone lies below the surface of the earth during part of its course but above it during the remainder, the eclipse is called central. Under these circumstances the eclipse is annular until the apex of the cone reaches the surface of the earth, then it becomes total for a short time, finally becoming annular again. An eclipse of this type happened on April 28, 1930. The path of the annular phase began in mid-Pacific and moved northeastward, becoming total just before reaching the coast of California. The shadow then crossed to the north of San Francisco until it reached Montana, there becoming annular again for the rest of its course. In such an eclipse the duration of the total phase is usually extremely short, the one in question lasting about 1.5 seconds at most.

In any one calendar year, the minimum number of eclipses (taking into accounts all kinds, lunar and solar, total, partial and annular, is two, both of them being of the sun. The maximum number is seven, of which five are of the sun and two of the moon. The solar eclipses may come in pairs, each pair separated by one month. If there are two such pairs in a year, and if the first eclipse occurs in the early part of January, another will occur late in December, thus making five for the year.

The duration of the total phase of a solar eclipse depends on the diameter of the shadow cast on the earth and on the portion of the earth that is swept by the shadow. It may be as short as a second or two, as in the case of the total phase of the central eclipse mentioned above, or, if the moon is very close to and the sun far from the earth and if the shadow crosses near the center of the earth as seen from the moon, it may last as long as seven and a half minutes. The general run of them last less than three minutes. The average width of the path of the shadow is 100 miles, although under favorable conditions it may form a belt of darkness 167 miles wide. The movement of the shadow across the earth is very rapid. The moon moves its own diameter in an hour, that is to say, about 2100 miles. Since the sun is so much farther away, the shadow moves across the earth at about the same velocity. But it must be remembered that the earth is rotating on its axis in the same direction as the motion of the shadow, with a velocity of 1040 miles per hour at the equator. For other stations this value must be multiplied by the cosine of the latitude. Therefore the resultant velocity of the shadow with respect to a point on the earth is somewhat over 1000 miles per hour.

The percentage of the sun's disc which is hidden by the moon is called the magnitude of the eclipse. It is usually expressed as a decimal fraction, the total area of the disc being taken as unity. Thus, for a total eclipse, the magnitude is 1.000. For a place just outside the path of totality, the magnitude will be very great, but will decrease with distance from the path. Thus, in the case of the eclipse of January, 1925, Weston was just outside the path, and the magnitude was 0.99. At Panama, which was much farther away from the path of totality, only about 20 percent of the sun was obscured by the moon.

The first eclipse recorded is said to have taken place on October 22, 2137 B. C. But the date is not too well founded, derived as it is from the early Chinese records. The event is famous because of the fact of the imperial astronomers, Hsi and Ho, who, instead of being on hand to frighten away the moon, went off and got drunk, thereby making their necks forfeit. An attempt has been made to fix an eclipse in the year 2155 B. C., but without success, as there was no eclipse visible in China in that year. It has however given rise to the verses:

> Here lie the bones of Ho and Hi,
> Whose fate though sad was risible,
> Being hanged because they failed to spy
> The eclipse that was invisible.

Confucius, the celebrated philosopher of China, in his book, "The Annals of Lu", records 36 eclipses between the years 720 and 495 B. C., of which 32 have been verified. The Chaldeans also, who have been credited with the discovery of the Saros, recorded many eclipses, the earliest of which took place in 763, 669, and 661 B. C.

Eclipes have been used at various times to fix dates in ancient history. The most celebrated is the so-called eclipse of Thales, the mathematician of

Miletus. A war between the Lydians and the Medes was stopped very suddenly by the advent of an eclipse of the sun. Thales, according to Herodotus had already predicted the eclipse "within the year", probably with the aid of the Saros, with which he was no doubt familiar. The date has been fixed at May 28, 585 B. C. Another case was the siege of Syracuse by the Athenian fleet under Nicias and Demosthenes. The Athenians had been unable to make any headway against the defenders and had decided to withdraw, but on the night of August 27, 413 occurred a total eclipse of the moon, which threw the invaders into a panic. The soothsayers were consulted and gave the advice to continue the siege for thrice nine days, but during that period the Athenians were badly defeated, with the result that the two generals were executed.

Until the growth of astronomical science made the knowledge of the causes of eclipses absolutely certain, eclipses were objects of great popular terror and superstition. The people believed that the moon or a great dragon was devouring the sun, and that steps must be taken to frighten away the invader. We read of the people running wildly about the streets, beating drums and pans, and shouting and screaming to achieve this purpose. The fact that certain great disasters or defeats in battle were preceded by eclipses caused them to be looked on as omens and portents of evil. Even in this day and age, a superstitious dread of them still persists in some parts of the earth. The writer has it on good authority that as late as last April an example of this was witnessed in Iraq. The narrator of the story said that on a certain evening he was disturbed by a terrific clamor in the street, down which a mob was pouring, beating kettles, drums, anything that could make a noise, and accompanying the racket with cries and yells, the crowd being constantly augmented by fresh recruits from the houses and alleys. His first thought was that a "Holy War" was under way. But when the rabble had swept past his house, he made inquiries and was informed that an eclipse of the moon was in progress and that the people were trying to scare away the dragon which was eating the moon. Evidently there is room for a little education in that country.

As the knowledge of eclipses grew and popular superstition began to abate, these phenomena began to be looked forward to as means of obtaining fresh knowledge of the motions of the sun and of the moon, and of the constitution of the sun's atmosphere. Eclipse expeditions were formed which traveled to the ends of the earth to observe them. Unfortunately most eclipses seem to choose the most inaccessible parts of the earth in which to happen. Consequently eclipse expeditions cost a great deal of time and money, especially considering the short time in which actual observations are possible. S. A. Mitchell, the director of the Leander McCormick Observatory at the University of Virginia, had up to 1925 traveled nearly 50,000 miles to witness five eclipses with a total duration of about 18 minutes. It is therefore evident that in order to make the most of the time for observing, extensive preparations must be made. Among the eclipses which have been observed in the last five years are the following: January 14, 1926, at East Africa and Sumatra; June 29, 1927, in England and Norway; May 9, 1929, in Sumatra and Cebu, P. I.; October 21, 1930, at a little island in the south Pacific Ocean, named Niaufou and nicknamed Tin-Can Island. A volcanic eruption had destroyed one-third of the island earlier in the year.

Jesuit astronomers have not been in the background in the matter of eclipse observations. In 1860, photography was first applied to an eclipse of the sun by Warren de la Rue and by Father Angelo Secchi. The results obtained by the former were rather meager, but those of Father Secchi were very good. Equally successful were his observations of the eclipse of December 20, 1870, in Sicily. Father Stephen J. Perry, director of the observatory at Stonyhurst College, England, was four times appointed to command government eclipse expeditions. The first of these was in 1870 at Cadiz, in Spain, the same eclipse as that witnessed by Secchi. Sixteen years later he went to Carriacou in the West Indies in charge of a government expedition. The following year, 1887, saw him at Moscow in the same capacity, although the expedition was fruitless due to heavy clouds. Finally in 1889, he was commissioned to observe the eclipse at the Isles de Salut, off the coast of South America. However the climate of the islands belied their name, and Father Perry was stricken with a fever. In spite of this he kept at his work and successfully completed the observations, but died five days later, a martyr to science, on board H. M. S. *Comus*. (Incidentally it was also Father Perry who was twice named to lead government expeditions to observe the transits of Venus across the sun, the first time, in 1874, at Kerguelen Island in the Indian Ocean, later at Madagascar in 1882). Father Aloysius J. Cortie, recently director of the Stonyhurst Observatory, was likewise in charge of British expeditions, in 1911 to the Tonga Islands in the East Indies, and in 1914 to Hornoesand, Sweden. Father Cortie died in 1925. Finally, the eclipse of May, 1929, was witnessed at Cebu by a party from the Manila Observatory, Father Charles Deppermann being in charge of the expedition.

(*To be continued*)

BIOLOGY

THE THYMUS GLAND

AUSTIN V. DOWD, S.J.

The thymus gland attains its greatest size at the end of the second year of life, and remains practically stationary until the time of puberty. After that it degenerates rapidly. It does not disappear altogether, however, as the degenerate mass remains somewhat akin to its original structure, but very much shrunken, and retains within itself a small portion of thymus tissue. Functionally it appears to have some activity even in maturity.

Examined at the period of most rapid growth, it will be found to consist of two lateral lobes placed in close contact along the middle line of the body, situated partly in the mediastinum, partly in the neck. It extends from the level of the 4th costal cartilage upward to the lower border of the thyroid gland. It is covered by the sternum, and by the origins of the sterno-hyoid, and sterno-thyroid muscles. Below it rests upon the pericardium, separated from the arch of the aorta and the great blood vessels by a layer of fascis. In the neck it is situated in the front and sides of the trachea, behind the sterno-hyoid, and sterno-thyroid muscles. The two lobes are usually of different sizes, and occasionally are united in a single mass; sometimes they are separated by an intermediary lobe. In color, the thymus is pinkish gray, soft and the surface is lobulated. It is about two inches in length, one and one half inches in width, and about 6 mm. in thickness. At birth it weighs about half an ounce.

Histology:—

In its final development the gland has the appearance of an elaborate lymph-gland, the lymphoid tissue being arranged in lobules found in the inward prolongations of the connective tissue capsule. The reticulum of the lobules can be seen in the medulla, where the lympoid cells are less thickly packed, to consist of large transparent branched cells. In the center of most lobules is seen the concentric corpuscle of Hasall, thought to be the remains of the original tubular gland. The significance of these elements is still under discussion.

Physiology:—

It has been claimed that the thymus is no more than a lymph gland. Experiments tend to prove this statement false, although the entire physiological significance of the gland is yet unknown. Haemoglobin has been found in the thymus in cysts or cells, and similar cells have been found in the lymph issuing from the gland. From this it seems to be a fact that the gland is a source of colored blood corpuscles.

The lymph glands do not shrink in size after puberty, nor do they alter their size when the testes has been removed. The Thymus does, yet the lymphoid tissue is apparently ordinary lymphoid tissue, because increase of it in the thymus is accompanied by an increase of it elsewhere. Still other findings tend to show that the thymus has a definite endocrinal function, even though it cannot be stated as yet just what it is.

Removal of the gland in young animals has produced death in most cases. This operation was performed in subjects under ten days old. In slightly older animals, after the gland was removed, the skin became soft and pasty, with an increase in the weight of the animal. The bones at the extremities did not grow as rapidly as they should, the blood stream became impoverished, and in some cases death by coma resulted. In some experiments however there were no apparent results. In humans it cannot be ascertained whether a child under ten days can live without the gland. In children of 2 or 3 years, and older it has been removed with no serious defects. In other cases rickets set in. Removal of the ovaries and testes seem to cause enlargement of the thymus, and in castrates the thymus is very slow to disintegrate. When the thymus is removed the gonads become abnormally large and develop much quicker than in normal animals. This seems to show that the thymus has some direct connection with the gonads.

Thymic asthma seems to be caused by overaction of the gland. In two cases of status lymphaticus, accompanied by thymic asthma, enlarged tonsils, spleen and lymphatic glands (usual symptoms of status lymphaticus) there were also noted general weakness, flabbiness, and cyanosis; (dark bluish or purplish discoloration of the skin, and the mucous membrane due to deficient oxygenation) the blood picture showed a marked lymphocytis. Radiation with X Rays of the Thymus alone completely cleared up the blood picture to normal. Insufficient dosage causing stimulation of the gland made the condition worse. These reports are similar to those found in the case of dogs, obtained by the injection of thymoid extract, and over-feeding of thymus gland, and suggests that death was caused by the overaction of the Thymus gland. The Thymus has been found enlarged in exopthalmic goitre, and it is also enlarged in myasthenia gravis (chronic progressive muscular weakness, usually of the face and throat, accompanied by atrophy.) In the case of rickets and maramus (extreme atrophy, usually in young children; the cause is unknown, probably a form of auto-intoxication) the gland has been found atrophied. In a case of sex maturity associated with a destructive suprarenal tumor in a girl of two and a half years, no trace of thymus tissue could be found. Some authors think that the chief functions of the gland is detoxicating.

According to them, when the gland is underacting toxins are not neutralized, and all the consequences of removal, or under action, for example, rickets, are due to this lack of neutralization of toxins.

Therapeutics:—

Thymoid extract seems to act as a curative in exopthalmic goitre, and simple goitre. It has been found beneficial in cases of Mongolian idiocy, and it appears to be helpful in cases of rickets, and in those conditions where lime is required. Accurate knowledge of the extract is so slight however, that therapeutic employment is based entirely on empiric lines.

Conclusions:—

The weight of experimental evidence seems to show that the Thymus is more than a lymph gland. From the experiments reported above, especially those based on therapeutic lines, we can state with probability that the Gland has an important relation to the thyroid gland, the sex glands, influences the normal growth of bones, and has something to do with the distribution of the lymph in the blood. It seems to be necessary during the first ten days of life, and probably cannot be dispensed with during the first two or three years of life.

There have been a great deal of contradictory reports from experiments with the Thymus Gland, so that Science is waiting for more accurate data before She can pronounce with absolute certainty the real nature of the gland and its functions.

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PATH OF THE INFERIOR VENA CAVA TO THE HEART IN THE HUMAN EMBRYO

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

There is considerable obscurity in the accounts given by the different embryologists as to how the blood from the liver, alimentary tract and the lower limbs of the human embryo reaches the heart, or to put it another way what primitive vein is represented in the cardiac end of the inferior vena cava.

We know the vitelline veins unite to form the sinus venosus, and opening into that sinus venosus we have the two common cardinal veins, and the two umbilical veins.

In the development of the embryo the portal circulation is developed by the formation of three anastomoses between the right and left vitelline veins, two ventral to the duodenum and one between these two dorsal to the duodenum. By the degeneration of the right vitelline vein between the caudal anastomosis and the middle one, and the degeneration of the left vitelline vein between the middle and cephalic anastomosis, we have an S-shaped vessel, the portal vein, formed which carries the blood from the yolk sac and the gut into the sinusoids of the liver.

When the liver has grown enough to reach the lateral wall of the abdominal cavity, it comes in contact with the umbilical veins, and their blood is directed into the sinusoids of the liver, and that portion of each umbilical vein between the ventral margin of the liver and the heart degenerates, and soon after the right umbilical vein degenerates throughout its entire extent. The left umbilical vein then moves toward the median line and the entire amount of blood returning from the placenta passes into the liver, and as it were, forces its way through the sinusoids making a new channel between it and the right vitelline vein near its point of leaving the liver close to the median line. This new channel is the ductus venosus which passes along the ventral portion of the liver and after birth atrophies and becomes the ligamentum venosum of the liver.

After entering the liver, the vitelline veins break up into sinusoids, and constitute afferent and efferent sets of veins, the latter becoming the hepatic veins which empty into the inferior vena cava.

As these changes are taking place there develops in the caval mesentery just behind the liver a vessel which becomes known as the pars hepatica of the inferior vena cava. Into this the remains of the left vitelline, which is now the left hepatic, empties, while the remains of the right vitelline vein between the heart and the diaphragm lengthens out to constitute the uppermost portion of the inferior vena cava while the upper end of the pars hepatica fuses with it at the point where the right hepatic vein joins the inferior vena cava.

Hence we see that it is a persisting portion of the right vitelline vein which constitutes the portion of the inferior vena cava between the pars hepatica and the heart.

So we may regard the inferior vena cava as developed from below upward from the following segments:—

1. Junction of the common iliac veins which have developed from the post cardinal veins.
2. Lumbar segment of the right supracardinal vein.
3. The supracardinal-subcardinal anastomosis of the right side.
4. The prerenal segment of the right subcardinal vein.
5. The pars hepatical in the caval mesentery.
6. The elongated persistent cardias end of the right vitelline vein. Careful study of Patten's fig. 123, p. 234, Emb. of the Pig, together with these hints, will, I hope, make this obscure point clear.

ORIGIN OF THE HYDROCHLORIC ACID IN THE STOMACH

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

While many tests have been made to determine how the HCl of the gastric juice is produced the question seems to be unanswered. Michro-chemical tests indicate that it is the function of the parietal cells to secrete the acid but the chemistry of the process is a matter of conjecture. Wright seems to think that it possible that some weak acid like H_2CO_3 acts upon NaCl, but Malay would make the process much more complicated regarding the reaction as follows: $NaH_2PO_4+NaCl=Na_2HPO_4+HCl$ The dihydrogen phosphate is then recovered by the action of CO_2 and H_2O on the disodium phosphate, thus:

$$Na_2HPO_4+CO_2+H_2O=NaH_2PO_4+NaHCO_3$$

This reaction could not take place in the presence of the HCl formed but somewhere in the tissues or blood. However, if CO_2 and H_2O can act on the phosphate, there is no reason why they could not act equally well on the NaCl which is always present, and in fact is known to be the compound which furnishes the Cl for the HCl of the gastric juice. If NaCl is withheld from the diet for a sufficient length of time the HCl will not be formed, and if NaBr is fed instead of the NaCl the acid formed will be HBr. But whether the CO_2 and the H_2O act to restore the NaH_2PO_4 or act directly on the NaCl, there still remains the difficulty of the presence of a bicarbonate in the one case and a carbonate in the other which would immediately neutralize the HCl produced. Here seems to be the function of the acid cells, the parietal cells, to separate the HCl from the alkaline compounds which are absorbed by the blood. Possibly here is another one of those cases which require the presence of a vital principle to explain a rather extraordinary reaction.

However, Harvey and Bensley claim to have demonstrated by color reactions that there is no HCl in the fundus of the gastric gland, but that it is found only in the neck of the gland and on the internal surface of the stomach. They are inclined to attribute the production of the acid to organic chlorides. If you have seen any late work on this problem, let us hear from you.

NOTES

Department of Biology, St. Joseph's College

Simkins' Text-Book of Human Embryology, 1931, is a book in the class of Arey's Develomental Anatomy, Jordan & Kindred's Embryology, and has brought the subject up to date by introducing the latest work reported in the literature. The cuts are good but the labeling is done in very small print. The author has a very positive way of putting down his idea on a disputed point, seeming to leave no room for further discussion.

We were able to buy some bones for human osteology at very good prices and I am including the prices here for the benefit of any who may be in need of a stock of human bones.

Unbleached Skeleton with Head and 4 Ribs, 3 vertebrae and the balance of bones one each, $17.00; Same bleached, $26.00

Complete skeleton, complete with all bones, unbleached, $37.00. Same bleached, $50.00. Spinal Columns, complete with pelvis, $8.00. Humerus, Arm and Hand, $6.00; Femur with foot, $6.00; Scapulas, $1.25; Clavicle, $1.25; Ribs, $0.40.

These can be purchased from Richard Young, 215-217 N. 15th St., Philadelphia, Pa.

NOTES

Department of Biology, Fordham University

Rev. Joseph Assmuth, S.J.

Our Mendel Club, made up of undergraduate students taking Biology just received from the press the November issue of the Cabmuth, which contains many interesting articles written by the members of the Club.

The Graduate Students are doing considerable work along lines of research on the Bat; comparative study of the blood of mammals; the Protozoa fauna of nearby ponds; Pollen germination in various media, and micro-measurements of various types of Pollen; Micro-sublimation of the Spanish fly and the Chinese beetle.

Dr. Charles Noback of the N. Y. Zoological Gardens is assisting one of our students in obtaining the kidneys of various birds, so far we are working on the kidneys of the Broad Winged Teal, Coscoroba Goose, Peruvian Pileated Sparrow, the Starling, Coover's Hawk, and two unknown species.

We have two balanced aquaria, one Common and the other Tropical, which are under observation by the students.

This department recommends the two latest Grubler stains, used for multiple staining made by Dr. K. Hollborn in Dr. G. Grubler's Laboratory. Nuplascoll, one of these new stains, is a modification of one of the iron haematoxylin group. It gives a distinct nuclei coloring, the well known Acid Fuchsin—picric acid coloring, and a green color for connective tissue. This Nuplascoll is obtainable as a dry powder. The stock solution is made by dissolving 1 gram of the dry stain in 20 c. c. hot distilled water. This solution may be kept for some time. The staining time is from 15-30 minutes according to the specimen and the preparations must be mounted in neutral balsam.

The other stain called Hollborn "H. G. E." stain is a combination of Haematoxylin—Van Giesen—Elastin staining. This H. G. E. colors simultaneously the nuclei black, the elastic tissues brown, the collagen tissues red and the rest of the plasma yellow. The staining technique of this is a bit more complicated than that of the first mentioned stain but considering the results obtained is very simple. Two solutions, A and B are made. Solution A.: 1 gram Iron Haematoxlin ("H") is dissolved in 100 c. c. of hot (not boiling) distilled water. When cold the solution is filtered. Solution B. O. 5 grams Van Giesen-Elastin stain ("H") is dissolved in 100 c. c. of 70% alcohol warmed in a water bath. The solution is filtered when cold. Stain with solution A. about 5-10 minutes, rinse with distilled water and then immediately into solution B where it remains for about one and a half hours then into 70% alcohol for washing and up through the alcohols into Xylol and mount in Canada balsam. The balsam must be neutral and free from volatile and turpentine-like oils.

Further information concerning the technique etc. will be gladly furnished by the Department of Biology of Fordham University.

CHEMISTRY

MICRO-CRYSTALLIZATION FROM SOLUTION

Rev. R. B. Schmitt, S.J.

There are a few fundamental principles of crystallization that might be helpful to our Chemists, in order to obtain the true form and ''habit'' of crystalline substances. Many mistakes and wrong interpretations are made from the improper preparation of a substance in the crystalline form. There is a marked difference between many substances that are crystallized by ''evaporation to dryness'' and the formation of these crystals in a ''liquid medium.''

The chemical microscope is an excellent means of recognizing and photographing the true structure of crystalline substances in the solid phase. The space lattice, in which the atoms of a crystalline substance are arranged, is the basis of its symmetry and of its class within the crystal systems. The lattice constitutes the essential nature of any given solid phase, and primarily governs its internal properties such as refractive index. The external properties of crystals involve also the surrounding medium, and the geometrical faces exhibited are subject to variation even though the space lattice is wholly uneffected. The degree of supersaturation, or supercooling of the phase from which the crystals are formed is an important factor governing their size and number. The number of crystal nuclei formed determines the size of the crystals, since the amount of material separating is divided among them. For the growth of good sized crystals, the number of nuclei should be kept low, so that any crystallization will be about a few centres which will thus develop to a larger size. If a solution is supersaturated and crystallization is initiated by stirring or ''seeding'', a large number of very small crystals are formed. Local supersaturation is frequent, even while crystals are separating in adjacent portions of the same drop of solution.

The surface on which growing crystals lie restricts the deposition of materials on one face, so that the lower side of the crystals are usually flattened. This distortion may be avoided if crystals can be grown suspended in a liquid. Furthermore, if the drop of liquid is too shallow, the growth of crystals upward is also restricted, and so there is another distortion.

The use of the chemical microscope for the examination of crystals has two advantages: the specimens are easily prepared and the enormous saving of time. It is understood, of course, that with elaborate methods of specialized instruments with accurate control of the rate of evaporation, cooling, mixing of the phase, pressure, vacuum or inert atmosphere, etc., the most perfect form of crystals can be obtained on a macroscopic scale. However, for rapid laboratory methods, crystallization on a microscopic slide are accurate enough for identification and comparison. Crystallization on a microscopic scale has the great advantage, that crystal growth can be followed directly, and physico-chemical changes which might otherwise be missed can be observed as they occur. The various procedures employed in the formation of crystals on a micro scale exemplify many important physico-chemical principles, and are constantly used in microscopic analysis.

Micro-crystallization from solution is the most commonly employed means of obtaining crystals for microscopic study. Water is used as a solvent when possible, but acids, alkalies, or organic liquids may also be utilized. Frequently the solubilities and habit vary so widely in different solvents that crystallization from more than one is necessary for full information. In general the method is this: place a drop of water on a clean object slide; the drop should be 5 to 7 mm. in diameter, and 1 to 2 mm. deep. Introduce into the drop a tiny fragment of the substance to be recrystalized; the quantity should be just enough to saturate the drop, and it should be added in small portions, with stirring each time. Large particles may be crushed by the tip of the glass rod or spatula used for handling the material. In stirring, the rod should be held nearly upright, in order to avoid spreading the drop to form a thin film on the slide. Solution may be hastened by cautiously warming the preparation over the micro-burner, but care should be taken to avoid rapid evaporation. A crust of imperfect crystals will form around the edges of the drop, in the course of a few seconds, especially if the solution is allowed to cool, or if evaporation is accelerated by blowing across it. This crust is of no value for study and should be pushed into the centre of the drop, which may be still unsaturated; in doing so the rod should be held vertically, and spreading the drop or scratching the slide should be avoided. Evaporation should be continued, preferably without further heating, the solution being kept "seeded" by gently stirring in the crystals which separate at its edge. As soon as crystal growth is well under way, the slide should be cooled, by pressing it against a cold object, so that evaporation should proceed slowly at room temperature. The examination of the crystals may now be begun, but occasional stirring is necessary to prevent localized supersaturation in the drop as it evaporates further.

As soon as evaporation has gone so far as to leave the growing crystals projecting above the surface of the drop, their faces become imperfect, and recrystallization is again necessary. This is accomplished by placing a very tiny drop of water on the mass of crystals, by means of the stirring rod. Rather less than enough liquid to redissolve the crystals should be added; in this way some of them remain to "seed" the next crop, and no time is lost in evaporating excess solvent before regaining the saturation point. The crystallization procedure is continued as above. Several recrystallizations of a single preparation are ordinarily possible without loss of material, and are usually necessary in order that the crystals may always be studied while completely immersed in their mother liquor and before they have grown into contact with each other.

Insoluble substances should be added to the drop in very small amount, since the excess will not dissolve and may interfere with the observation of the portion which does recrystallize. Warming the solvent, with a minimum of evaporation, will facilitate solution. Only very small crystals will be formed at best, and to obtain them the solution should be evaporated or cooled very slowly.

Highly soluble substances will ordinarily crystallize very rapidly when once the solution is saturated, for a very little further evaporation results in the separation of a large amount of material, often in dense masses unsuitable for study. A cover-glass may be placed over the drop, to retard evaporation, after crystallization has begun.

Substances much more soluble in hot water than in cold water may best be crystallized by cooling, rather than by evaporation. Hydrolysis of certain metallic salts is likely to occur if it is necessary to heat the substance for some time in water, or if repeated recrystallizations have been made. It may best be prevented by a trace of the appropriate acid.

Organic solvents may be handled like water, provided they are not too volatile or too mobile. Where feasible, the less volatile of the possible solvents should be chosen, xylene instead of benzene. Crystallization from very volatile solvents may be controlled by covering with a cover glass to retard evaporation. Such solvents and other organic liquids of low surface tension, tend to creep over the slide and are difficult to maintain in a sufficiently thick layer for proper crystal growth. To aid in their manipulation tiny watch glasses or concave-ground slides may be used. If the crystallization has been made in a test tube, crystallizing dish, or other vessel, the crystals may be pipetted to a microscopic slide for study.

Many other factors and conditions may be encountered in actual laboratory practise, and each set of circumstances will demand the application of the known chemical principles. These few suggestions may be useful since crystallographic concepts are being employed in an ever increasing variety of chemical problems, and have added much to our understanding of the nature of matter.

RENOVATED CHEMISTRY BUILDING AT FORDHAM UNIVERSITY

REV. J. B. MUENZEN, S.J.

Upper classmen, who returned to Fordham in September, found the one-time Medical School Building so revamped that only the exterior walls remained unchanged. With the opening of the new Physics Building in September last year, the entire three floors were turned over to the Chemistry Department. This afforded an opportunity for expansion into larger and much needed quarters. Plans were drawn up last winter in conjunction with the engineers of laboratory equipment companies and, later, various subsidiary contracts were drawn with the idea of converting Chemistry Hall, as it is now known, into a practically new building to be devoted entirely to Chemistry.

New equipment was purchased for the one time Physics' laboratories and considerable moving around was done with the old Chemistry equipment, the idea being to get all the laboratories out of the basement; to get the Inorganic laboratories on the first floor; to accommodate students in General Chemistry and to get the research laboratories on the top floor.

A complete system of Duriron plumbing has been installed, the entire electrical system thoroughly overhauled and the interior of the building has been freshly painted. Mastic tile has been laid on all the floors except on that of the front hall which is of stone tile.

Adjoining his office, each professor has a large, private laboratory, fully equipped to carry on the most elaborate type of research work. There are eight private Laboratories and two more larger research laboratories so arranged as to give semi-private working space for a total of twenty-four candidates in Master and Doctorate work. All these private laboratories, including the research laboratories, are equipped with compressed air and vacuum supplied by two new pumps, steam, and direct current, which is supplied by a new Motor Generator set.

A new automatic Stoke's, steam-operated still has been installed in the pent house on the roof feeding into a hundred gallon storage tank from which distilled water is piped to the various laboratories. A large Matheson gasometer, housed on the roof, supplies Hydrogen Sulphide to each desk of the Qualitative and Organic research laboratories. The Department is experimenting, in conjunction with engineers from the Hoke Valve Corp., with a new type of reducing valve which, if successful, will allow Hydrogen Sulphide to flow directly into the pipe line. Thirty large electric fans in various parts of the building take care of the necessary ventilation.

Two spacious rooms have been devoted to a library, one containing periodicals and reference books for graduate students and the other, a reading and loan library for undergraduate students.

The unique feature of the building is a splendidly equipped laboratory for carrying on Micro Analysis according to the Pregl method.

Courses in Physical Chemistry are under the direction of Mr. Wm. Hammill from the University of Notre Dame. Dr. Leopold R. Cerecedo, recently of Yale and the University of California, is in charge of the Organic Department, Graduate and Undergraduate.

The Chemistry Department is host to 985 students.

PHYSICS

X-RAYS AND THE QUANTUM THEORY

Rev. Bernard F. Doucette, S.J.

This paper will be only a brief outline of the part X-rays have taken in giving evidence in favor of the quantum theory. We know that the quantum theory originated as an explanation of the peculiar spectra of black-body radiation and of the specific heat phenomena of matter at low temperatures. Since then the theory has been confirmed by further evidence and part of this is due to phenomena connected with X-rays.

One question regarding quanta concerned their proportion. According to the theory they were like particles sent off into space and proceeding in straight lines. Very fine particles of bismuth were placed in the path of the very weak X-rays and it was found that they would eject electrons, known by an increase of charge. These particles were between $1x10^5$ and $5x10^5$ cm. in diameter, and were placed between the plates of a Millikan condenser, the lower plate of which was the anti-cathods of the small X-ray tube. These experiments only tell us that if quanta exist, they are as small as these particles, and not larger. They tell us nothing about the manner of collecting energy on the part of the receiving particle.

Another series of experiments give us an idea of the length of quanta in the direction of propagation. The method consists in a very rapid interruption of a beam of light. Two crossed Nicol prisms have two Kerr cells placed between them. Kerr cells consist of condenser with a suitable organic liquid between them. Kerr cells consist of condenser, with a suitable organic liquid between them. An electric field across these condenser plates will change plain polarized light to elliptically polarized light. When the field of the two cells are equal, no light can pass through, but when the fields differ, then the elliptically polarized light from the first cell is not compensated by the second and there is a component which can be transmitted by the second Nicol prism. By means of light frequency alternating current, these cells form an electro-magnetic shutter which was operated as fast as 10^9 times per second. With this apparatus and utilizing light "waves" instead of X-rays, it seems that the so called quanta are not over a few centimeters in length, if even that long.

One of the important confirmations of the quantum theory is the excellent explanation it gives of the photo-electric effect. Briefly, this phenomenon is the release of energy from a metal when it is illuminated. Ultra-violet and X-rays are the ordinary means of illumination. There is no necessity of describing the photo-electric effect in detail yet there is one aspect that should be considered. Whether weak or strong X-rays fall upon the metal, the electrons escape at the same velocity. Strong X-rays may cause more electrons to be ejected, but the velocity of emission does not depend upon the intensity of the illumination. The quantum theory does not explain this aspect of photo-electrical phenomena. To do so would mean explaining, in an analogous sense, how a plank dropped 100 feet upon the smooth surface of a lake caused waves to travel a considerable distance and then strike another plank with enough force to rise above the water. But, the positive results of explaining the photo-electric effect are important, and due to such explanations, a method of measuring Planck's constant was derived. The value obtained is in close agreement with other determinations.

Corresponding to the photo-electric effect is the inverse photo-electric effect. If radiation falling upon a metal allows electrons to escape, then electrons should cause radiation when they bombard a metal. We have this phenomenon in all X-ray tubes.

We have very interesting results of the study of X-ray scattering. This happens when X-rays fall upon matter and part of the energy is absorbed and the rest is scattered. Absorption occurs in the phenomena of fluorescence where the matter is so changed that it can emit radiation at a frequency different from the incident X-rays. The scattering of X-rays however, is not easily explained without the help of the quantum theory. The Compton effect requires unidirectional quanta for its explanation. When X-rays fall upon a metal or other suitable substances and the so-called "reflected" beam is then examined by an X-ray spectrometer, a radiation of a new sort is found and is due to the encounters between the original radiation and the free electrons, as Compton explained it. With the help of this phenomenon, another method for determining the value of Planck's constant was developed, which, when measured, closely agreed with other determinations.

X-ray spectra of various metals are very interesting and are explained easily by the assumptions of the quantum theory. The spectra show the existence of different "energy levels" as they are called, and these give strong evidence of the existence of quanta. Also, on the photographic plates used for X-ray spectra, there is further evidence of the existence of quanta, namely the peculiar action of the silver bromide in the emulsion on the plates. There were found, in all exposed silver bromide plates, two definite changes in the darkening of the plates, always at the same frequency. These changes were explained as the absorption limits of silver and bromide, that is, the frequencies where the quanta can eject electrons in the silver or the bromide of the emulsion. Other light-sensitive substances were used and similar changes in density were found, peculiar to each substance. The quantum theory explained these phenomena very easily.

In this paper, a detailed explanation of all phenomena involving the quantum theory cannot be given. All that can be done is to indicate the various phenomena which confirms the quantum theory, and in these, X-rays have had an important part. This is evidence that X-rays are made up of quanta, but the final undeniable proof that they are so constituted has not been presented yet. Whether or not it will be presented is a question to be answered in the future.

PHYSICS AT GONZAGA HIGH SCHOOL

HAROLD H. PFEIFFER, S.J.

The Science section of the Class of 1933 has shown a pleasing interest in the study of Physics. Although the first few weeks of the course are devoted to the uninspiring task of training the mind to the habit of explaining familiar facts of daily occurrence, by the application of a few basic Mechanical Principles, this year's class at Gonzaga has attacked these problems with the natural enthusiasm and consequent success of a boy who "wants to know how it works". The enthusiasm of the more inquiring and intuitive is being guided carefully towards the application of these fundamentals to the spectacular engineering of the Modern Physics. Already the similarity between the Gravitational Potential Function and the field of High Frequency Radio (or other spherical wave front radiation), as regards a distant element, has been suggested and discussed.

A boy is practical. Detailed theoretical discussions are usually discouraging to the novice investigator. The step from theory to practical application must be quickly yet carefully taken. In this regard the interesting display of experiments, ready to operate, at the Washington National Academy of Science are of great assistance. Brief non-technical explanations and directions for operating these equipments are prominently posted so that the visitor may, (in most cases by merely pressing a button) operate the device himself. Many visits have been made to the Academy, and the class as a group proposes a more detailed study of these demonstrations.

The Photo-electric cell, with its legion of commercial uses, is the modern application of that outstanding and unique experiment which is the bulwark of Einstein's defense of the Quantum Theory. The oscillograph produces instantaneously a graphic representation of the voice of the operator. The Cathode-Ray (*apparently* a beam of light) is deflected in a magnetic field. All of these and many illustrations of well-known physical phenomena have been important stimuli to the students as they search into the orderly mysteries of natural science.

SEISMOLOGY

GEORGETOWN SEISMOLOGICAL OBSERVATORY

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

A new type of recorder*, constructed by the American Instrument Co. of Washington, D. C., has been installed at the Georgetown Observatory.

The recorder is a three component type, with three drums mounted integrally on a single shaft. It is driven by a G. E. synchronous motor. The motor speed of 1,800 r. p. m. is reduced in the ratio of 57,000: 1 by three sets of worms and worm gears, giving a drum speed of two revolutions an hour, with a lateral travel of one fifth inch per revolution. As the length of each minute is exactly 20 millimeters, by using a scale graduated in .03 cm. the record may be read directly in hundredths of a minute.

The advantages of the synchronous motor drive are: 1st. there is no deceleration, as in the case of the spring drive supplied with the original Galitizin recorders. This means that the minute marks line up perfectly on the record, facilitating rapid identification of successive hours. 2d. There is no more winding to be done. 3d. As the three drums are on one shaft, perfect synchronization between the records of the North, East and Vertical components is assured. The rotating assembly is statically balanced, reducing back-lash to a minimum.

A section of record with NAA time signals

In addition to the radio-relay equipment which records the NAA time signals directly on the records, and has been described in a previous issue of the Bulletin, a time switch, type 831 also made by G. E. has been put in the line of the power pack. This makes the recording of time signals entirely automatic, so that correct time is assured at least once a day, independent of any observer.

The installation of the new three-drum recorder necessitated the re-assembly of all the Galitizin instruments in the vault under the quadrangle.

When this work is completed a catalogue of epicenters of earthquakes recorded at Georgetown will be compiled, indexed according to azimuth and distance, with respect to Washington.

The manuscript of a book entitled "Seismometry", by Father Sohon, who succeeded Father Tondorf as Director of the station, has been accepted by John Wiley and Sons, for publication. This work will appear as a companion volume to a work by Father Macelwane, to be entitled "Geodynamics", and the two will constitute a series called "An Introduction to Theoretical Seismology".

*For further details and specifications cf. National Research Council Bulletin, June, 1931 (Transactions of American Geophysical Union.)

RECENT BOOKS

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

BIOLOGY

A Text-book of Experimental Cytology, by Gray.
The MacMillan Co., New York.

The Use of the Microscope, by John Belling.
McGraw, Hill Book Co., New York.

The Biology of Civilization, by C. C. Walker.
The MacMillan Co., New York.

Principles of Functional Anatomy of the Rabbit, by E. D. Crabb.
P. Blakiston's Son & Co., Philadelphia, Pa.

CHEMISTRY

The Electrochemistry of Solutions, by S. Glasstone.
D. VanNostrand Co., Inc. New York.

Recent Advances in Analytical Chemistry, Inorganic Vol. II.
by C. A. Mitchell. P. Blakiston's Son & Co., Phila., Pa.

Practical Physiological Chemistry, 10th Edition.
by P. B. Hawk, O. Bergeim. Blakiston's Son & Co., Phila., Pa.

The Structure of Crystals, 2nd Edition, by R. W. S. Wyckoff.
The Chemical Catalog Co., Inc. New York.

A Comprehensive Treatise of Organic and Theoretical Chemistry,
Vol. XI, by J. W. Mellor, Longmans & Co. New York.

Oxidation—Reduction Potentials, by L. Michaelis,
J. B. Lippincott Co., Philadelphia, Pa.

Laboratory Manual of Physical Chemistry, 2nd Edition
by Davidson & VanKlooster. John Wiley & Sons, New York.

Laboratory Manual of Gas, Oil and Fuel Analysis,
by Carl J. Engelder. John Wiley & Sons, Inc., New York.

Colorimetric and Potentiometric Determination of pH.
By I. M. Kolthoff. John Wiley & Sons, Inc., New York.

Radiations from Radioactive Substances, by Sir E. Rutherford,
The MacMillan Co., New York.

Systematic Organic Chemistry. Revised, by Cumming, Hopper & Wheeler.
D. VanNostrand Co., Inc., New York.

Analytical Chemistry, by John C. Ware.
John Wiley & Sons, Inc., New York.

Examination of Water, Chemical and Bacteriological, 6th Edition,
Revised, Wm. P. Mason, John Wiley & Sons, Inc., New York.

Quantitative Analytische Wikromethoden der organischen Chemie in vergleichender Darstellung, by C. Weygand.
Buchhandlung Gustav Fock, Leipzig.

Lehrbuch der anorganischen Chemie, by Heinrich Remy,
Buchhandlung Gustav Fock, Leipzig.

Chemical Analysis of Iron and Steel, Lundell, Hoffman, Bright.
John Wiley & Sons, Inc., New York.

Potentiometric Titrations, Second Edition, Kolthoff—Furman.
John Wiley & Sons, Inc., New York.

PHYSICS

Matter and Radiation, by Buckingham,
Oxford University Press.

The Logic of Modern Physics, by Bridgman,
MacMillan & Co., New York.

The Universe in the Light of Modern Physics, by Planck.
Norton & Co., New York.

BOOK REVIEWS

RADIO ELEMENTS AND ISOTOPES: CHEMICAL FORCES AND OPTICAL PROPERTIES OF SUBSTANCES

KASIMIR FAJANS, *University of Munich.*

McGraw-Hill Book Co., Inc., New York City, 1931.

x+125 pp. 14.75×22.75 cm. $2.50

This, the ninth volume of the George F. Baker Non-Resident Lectureship in Chemistry at Cornell University, is a worthy continuation of the series of lectures which have been given by outstanding European chemists and physicists during the past five years. The introductory lecture is devoted to the "Development of Views Regarding the Nature of Chemical Forces". The remainder of the book is divided into two parts of unequal length. The first part consisting of a single chapter deals with the origin of the actinium series and with the stability of isotopes considered from a radioactive standpoint, though not limited to radioactive isotopes. The second part treats chemical forces and optical properties, a subject to which the author has recently directed much attention. It is divided into seven chapters dealing with the following subjects: Outline of Atomic and Crystal Structures; The Ideal Ionic Linkage; General Remarks on the Deformability of Ions; Change of the Refractives of Ions in Molecules and Crystals; Transitions between Ideal Ionic Linkage and Non-Polar Linkage; Adsorption of Ions on Saltlike Crystals with Applications to Volumetric Analysis; and Photochemical Applications of Ion Adsorption.

S. C. Lind.

A HISTORY OF CHEMISTRY

F. J. Moore,

Late Professor of Organic Chemistry, Massachusetts Institute of Technology. Revision prepared by William T. Hall, Associate Professor of Analytical Chemistry, Massachusetts Institute of Technology. Second Edition. McGraw-Hill Book Co., Inc., New York and London, 1931. xxiii+324pp. 78 plates. 14×20 cm. $3.00.

This volume was constructed from a series of lectures which dealt with the fundamental ideas of the science; their origin, their philosophical basis, the critical periods in their development, and the personalities of the great men whose efforts have contributed to that development. The person addressed is the more mature student of chemistry, though few portions of the book will present serious difficulties to the general reader. The aim has been to emphasize only those facts and influences which have contributed to make the science what it is today; the claim of a topic for consideration has been not its practical but its historical importance. It has been asked, not whether the work was itself of value, but did it contribute a new fundamental idea. Little attention has been paid to questions of priority. The general plan of the book remains unchanged in this second edition; the content has increased about five per cent by the inclusion of new material. Recently discovered data have in a few cases necessitated the restatement of facts. It is pointed out that alchemist doctrines prevailed in China as early as they appeared in Egypt and that Basilius Valentinus probably never existed (his reputed likeness is nevertheless reproduced). Brief biographical sketches of a number of brilliant chemists who died during the last twelve years are given. An additional chapter is devoted to Americans who did much to develop chemistry in this country, no mention being made, however, of a number of eminent scientists who are still alive. A portrait of the author and an account of his life and his career as a scientist and teacher precede the text proper.

The author has done his work well, within the limits he has set for himself. The text has stood the test of classroom use and with the co-operation of a widely read instructor it can serve as an excellent framework on which to build an introductory course. It is frankly a textbook and suffers from the evils which are the necessary accompaniments of its didactic objectives. Biographical paragraphs are informing, but are usually uninteresting and never make for smooth reading.

The title of the picture by Chartran facing p. 66 is not correct, an error that occurs in several other texts. The painting hangs in the Sorbonne, but Lavoisier had no connection with this school and certainly did no work there. The scene is usually labeled "Lavoisier converting Berthollet to the antiphlogistic doctrine." Rouelle lectured at the Jardin du Roi (des Plantes) and not at the College Mazarin (p. 52). Lavoisier was condemned on a trumped-up charge of treason, and watered tobacco actually playing a minor role in the long list of accusations brought against him and his fellow Fermiers Generaux. The reviewer cannot agree with the statement (p. 232) that Baeyer was a practical empirical chemist rather than a theoretical dreamer. The biography of Nef (p. 307) was written by L. W. not L. F. Jones. Le Chatelier assuredly deserves mention for something more than his translation of Gibbs' paper on heterogeneous equilibrium.

A little more care might have been used with regard to the references suggested for further reading. None of the standard English histories of chemistry are mentioned, the numerous recent books and particularly the articles in the periodicals are largely ignored; definite citations to the literature could well have been incorporated in the body of the text. In some cases the original German works are recommended although English translations are now available, a rather surprising condition if viewed in the light of the statement (p. 307) that "Nef's writings are hard to read, partly because they are published for the most part in German." This fault can easily be remedied in the next edition, for so useful a book deserves to be brought up to date periodically.

Ralph E. Oesper.

NEWS ITEMS

BOSTON COLLEGE—CHEMISTRY DEPARTMENT

O'MALLEY RESEARCH FELLOWSHIP

This year a gift was made to Boston College whereby a fund was established to aid and stimulate graduates of the College in the attainment of higher degrees. The first incumbent is a member of the graduating class of 1931. He showed such all round attainment and signalized himself so well in Chemistry that he was offered this Fellowship with the opportunity of going to Johns Hopkins University to work for his Ph. D. in Chemistry. He is there at present and gives promise of doing well.

There are 698 students taking Undergraduate Chemistry in eight different courses. Their work is supervised by five full time professors, one assistant professor, and five Fellows. Students are divided as follows:

General Chemistry	359
Stoichiometry	45
Qual. Analysis	85
Quant. Analysis (2nd. Sem.)	30
Volumetric Anal. (2nd. Sem.)	60
Colloid Chemistry	13
Organic Chemistry	55
Extension Course	41
Physical Chemistry	10
Total	698

In the Graduate Department there are ten students working for their Master's degree in Chemistry. Five of these hold Fellowships.

This year the Seminar in Chemistry begins its meetings November 6. There will be twenty papers presented on succeeding Fridays up to April 29, 1932. The topics commence with an appreciation of Michael Faraday whose name is mentioned for special honors this year. Succeeding papers discuss various aspects of chemical theory and accomplishment, emphasizing wherever possible Faraday's influence and inspiration.

BOSTON COLLEGE—DEPARTMENT OF PHYSICS

A few changes in text books have been made in the various courses in the Physics Department. Among the new additions are F. H. Wood's

"Text Book of Mechanics" for the Juniors in the B. S. Physics Course, and the "Laboratory Manual of General Physics" by Taylor, Watson and Howe, for both the Freshmen and Sophomores in the B. S. Course.

The text-book of Mathematics for the Freshmen B. S. Course is Griffin's "Introduction to Mathematical Analysis" introduced into the course in September, and already giving indications that the change has been a happy one. It is hoped that the Freshmen will be able to complete the book in one year and thus be well prepared for the courses in the Calculus and Differential Equations included later in the Science curriculum.

The Physics Academy has convened and inaugurated its program of bi-monthly lectures. Mr. Edward Hurley, President of the Academy, presented at the opening meeting an interesting paper on "The Science of Musical Sounds."

The Radio Club, under the direction of Father John Tobin, S.J., is planning a series of talks designed to give a theoretic and practical knowledge of radio communication. During the year professors from neighboring universities and members of local radio concerns, will speak at some of the meetings.

LOYOLA COLLEGE, Baltimore, Md. Biology Department. The Mendel Club is conducting a seminar in biology. The first meeting was held on November 17; these meetings will continue bi-monthly until May 15, 1932.

Chemistry Department. The following lectures will be presented to the members of the Loyola Chemists' Club during the present scholastic year: "Seeing Inside the Molecule", Dr. Donald H. Andrews, Johns Hopkins University; "The New Era in Synthetic Organic Chemistry", Dr. E. Emmet Reid, Johns Hopkins University; "Finger Prints of Crystals", Dr. Herbert Insley, Bureau of Standards; "Chemistry of Municipal Sanitation", Dr. William Schroeder, Sanitation Commissioner of New York City; "The Relation of Radium to Geologic Phenomena," Dr. Charles S. Piggott, Geophysical Laboratory, Washington, D. C.; "The More Powerful Reducing Agents in Volumetric Analysis", Dr. William M. Thornton, Johns Hopkins University; "Free Radicals in Organic Chemistry", Dr. Francis O. Rice, Johns Hopkins University; "The Role of Chemistry in the Examination of Municipal Supplies", Dr. Frederick G. Germuth, Bureau of Standards.

Physics Department. Mr. Lincoln J. Walsh has been appointed Assistant Professor of Physics.

ST. JOSEPH'S COLLEGE. DEPARTMENT OF CHEMISTRY.

The chemistry books have been removed from the students library and will be placed in the Chemistry Department Library which will be opened for the Chemistry students in the near future.

A Chemistry Club for selected students will be formed at the beginning of the second quarter of the school year. Students who attain a definite mark in Chemistry will be invited to join.

Three graduates of the Class of 1931 are majoring in Chemistry for their Master's Degrees.

CANISIUS COLLEGE, BIOLOGY DEPARTMENT

Registration in the biology courses for the current year:

Freshman Biology, Pre-medical	80
Sophomore Biology, Pre-medical	45
Histology, Junior Pre-medical	34
Junior Elective, Arts and Science	25
Senior Elective, Arts and Science	15
College Course for Teachers	21
Special and unclassified	3
Total Registration	223

It is to be noted that the increase in freshman registration this year was largely in the pre-medical course. As a result of this excessively large registration considerable difficulty was experienced by the heads of the several science departments in arranging a suitable laboratory schedule. The course given this year in the College Course for Teachers is in elementary biology, botany and invertebrate zoology. This year's class in histology is the largest in recent years.

CANISIUS COLLEGE, PRE-MEDICAL CLASSES

On October the twenty-first, by invitation of the Reverend Dean of Canisius College, Doctor Koch, Dean of the University of Buffalo Medical School addressed the pre-medical students of the college. He stressed among other things the necessity of fundamental biology. He also stated that in considering a candidate's application the board of admission is careful to survey the results of the aptitude tests conducted by the Association of American Medical Colleges.

THE PHYSICS DEPARTMENT

The Physics registration this term totals 174, divided as follows: Mechanics, 52; General Physics, 90; Extension, 24; Advanced, 8. To these will be added a large Pre-med. class in Mechanics in February.

A series of three lectures on the subject, Seismology, broadcast over WBEN under the auspices of the Buffalo Educational Council, was recently concluded by Father Delaney.

A feature of the Opening Dinner of the Men's Temple Club was an illustrated lecture on Einstein's Relativity by Father Delaney.

Negotiations are under way with the Carnegie Institution laboratories at Pasadena for the loan of a Wood-Anderson seismograph for the purpose of measuring the local ground tilt and also to determine the practicality of the Wood-Anderson seismograph as permanent installation at the Canisius Observatory.

CHEMISTRY DEPARTMENT

The enrollment in chemistry courses is the largest in the history of Canisius College. One hundred and sixty-eight students are listed in the three general inorganic chemistry courses, 21 in the qualitative analysis course, 18 in quantitative analysis, 35 in analytical chemistry, 69 in organic chemistry and 10 in physical chemistry. The total number is 321. Because of the consequent congestion of laboratories, new laboratory space for analytical and physical chemistry is being planned for 1932.

Six graduate courses in chemistry have been introduced this year—History of Chemistry, Inorganic Preparations, Advanced Theoretical Organic Chemistry, Organic Preparations, Qualitative Organic Analysis, and Advanced Quantitative Analysis.

HOLY CROSS COLLEGE. Chemistry Department. The programme of the Seminar conducted by the Department of Chemistry includes subjects from the following branches of Chemistry: Inorganic Synthesis, Thermodynamics, Colloid Chemistry, Organic Chemistry, History of Chemistry, Physical Chemistry, Reaction Rates, Organic Synthesis and Analytical Chemistry. The meetings are held bi-monthly.

BROOKLYN PREPARATORY. Programme of the Brooklyn Preparatory Research Club: October 2, Mendel's Law of Characteristics; October 9, The Position and Action of the Digestive Organs in the Human Body; October 23, Sources of Tuberculosis; October 29, The Importance of Personal Hygiene; November 6, Glands that Act as Hormones; November 13, The Ionization Theory; November 20, The Importance of Chemistry in Biology; November 21, Preparation and Study of Slide from Cat's Stomach; and December 4, Narcotics and Poisons. Their Effect on the Human Body.

WOODSTOCK COLLEGE. Father John Brosnan is giving a series of lectures on lithographing and color-photography. Mr. Highouse of the Levitt-Ferguson Co., of Baltimore, gave a demonstration of glass-blowing on November 9. Special academies in Analytical and Organic Chemistry are being held. There are eleven philosophers taking the Elective Laboratory Course in biology.

WESTON COLLEGE. Chemistry Department. A new text-book and laboratory manual have been introduced this year: "An Introduction to Chemistry", by Timm; and "The Laboratory Manual" by Father Strohaver.

Mathematics Department. The philosophers are given an opportunity to attend the special courses in mathematics. The class in Mathematical Analysis, Griffin, has seven students and is conducted by Mr. Joseph Murray. Vector Analysis, Gibbs-Wilson, has two students and is conducted by Mr. Joseph O'Callahan. Mr. William Sheehan is tutoring one student in Differential Equations.

Seismology Department. The Seismic Station is equipped with a Synchronome (free pendulum) Master Clock. The seismograph was donated by Georgetown University by Father Tondorff and installed by Father Sohon. Father Quigley is in charge of the station.

Physics Department. The advanced physics class for the third year philosophers comprises not only those specializing in physics but also the special chemistry students. The purpose is to give these students a knowledge and facility of physical instruments used in physical chemistry.

GONZAGA HIGH SCHOOL, Washington, D. C. The class in biology has taken to field work with great interest. Since their class-work has been on the plant, their endeavors have been confined to this phase. Most of the interest is aroused by competitive work. Each student brings as many specimens as possible. The students then dissect and identify the essential parts of the flower. A group of twelve students are cultivating begonias, pollinating the female blossom with the various male flowers.

LOYOLA HIGH SCHOOL, Baltimore, Md. Mr. Francis A. Sanders, Loyola College, '31, is instructor in Chemistry. Mr. Edward S. Matelis, the instructor of last year, has entered St. Mary's Seminary. Mr. Henry L. Griffin is instructor of Biology; and Father Joseph M. Kelly is instructor of Physics.

CANISIUS HIGH SCHOOL. The Physics Department has been completely renovated during the last few months. New apparatus and equipment has been installed.

Biology Department. The increase in the number of science students in second year required the establishment of two biology classes of 24 and 28 students each. This also necessitated a reorganization of the department, and it was moved to more convenient quarters which are well supplied with cases, etc. A museum is in the initial stages of formation and the students have shown remarkable zeal and industry in bringing biological specimens. While there are no science clubs existing, fall and winter trips to the Buffalo Museum of Science are under way and it is hoped that interest in things biological will thus be sustained until the field trips in spring.

GEORGETOWN PREPARATORY. The new laboratories of Biology and Physics are located in the new south wing, well lighted and splendidly equipped. Father Gipprich of Georgetown University planned and supervised the construction of the physics lecture-room and laboratories. The late Father Tondorff, also of Georgetown University planned the excellent equipment of the biology laboratory and lecture furniture. The course in Biology is conducted by Dr. J. Bay Jacobs, eminent surgeon and lecturer at Georgetown Medical School. Father Edward Berry has installed a sound equipment for the movies. The walls of the projection-room were covered with a brown felt to absorb the sound vibrations. The equipment was purchased from Weber Machine Co., Rochester, N. Y., and is easily convertible into a public address system. The cone speaker with proper baffle gives splendid reproduction of speech and music.