A. M. D. G.

BULLETIN

of the

American Association of Jesuit Scientists

(Eastern Section)

For Private Circulation

LOYOLA COLLEGE
BALTIMORE, MARYLAND

VOL. IX MAY, 1932 NO. 4

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EASTERN STATES DIVISION

Vol. IX — May, 1932 — No. 4

EDITORIAL

The outstanding scientific work of the Society is without a doubt the accomplishments of the Jesuit Observatories throughout the world. For about two centuries our Fathers have devoted their time and energies to research in Meteorology, Astronomy, Magnetism, and Seismology. In many countries our Fathers were the pioneers in this field of scientific endeavor. The Jesuits were the pioneers in China, the Philippine Islands, India, Cuba, South America, and North America. The first seismograph in the United States was installed at Georgetown University just twenty-one years ago.

In the tropical countries where the hurricanes and typhoons hold sway with their destruction of life and property, these Fathers have been the ambassadors of mercy. Each year, by the faithful discharge of their duties and the knowledge acquired by years of observation and the study of accumulated data, they actually save hundreds of human lives, and millions of dollars of property, ships and cargoes.

Those who give their research to tropical storms carefully study these treacherous disturbances in order to find some sign or group of signs that would invariably prove the existence of a cyclone or typhoon while it is at a great distance from the observer; then to determine what part of the horizon it is coming from; also to locate the trajectory or curve along which the storm would move; and to do this in time for the observer to take himself to a safe distance from that fatal curve; and finally to determine the distance of the storm from the observer, its intensity, area, and velocity.

For thirty-nine years Father Louis Froc was the faithful forecaster of weather and typhoons at Zikawei Observatory, China, and in the Orient was affectionately known as the "Father of the Typhoons". Only a few weeks ago in Paris, Father Froc was decorated by the President of France with the distinguished service medal of: "Officer of the Legion of Honor."

The observations and publications of Father Vines of Belen Observatory, Havana, Cuba, are equally famous. The names of Father Algue' and Faura are held sacred in the history of typhoons of the China Sea and the Philippine Islands. Also the name of Father Ricard, "the Padre of the Rains" is held in the highest esteem in California.

The daily grind of the regular routine of meteorological observatories is tedious, wearisome, irksome and fatiguing. Those who devote their lives to this scientific research are truly heroic. Usually, it is only in the time of distress or disaster that most of us become aware of the fact of the faithful work of these observatory workers.

What a glorious book could be written of the records and labours of the indomitable champions of science which surround the illustrious names of Fathers Ricci, Schall, Verbiest, Chevalier, De Moidrey, Froc, Algue', Faura, Secchi, Vines, Ricard and Hagen.

A Personal Tribute To
Rev. G. L. Coyle, S.J.

I never went to a chemical meeting without having as one of my first inquiries—Is Father Coyle here? And generally he was present. Frequent contact with him during many years made me seek him out because it was a delight to be in the atmosphere of optimism, good will and kindliness that was always about him. I never heard him criticise any one harshly. He was one of the true gentlemen who speak only the best, and do not retail gossip, malicious or otherwise. He saw the sunny side of life, and his famous stories were always humorous or witty, but there was no sting in them. Father Coyle was interested in using his chemical knowledge to solve industrial problems. He spent much time in this kind of work, out of love for it, when there was no urge for financial reward.

Father Coyle was enthusiastic in his work. As a teacher he had before him the ideal of making men as well as chemists. Not only by example but by precept he developed in his students an appreciation of how men can live together amicably by regarding the rights of others. His teachings were demonstrated in the every day intercourse between his students in the laboratory.

After his call to Georgetown University Father Coyle devoted a large part of his time to the perfection of his well conceived plans to build up a great research organization to study pressing biochemical problems the solution of which would add to the health and happiness of mankind. He undertook to raise himself the large endowment required. I have heard from others how, against every disappointment, he fought on. He never grew restless from everlasting waiting and frequent rebuffs. He was, at last, successful and in addition to the sums collected others will be provided as the result of his tireless efforts. In my feeling of sorrow on hearing of his death one thing stood out clearly—the realization of the fact that he did not live to see his beautiful dream completely come true.

Those of us who knew him well will have forever his example of the beauties of a life made sweet by cheerfulness, unselfishness, and a love for others proved by practical deeds.

James F. Norris,
Professor of Organic Chemistry,
Massachusetts Institute of Technology.

Zikawei Observatory

Meteorological Observatory

Observatory Staff

ZIKAWEI OBSERVATORY
SHANGHAI, CHINA

REV. RICHARD B. SCHMITT, S. J.

At Zikawei, a suburb of Shanghai, is the largest private meteorological organization in the world operated by the Jesuit Fathers of the French Province. This observatory is connected with a net work of stations from Siberia to Manila, from Indo-China to Guam in the middle of the Pacific. Their notable service to humanity and commerce has continued for more than sixty years, and their scientific work and research is internationally recognized.

The Zikawei Observatory Staff is as follows: Reverend Paul Lejay, S. J., Director General; Reverend Ernest Gherzi, S. J., Director of Meteorological and Seismological Observatories; Reverend M. Burgand, S. J., Director of Magnetic Observatory; Reverend E. de la Villemarque, S. J., Director of the Astronomical Observatory. Brother Aquinalde, S. J., is assistant to Father Villemarque, and Brother Lord, S. J., is assistant to the Director General. There are also twelve Chinese laymen regularly employed in assisting the various Directors in their respective departments.

The Zikawei Observatory is an exceptionally busy place. There follows the programme of the Meteorological Observatory:

7:00 A. M.	Reception of weather report from United States Navy.
7:15	Weather report from air line and forecast for air lines.
7:20	Reception of weather report from Korea.
8:00	Weather report to the semaphore at Shanghai.
8:15	Reception and forecast from Chinese Army Aviation.
8:30	Weather or storm signals for the semaphore and ships if convenient.
9:00	Weather report from Italian Navy radio.
9:45	Synoptic bulletin for all far Eastern observatories and ships 4000 KM round, on 42 meters and 24 meters simultaneously.
10:15	Weather map for air line and forecast to be shown at the semaphore. Weather map for the semaphore.
10:30	Air sounding by pilot balloon for air line.
10:45	Forecast given to the Shanghai radio for ships.

10:55	Time signals sent on 24 meters and 600 meters simultaneously.
11:15	Forecast for the air line.
11:55	Time signals by ball dropped for the Shanghai harbour. Gun fired.
2:00 P. M.	Weather map for the semaphore.
4:00	Reception by radio of weather report for United States Navy.
4:30	Weather forecast for newspapers and for ships through the Shanghai French radio.
4:45	Weather map for the air lines.
4:55	Time signals on 24 meters and 600 meters.
6:00	Radio correspondence with Manila.
6:40	Reception of weather report from Chinese Navy station in Pratas Island, China Sea.
6:50	Weather and storm signals to the Chinese Navy station in Pratas to be repeated on 600 meters wave for ships coming up from Singapore.
8:30	Weather report from semaphore station and forecast and storm signals for the French radio for 10:00 P. M. bulletin.
8:55	Time signals by lamps for the Shanghai harbour.

The Radio Broadcasting Station of the French Concession sends out the weather forecast four times a day, and during the typhoon season twelve times a day. Experimental work is progressing with the Rugby Weather Bureau, England, for long range weather forecast.

Weather maps are printed every day at the Zikawei Observatory for distribution in the Shanghai area. Exchanges are maintained with three hundred observatories and institutions. Each month about one hundred and fifty letters are received from various commercial companies seeking information about weather conditions in order to secure the shipping of various cargoes, insurance and other commercial problems. This tremendous task is performed by Father Ernest Gherzi, and he is assisted by eight Chinese laymen, who have charge of receiving the numerous telephone calls from the semaphore, the harbours and the French Radio station. About four hundred telegrams are received each day.

The excellent work of the Zikawei Observatory has continued since 1873. In the sixteenth and seventeenth centuries the scientific work of the Jesuit Fathers in Peking became famous in the Far East, particularly by the work of Father Ricci, Father Shall and Father Verbiest. These three Jesuit scientists received special recognition from the Chinese government, and were given the title of "Magistrates of the Court of Mathematics." Many of the instruments used by these Fathers are still preserved at the observatory in Peking (now Peiping).

REV. ERNEST GHERZI, S. J.

One of the most important tasks of the Zikawei Meteorological Observatory is the forecast of the path of the typhoons. Shanghai is the fifth largest port in the world, and the destiny of many ships is at stake during the typhoon season. There is a large municipal semaphore near the harbour which flashes the signals of the directions and intensity of the typhoon. It is a thrilling moment for the Father in charge of forecasting, when conscious of his responsibility over an immense fleet of ships, he sees upon his chart the oncoming destructive typhoon. During the past fifty-eight years *more than one thousand* typhoons have been forecast and signaled from the Zikawei Observatory.

These forecasts, no doubt, have saved thousands of lives and many ships have escaped destruction among the rocky islands that infest the coast of Indo-China. Various testimonials of approval have often encouraged the Fathers in the work. Several governments have decorated various Directors of the observatory. In the British Naval Review we find: "The Staff of Zikawei Observatory has merited the gratitude of the entire shipping world"; and again: "To the Staff of Zikawei Observatory is due a debt of thanks which nothing can ever adequately repay."

Research work in all the departments of the observatory is in constant progress. The scientific data so laboriously accumulated during the many years of operation are always a source of further study. Expeditions are often made and geographical data determined. One of these investigations resulted in the making of fifty-four maps of the High Yang-Tse-Kiang River, and the positions of fifty towns determined.

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Belen Observatory

Belen College

Observatory Atop Central Building

BELEN OBSERVATORY
HAVANA, CUBA

REV. RICHARD B. SCHMITT, S.J.

For seventy-eight years the Belén Observatory, Havana, Cuba, has given uninterrupted service to the inhabitants and marine service of the West Indies. Father Anthony Cabre organized the original observatory in 1857. At that time the science of meteorology was in its infancy; however, the reports published show the variations of meteorological and climatological conditions from March 1, 1858. The publications of Belén Observatory received diplomas and medals of honor at the various expositions at Philadelphia, Paris, Chicago and Saint Louis.

In the year 1870, the golden age of Bélen Observatory began. Father Benito Vines, a man of rare ability, was made Director and immediately undertook the problem of research of the storms of the Antilles. The havoc wrought by cyclones was appalling, and the loss of life and property was heartrending. So, in the name of science and humanity, Father Vines determined to discover ways and means of issuing timely warnings of the oncoming storms.

For twenty-three years the heroic meteorologist took the readings of the various instruments and worked at his problem of how to organize a defense against hurricanes, and to lessen the loss of life therefrom. He had little assistance and his work was accomplished almost entirely by himself. The daily routine was tremendous. It included observations of atmospheric conditions every even hour from 4 A. M. until 10 P. M., and in time of special need, observations every hour of the day and night. The phenomena noted at each observation were readings of the declinometer, bifilar, barometer, thermometer (normal, maximum, minimum, wet and dry bulb), percentage of water vapor, relative humidity, direction and velocity of the wind, direction of upper, lower and middle strata of clouds, solar or luna halo, rainfall and magnetic disturbances. The annual reports of Father Vines gave accurate details of all these weather conditions, the average of all the observations of each phenomenon during each month, the daily mean of each observation, the monthly mean of each hour and the average of both of these means. The results were plotted on large monthly diagrams by means of curves. Among the automatic recorders of Belén Observatory was the Meteorograph invented by Father Secchi.

Father Vines was the first to work out with any success the essential features of the problem of cyclones. From his observations of the different clouds in different altitudes and the various currents of air and barometric pressures, he established the law of: ''cyclonic currents at different altitudes''; a law unknown before it was formulated by Father Vines. With this law thoroughly established, he invented two instruments: the cyclonoscope and the cyclononephoscope.

The results of the research work of Father Vines were published in such a scholarly way that he became internationally famous. He received the highest commendations from the United States, England, France, Germany, and India. On July 23, 1893, Father Vines closed his earthly career.

The successor of Father Vines was Father Lawrence Gangoiti who nobly carried on the work of his renowned predecessor. One of the outstanding accomplishments of Father Gangoiti was his accurate forecast of the hurricane of September 10, 1900 which caused such terrible havoc in Galveston, Texas.

The present Director General of Belén Observatory is Father Mariano Gutierrez Lanza, who has been laboring there for more than thirty-three years. The records of his work are well preserved in the excellent publications of the Observatory. Just to mention a few of the outstanding books edited by Father Gutierrez Lanza: ''Apuntes Historicos Acerca Del Observatorio Del Colegio De Belén''; ''Reportes Anuales Del Observatorio Del Belén''; ''Conferencias De Seismologia En La Academia De Ciencias De La Habana''; ''Catalogo De Ciclones En La Isle De Cuba 1865-1926''; ''Informe Sobre La Propuesta Simplificacion Del Calendario''; ''La Teoria De La Relatividad Por El Academico Merito''; etc. These and many other publications of Belén Observatory are internationally known, and many Governments and Observatories throughout the world have praised the excellent scientific work particularly in meteorology.

(*Editor's Note*: The data for this article was given by Father M. Gutierrez Lanza)

THE MANILA OBSERVATORY
PHILIPPINE ISLANDS

Rev. William C. Repetti, S.J.

Although many accounts have been written about the Manila Observatory there are some points which have not been touched which may be of interest to the readers of the Science Bulletin. Even the following account is intended only as a general survey of the activities of the observatory.

The observatory had its beginning in a very modest and gradual growth between 1865 and 1869 when Father Faura was sent to Manila to take up specifically the office of Director. In 1884 it became the official Weather Bureau of the Philippines, and as such received financial aid from the Spanish government. This arrangement was renewed under the American government and continues at present.

Manila Observatory

The name Manila Observatory emphasizes the private ownership of the observatory. The official designation is Central Office, Weather Bureau, Department of Agriculture and Natural Resources. The present Secretary of the Department is Mr. Rafael Alunan, an alumnus of the Ateneo.

Since the observatory is private property and located on the San Jose seminary grounds the government pays an annual rent for the use of the observatory as a government office.

The personnel of the observatory consists of Father Selga, Director; Father Saderra, Assistant Director; Father Coronas, Chief of the Division of Meteorology; Father Depperman, Chief of the Division of Astronomy; and Father Repetti, Chief of the Division of Seismology and Terrestrial Magnetism. All assistants and employees are Filipinos except a few missionary priests who act as observers in some remote localities.

The yearly salaries, in pesos, of the Fathers are as follows: Director, 5000; Assistant Director, 4000; Chiefs of Divisions, 3600. The office hours of the Observatory are 8:00 to noon and 1:00 to 4:00 P. M. There is a half holiday on Saturdays, on each day during the Carnival of two weeks in February, and for two months and a half during the hot season. A yearly leave of absence of twelve days with pay is granted. After two years service a more extended leave may be obtained.

The most important division of the observatory is that of Meteorology and typhoon warning and observation is of prime interest. Telegraphic reports are received twice daily of observations at 6:00 A. M. and 2:00 P. M. from stations throughout the entire archipelago and from the islands of Pelew, Yap and Guam. Guam is about 1600 miles east of Manila and the island stations are of prime importance because by far the greater number of typhoons come in from the east. Reports are also exchanged with the other Far East observatories in French Indo-China, Hong Kong, Zikawei and Japan. Father Gherzi of Zikawei collects and sends to Manila the reports of stations in China, Manchuria, and Korea.

An appropriation has been obtained from the legislature for a short wave transmitting set and this will prove of great assistance in getting reports from ships.

The spread of radio communication has greatly eliminated the use of Father Algue's barocyclonometer. As far as the writer knows, the Dollar and Canadian Pacific ships make no use of the barocyclonometer and as a matter of fact many ships do not carry it at all.

The principal instruments in the Meteorological Division, and in other Divisions also, of the Manila Observatory are the private property of the Society.

The astronomical division maintains the time service of the observatory and transmits it to various interested parties, Manila Railroad, Army Posts, etc. The Naval Radio Station at Cavite broadcasts the time signals twice a day. The principal equipment consists of transit, chronograph, two Riefler clocks and one Shortt Synchronome clock. The actual sending of the time is done with either one of two clocks regulated twice a day for this purpose. The new mechanism developed by the Naval Observatory in Washington is used to control the signals. This division also maintains apparatus for observation of atmospheric electricity. New instruments for this work are now on the way from Germany. The large equatorial telescope is now being used for variable star observations. Father Depperman has made a number of improvements in addition to building up a more accurate time service. A gallery has been removed from the dome of the observatory permitting a greater range of motion of the equatorial. A new observing platform that is carried around by the dome has been installed. New slit covers have been installed on the dome and arranged to open more easily than the original cover. The interior surface of the dome has been covered with Celotex which very materially lowers the inside temperature during the hot season. Father Depperman has two assistants in his division and a third man to assist in sending out the 10 P. M. time signals.

The correcting and rating of ship's chronometers is also a work of the astronomical division.

The Seismological Division has some of its instruments in the Meteorological building and some in the Astronomical observatory. The following are in operation; a complete set of Galitzin-Wilips; a Weichert 100 kg. Inverted pendulum; and two horizontal pendulums made in the shops of the observatory. The observatory has preserved all of its seismic instruments of the past fifty years and has a unique collection. We are in a rather poor location for good seismic observation. The Weichert is affected at times by tilt, the Galitzins are disturbed somewhat by traffic and other vibrations, and the whole city of Manila is on alluvium that introduces spurious vibrations and partially damps out surface waves.

A 200 kg. Weichert is maintained at the Naval Station in Guam, another at Butuan in Mindanao, a Vicentini and two horizontal pendulums at Baguio, a Vicentini at Mambajo, Camiguin Island, and a Vicentini and an Agamennone at Ambulong near the Taal Volcano. Simple pendulum seismoscopes still remain in some of the weather stations but they are worthless.

In pursuance of a resolution adopted at the Pacific Science Congress in Java in 1929 a monthly interchange of preliminary bulletins of important earthquake records is made between all the seismic observatories of the Far East, Java, Australia and New Zealand. The Japanese delegate agreed to this but the Japanese observatories have not adhered to the agreement. Within the first week of each month Manila sends out this preliminary bulletin together with a complete mimeographed report of the second preceding month. A seismic report is printed twice a year. Special articles on particular earthquakes and other related subjects find a place in this bulletin. Father Repetti is now engaged on an accurate determination of epicenters for the period 1920-29 and some interesting results have already been obtained.

No attempt is made to get newspaper publicity as in the States because it is practically worthless in the Far East. There are two assistants in this division who also assist in the magnetic work. A third assistant is at the disposal of both the seismic and astronomical divisions.

The magnetic division maintained its instruments in the observatory grounds from 1888 until 1904 when the installation of trolley lines in Manila necessitated a cessation of the work. In 1910 property was acquired north of Antipolo, observatory buildings were erected there, and

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TOTAL SOLAR ECLIPSE

August 31, 1932

Eastern Standard Time

Beginning 2:23 P. M. - Ending 4:36 P. M.

Total Eclipse Visible

Montreal, Canada
Lake Champlain, N. Y.
Haverhill, Mass.
Chatham, Mass.

Partial Eclipse in rest of United States

ASTRONOMY

TOTAL SOLAR ECLIPSE OF AUGUST 31, 1932

REV. THOMAS D. BARRY, S.J.

The American Ephemeris and Nautical Almanac for 1932, at the top of page 571, reads as follows: "III. A Total Eclipse of the Sun, August 31, 1932, visible at Washington as a partial eclipse." Such is the prosaic announcement of the coming event as given in the official astronomical yearbook for this country. Then follow some atronomical data under the headings of elements and circumstances of the eclipse. A few pages further on we find another page headed: "Besselian Elements of the Total Eclipse of the Sun" for the above date. There is also a general map of the eclipse, a page giving the geographical coordinates of the position of the moon's shadow at intervals during its progress, and another couple of pages giving the local circumstances for a number of cities. It is the purpose of this article to interpret this data and to give the times and other information for the benefit of those of our members who may wish to observe the eclipse.

The shadow of the moon first reaches the earth at a point whose latitude is approximately 80° north and longitude 110° east, that is, in the Arctic region a little north of central Siberia. From that point it travels eastward crossing the 180th meridian about 5° from the North Pole, thence southeastward across Hudson and James Bays, the Province of Quebec, New Hampshire and southern Maine, touching Cape Ann and Cape Cod in Massachusetts, leaving the earth from the middle of the Atlantic, near latitude 30° north and longitude 40° west of Greenwich. It takes about two hours to travel this distance, a record for Captain Frank Hawks to aim at. A little more detailed information about the path in southern Quebec and the United States will not be amiss. The northern limit of the path crosses the St. Lawrence River about forty miles west of the city of Quebec. Moving southeastward it strikes Maine near the intersection of the New Hampshire line with the Canadian border. It crosses the eastern end of the Rangeley Lakes, passes about fifteen miles southwest of Augusta, the state capital, and leaves the Maine coast at Boothbay. The southern edge of the path crosses the St. Lawrence about eight miles west of Montreal, enters the United States at the upper end of Lake Champlain, just misses Montpelier, Vt., passes through Concord, N. H., just includes Haverhill, Mass., and leaves the Massachusetts coast at Salem, but cuts across Cape Cod, just including Chatham. The center line crosses the St. Lawrence about ten miles east of Sorel, passes very close to Mt. Washington and North Conway in New Hampshire, cuts off the southern tip of Maine, leaving the coast about two miles east of Kennebunkport. In the rest of the United States the eclipse will be visible as partial only.

The width of the path varies slightly. At the St. Lawrence it is 101.8 miles in width, but by the time it reaches the coast it increases to 103 miles. The duration of the eclipse also exhibits a variation. Shortly after the beginning of the eclipse it will last 58 seconds on the central line. The length will increase until it reaches the southern end of Hudson Bay, at which place it will last 104.8 seconds. From then on it will decrease, lasting about 100 seconds in the United States, and about 66 seconds near the end of the eclipse. So it is seen that it will be near the maximum duration during its transit across Quebec and the United States. While crossing New Hampshire, the shadow will be moving at the rate of 2970 feet per second.

It will be seen from the above that none of our houses in the United States is included in the path of totality. Following are the local circumstances for the cities in the eastern section of the United States in which our colleges and high schools are located. Keyser Island and Kingston are also included. All times are P. M., Eastern Standard Time. Where Daylight Saving Time is in vogue, one hour must be added to the given time. By the beginning of the eclipse is meant the time at which the disc of the moon first touches the disc of the sun, by the end the time at which the moon's disc leaves the sun. P and V are the position angles of the first and last contacts, measured eastward from the north point and the vertex (point nearest the zenith), respectively, of the sun. For example, if P equals 307°, it means that the contact will take place 53° *westward* from the north point. The data for places printed in italics were taken directly from the table in the Ephemeris, those for the other places were obtained by interpolation from the large map accompanying the Eclipse Supplement to the Ephemeris. Times are given to the nearest minute only. The magnitude is the fraction of the sun's disc obscured at maximum, the diameter of the sun being taken equal to unity.

Place	Beginning				End				Mag.
	E. S. T.		P	V	E. S. T.		P	V	
Baltimore	2h	23m	315°	276°	4h	41m	120°	68°	.90
Boston	2	23	308	270	4	36	124	74	.99
Brooklyn	2	23	312	272	4	39	122	72	.95
Buffalo	2	14	314	282	4	33	120	74	.91
Jersey City	2	23	312	272	4	39	122	72	.95
Keyser Island	2	23	311	272	4	38	122	72	.96
Kingston, Jamaica	3	12	...	...	5	12	...	..	.57
New York	2	23	312	272	4	39	122	72	.95
Philadelphia	2	23	313	274	4	40	121	70	.93
Poughkeepsie	2	21	311	273	4	37	122	73	.96
Stockbridge	2	21	310	273	4	36	122	73	.97

Washington	2	24	316	276	4	41	119	67	.89
Wernersville	2	22	313	277	4	39	121	70	.92
Weston	2	23	308	270	4	36	124	74	.99
Woodstock	2	23	315	276	4	41	120	68	.90
Worcester	2	22	309	271	4	37	124	74	.98

The position angle from the vertex is given to enable the observer more easily to find the point of contact, since it is rather difficult to determine just where the north point of the sun is located.

For those who intend to view the eclipse within the belt of totality it would be advisable to make a choice of site at an early date. The principal factors to be considered are the weather and accessibility. As for the latter there should not be much difficulty. New Hampshire and Maine are a regular summer playground. Good auto roads cover the country pretty well, and may be found from the road maps obtainable at any gasoline station. Most of the places within the belt of totality are on the Boston and Maine Railroad or the Maine Central Railroad. It is probable that these roads will run extra trains on the day of the eclipse, for the convenience of those who wish to view the eclipse. The weather, on the other hand, offers a greater risk. The Eclipse Supplement mentioned above publishes a table giving the average percentage of sunshine at a few points along the path for each hour of the day, from August 30 to September 1. The averages are based on observations covering a five-year period. While the Maine and New Hampshire coasts have a slightly better average than inland points, it is not enough to give greater probability of fair weather at the time of the eclipse. The probability of clear sky will be about 55 per cent all along the line, with the exception of the higher peaks of the White Mountains. The latter exception is due to the fact that clouds frequently form over mountain peaks in the middle of the afternoon. Cloudy weather over the whole section may arise either from the ordinary cyclonic movement along the northern border of the United States, to the tail end of a tropical disturbance which may move up the coast (though these are more common in September), to local fog (though this usually dissipates in the course of the forenoon), or to convectional clouds of the cumulus variety, which frequently form in the afternoon following a warm, clear morning. For this reason it is difficult to make a prediction of clear weather with any certainty. The average wind velocity for the district is about 8 miles per hour. This is based on the same five year period.

Another requisite is an open space with a good view to the westward. The November, 1931, issue of "Popular Astronomy" carries the report of a committee of the American Astronomical Society, appointed to investigate conditions and possible sites along the path. The report contains a list of a large number of places, with information regarding accessibility and possible sites.

The following table gives the local circumstances for a few places within the path. They were computed from data given in the Eclipse

Supplement. The notation is the same as in the preceding table, the additional columns headed second and third contacts referring to the beginning and end of the total phase. It should be noted that, while the times are given to seconds, the uncertainties in the lunar and solar tables are such that an unavoidable error of several seconds may exist in the predictions. The Nautical Almanac Office of the Naval Observatory is at present using recent occultation observations in an attempt to better the predictions. The duration is that of totality.

Places within five miles of the central line:

	h m s	h m s	h m s	h m s	
Mt. Washington	2 18 42	3 27 33	3 29 13	4 32 49	100 sec.
N. Conway, N. H.	2 19 18	3 28 6	3 29 45	4 33 16	99
Conway, N. H.	2 19 21	3 28 11	3 29 49	4 33 22	98
Kennebunk, Me.	2 21 9	3 29 46	3 31 24	4 34 42	98
Kennebunkport, Me.	2 21 11	3 29 48	3 31 25	4 34 42	97

Places more than five miles from the center line:

Ossipee, N. H.	2 19 59	3 28 50	3 30 25	4 33 57	95
Portland, Me.	2 20 53	3 29 27	3 30 59	4 34 15	92
Portsmouth, N. H.	2 21 32	3 30 21	3 31 45	4 35 14	84
Newburyport, Mass.	2 21 38	3 31 2	3 22 3	4 35 42	61
Provincetown, Mass.	2 25 25	3 32 55	3 33 51	4 37 18	56

In all cases P for first contact will be 307°, for the last contact 124°; V for first contact will be between 268° and 271°, for last contact between 76° and 78°. The sun will be about 30° above the western horizon. Provincetown had better be avoided, as there are only two roads as far as Orleans, and one from there to Provincetown. As the Cape is a popular summer resort, the roads will probably be pretty well jammed on eclipse day.

The equipment for an "expedition" need not be very extensive. With a reliable watch and a shade to protect the eyes, good observing may be done. The shade may take the form of a piece of smoked glass, though there is danger of hurting the eyes, since it is difficult to spread an even coating of soot over the glass. It is also rather messy. A better plan would be to expose a photographic film to daylight and then develop it. That will give a shade of uniform density. Longer development will give a denser shade. It should be tried out on the sun beforehand to ensure satisfactory protection. Field glasses will be of great assistance in studying the corona during the total phase. If a small portable telescope is available, so much the better. It should be protected by a dark glass at the eyepiece for use in direct vision, or else a piece of white cardboard may be placed behind the eyepiece, and the sun's image projected on it. The eclipse of January 24, 1925 was observed by the writer at Weston by means of a small surveyor's transit set up near one of the windows of old Bapst Hall of happy memory. Behind the transit was placed a music stand of the ordinary collapsible variety, and on the stand a piece of white paper pasted to a piece of cardboard. The sun was projected onto this paper, giving an image about 8 inches in diameter, thus affording an excellent view of the progress of the eclipse. To compensate for the motion of the earth, the transit telescope was moved from time to time by means of the tangent screws. If the transit is equipped with a solar eyepiece, the eclipse may be viewed directly, but I think the other method is better, both eyes being used and more freedom of movement being permitted.

What can a non-professional astronomer, with the limited equipment described above, accomplish at an eclipse? The following suggestions may prove helpful for those who are not fortunate enough to be within the totality belt. The most important observations will be the times of the beginning and the end of the eclipse. A good watch, with as steady a rate as possible, is necessary for these observations. The watch should be checked before and after the eclipse by comparison with some accurate timepiece. The Naval Observatory will probably send out extra time-signals for the purpose from the government radio stations at Arlington and Annapolis. If a radio receiver of the necessary type (capable of receiving signals in one of the following bands, 16,000 to 17,000 meters, 2,000 to 3,000 meters, or 15 to 18 meters) is not available, comparison may be made with a clock in a jeweler's establishment. It should be noted that the time signals broadcast through the courtesy of various watch companies are rarely sufficiently accurate for this purpose. They are frequently several seconds out, and while they may be all right for setting the grandfather clock on the stairs, they are not suitable for accurate scientific work.

It might be well also to form some estimate of the darkness at the maximum eclipse, comparison being made with the light received from full moon. This is rather difficult to do, and the results can be considered as only approximate.

Thermometer readings may be recorded at five or ten minute intervals to note any drop in temperature during the progress of the eclipse. There should be a drop as the heat of the sun is cut off.

An eclipse gives one the opportunity of seeing some of the planets and brighter stars in the daytime. At this eclipse, Jupiter will be seen about 3° to the right of the sun. About 6° to the right of Jupiter will be *α* Leonis (Regulus), while Mercury, which is ordinarily seen only at rare intervals near the horizon, will be visible about 9° beyond Regulus. The four bodies will be almost on a straight line. In the southwest, *α* Virginis (Spica) should be visible. Other stars, not so bright, may be seen, depending on the magnitude of the eclipse at the place of observation.

Those equipped with cameras may try the following. Set up the camera, focused to infinity, in such a way that at the beginning of the eclipse the sun will be visible in the upper left corner of the finder. Fix the camera firmly, and then make an exposure at five or ten minute intervals, without changing the film, starting from the beginning of the eclipse. In this way a continuous record of the eclipse will be had on one film. The image of the sun will be about an eighth of an inch in diameter, but the progress of the moon across it should be clearly visible. For those who prefer a larger image, the following is suggested. Before the 1925 eclipse, the writer removed the lens system from an ordinary Brownie box camera, placed a piece of white paper in the plane of the film, opened the shutter, and then, placing the camera against the eyepiece of the transit, focused the sun on the paper. A mark was placed on the telescope tube for reference, as the focus for the visual projection was somewhat different. Then the shutter was closed and the film loaded. Whenever a picture was desired, the telescope tube was moved out to the mark, care being taken that the entire sun was in the field (which could be determined from the projection on the music stand), the camera was quickly brought up to the eyepiece and the exposure taken. More than one exposure on the same negative was not practicable, so that the film was changed after each exposure. Six fair images about 7/8 inch in diameter were obtained in this way. The edges were not extremely sharp, due probably to the fact that the initial focusing was not too exact and to the difficulty of focussing a telescope which was not corrected for photographic rays. Care should be taken not to hold any inflammable parts of the camera close to the eyepiece, as the converging rays of the sun may easily start them burning. The following method was also tried at Weston at the same eclipse, yielding better images, over an inch and a half across. It is applicable wherever the equipment is at hand. The parallel rays of the sun were introduced into the darkened physics laboratory by means of a porte-lumiére. After passing through a lens of 12-feet focal length, they were focussed on the plate of a Graflex camera, also with the lens system removed. This method gave much sharper images than the preceding.

Those situated within the total eclipse path may try the following in addition to the observations already mentioned. Just before the arrival of totality, a watch should be kept for shadow bands, which should move in a general southeasterly direction. A rather bright area, such as a stretch of dirt or concrete, would be advisable as a place to observe them. The number of the bands, their direction and the number passing per minute should be noted. (If one is situated outside the path, but fairly near it, it would be worthwhile to look for this phenomenon, as well as for Baily's beads.) The number and position of Baily's beads (cf. the last article, p. 118) should be noted. A couple of seconds before totality the shadow of the moon will be seen bearing down on the station at the rate of almost 3,000 feet per second. During totality the shape and extent of the corona (in terms of the sun's diameter) may be noted. The position and shape of prominences should also be recorded. If one is not equipped to record the spectacle photographically, but is handy with a drawing pencil, he may try drawing a picture of the eclipse. It will be necessary to work fast, as the duration of the eclipse will be only about 100 seconds at most. After totality, the shadow bands may be looked for again.

It is suggested that if several people are to observe the eclipse at the same place, the different observations be entrusted to different members of the party.

This will be the last eclipse visible and accessible for some time. In July, 1945, there will be a total eclipse visible in Canada, and the next one will cross Florida in March, 1970. *Verbum sat sap.*

Corrections in previous article:

Page 116, line 8: for 520000, read 5200.

Page 117, line 27: for "westward", read "eastward".

NOTES ON OUR SPANISH OBSERVATORIES

REV. THOMAS D. BARRY, S.J.

The following quotations have been taken from a secular daily of Barcelona, "La Vanguardia", under the dates mentioned below.

January 27.—It is said (and we recognize it as rumor only) that all the equipment of the Observatory of the Ebro has been claimed by an American house, because, inasmuch as it was not entirely paid for, it was used only in trust.

Same date.—Tomorrow the director general of the Geographical and Statistical Institute will leave (Madrid) for Granada to take charge, in the name of the Government, of the scientific equipment and Observatory of LaCartuja, which belongs to the Jesuits.

January 29.—The civil governor of Tarragona has been visited by the illustrious man of science, Fr. Rodés, S.J., director of the Observatory of the Ebro, who informed him that the decree of dissolution of the Society of Jesus cannot touch the said Observatory, since it depends on a legacy and is now under the care of a commission. The governor informed Fr. Rodés that the above statement should be put in writing and forwarded to the government, to whom belongs the decision.

February 4.—We are advised that in spite of the visit made to the Observatory of the Ebro by the director general of the Geographical and Statistical Institute, representing the government, the act of taking it over by the State has been deferred, since it is opposed by the guardianship of the Observatory, legally established in Tortosa.

Concerning the services of the Observatory, Fr. Rodés, S.J. has offered the following data:

The present budget of the Observatory amounts to some 50,000 pesetas annually, not counting the salaries of the religious personnel which conducts it.

"The State would have difficulty in carrying on with less than 200,000 pesetas. Today is pays 25,000. For some years it has paid 16,000.

"In return, the Observatory supplies daily telegrams for the meteorological service; particularly magnetic data, computing them from the magnetic components, for the use of geographical engineers.''

The State counts on replacing us with a fit and competent personnel, went on Father Rodés, but considering the location of the Observatory and the variety of precise measurements, it would be difficult to supplant the religious personnel, which is engaged in no other work.

If the government accedes, the illustrious Jesuit intends to remain at Tortosa, provided the government recognizes the new legal status of the Observatory of the Ebro, an indispensable condition for his continuance in the post he occupies.

The Observatory since its foundation in 1903 has always been under the direction of the Fathers of the Society of Jesus, first under the great astronomer P. Cirera, later under the present director, Fr. Luis Rodés, both known the world over as eminent in the field of Astronomy.

The scientific world always remembers the great kindness shown the European and American celebrities by the Observatory in 1905, when the men of science gathered at Tortosa to get precise data from the eclipse of the sun, the center of whose shadow passed Tortosa.

They also remember the pamphlets published by the Observatory on the connection between solar activity and various phenomena on our planet, especially the electro-magnetic phenomena, the problem which so interests the scientific world by its theoretical and practical importance, the basis of the meteorology of the future, since it will help solve the problem of the influence of the sun on atmospheric changes.

All these studies and those still awaiting solution will be hindered if the present possessors of their secrets leave, and Tortosa and Spain will lose a center of universal renown, a child of the exclusive labors of the Jesuits, if the government does not give assurance that the Observatory will continue under the wise and expert direction of the famous Father Rodés.

It would be truly lamentable if persons ignorant of the studies being undertaken should take charge of the Observatory, breaking the continuity of the work which succeeds in spreading its value beyond our frontiers.

February 6.—We have been asked to publish the following note:

''The Secretary general of the International Astronomical Union, under date of February 1 of the current year, announces the nomination of Father Luis Rodés, S.J., as member of the Commission for the study of the relations between solar and terrestrial phenomena.

''This commission was created in 1925 by the Executive Committee of the International Council of Scientific Investigations, and at present is composed of twelve members of different nationalities, and gives Father Rodés the honor of representing Spain.

''It is a notable coincidence that Father Rodés was notified of his appointment on the very day on which a government commission was busy taking over the Observatory of the Ebro, replacing its present director.''

BIOLOGY

THE ADRENAL GLANDS

William J. Walter, S.J.

In man these glands are situated on the upper surface of the kidneys. The glands are composed of cortex and medulla, each having a separate embryological origin. The cells of the cortex develop from a thickening of the coelomic epithelium on either side of the root of the mesentery and therefore are mesoblastic in origin. The adrenal medulla is developed from a mass of cells which first lie close to the posterior root ganglia and later migrates out to differentiate into the sympathetic nervous system and the chromophil tissues. The chief peculiarity of the medullary cells is their brown staining reaction;—with chromic acid or its salts the medulla takes on a dark brown stain, and is therefore often referred to as chromophil tissue. This chromophil tissue is found not in the medulla alone but also in the carotid gland and in the sympathetic ganglia.

The functional significance of the adrenal glands was first discovered by Dr. Thomas Addison in 1849 when he observed that a marked pathological condition of the adrenals produced a peculiar type of anemia which was associated with severe muscular weakness, diminution in vascular tone, and finally prostration. A few years later it was shown by Brown-Sequard that the removal of these glands was followed by death in a few days, and this feature clearly set them apart as organs of special physiological importance. Adrenalectomy is a fatal operation; the mortality is 100% and follows, usually within a week or ten days after complete removal of the adrenal tissues. The most skillful surgical technique, combined with optimal post-operative attention, and the insignificance of the tissue lost—roughly one three-thousandth of the body weight—has not lessened the 100% immortality.

These facts inspired investigators to repeated efforts, and in 1895 Oliver and Schafer discovered a secretion of the medullary portion of the adrenal structures, which is now called adrenalin. Adrenaline occurs only in the cells of the medulla and not in the cortex of the gland. It has been isolated and prepared in pure form and its chemical structure has been demonstrated to be a methyl-amino derivative of catechol and its formula is $C_9\ H_{13}\ NO_3$.

The physiological action of adrenalin is seen in the marked effect it has on the heart rate and blood pressure. The great slowing of the heart rate is due to an action of the adrenalin on the cardio-inhibitory center since is disappears when the vagi are cut or after the administration of atrophin. In addition to the heart effect adrenalin causes a strong contraction of the arterioles of the involuntary muscles. Even voluntary muscle is affected by adrenalin for injection of it produces an increase in the tone of the muscles, the contractions being increased in size and the subsequent relaxations being more rapid and complete. Adrenalin also has an effect on the body metabolism as regards the carbohydrates. When injected it stimulates the process of glycogenesis and causes an output of sugar in the urine which lasts for some days. Under high emotional excitement, as in rage or fear, there is an increased secretory activity of the gland, a protective measure which improves the tone of the heart and muscle. A solution of one part of adrenalin in a million will cause effects when injected. When administered in large doses adrenalin has a distinct toxic effect and when given intravenously a lethal dose is about one mgm. per kilogram of body weight.

Yet despite the effects of adrenalin on the body functions, the fact remains, that the extirpation of the adrenal medulla alone is not necessarily fatal, and administration of medullary extracts will not avert the impending disaster after complete adrenalectomy. As an additional proof of this fact Biedl has shown that in those fish in which the cortical substance exists as a separate anatomical structure, the interrenal body, extirpation of this organ is followed by progressive muscular weakness ending in death. From this fact it was assumed that the adrenal cortex must secrete a substance essential to life. Supporting this assumption were the following facts: (1) the chromophil tissue is not found in the medulla alone but also in the carotid gland and the sympathetic ganglia, and should the adrenal medulla be removed its functions may be supplied more or less perfectly by the outlying cells belonging to the same tissue; (2) the secretion of adrenalin occurs in the adrenal gland only in the cells of the medulla, and not in those of the cortex; (3) the cortex and medulla of the adrenals have different origins embryologically, and thus it is probable that they have different functions. The logical conclusion to be drawn from these facts, seems to be that the cortical cells have some specific and essential secretion, and it would seem possible, moreover, that the fatal consequences of adrenalectomy are due to the loss of the cortical rather than the medullary substance.

Evidence is rapidly accumulating to prove that at best adrenalin serves as an emergency factor, particularly under conditions of emotional stress when the action of the nervous system needs to be augmented. Thus adrenalin is no longer being regarded as indispensable to the body functions. The same evidence points to the undoubted indispensability of the adrenal cortex, for it seems to be established that death follows the removal of the latter rather than interference with or loss of the medulla.

Researches by Swingle and Pfiffner at Princeton University (1929-30) point to this ability to maintain adrenalectomized cats alive by suitable administration of cortical extracts. The progress of these two investigators over their predecessors apparently lies in a more successful separation and concentration of the effective portions. Still more recent experiments by Dr. Frank A. Hartman of the University of Buffalo support this view that the cortical cells produce a hormone essential to life. According to the data of his experiments bilaterally adrenalectomized cats suffer from a loss of appetite and weight, and a muscular weakness which leads to prostration and death. Yet cats with both adrenals removed and treated with an extract of the cortex seem to be able to live indefinitely. Six cats so treated were still living at the time his paper was published, and their ages were 28, 39, 54, 61, 74, and 170 days since adrenalectomy. All were living a perfectly normal existence, all ate as well as normal and gained weight. Two adrenalectomized cats were brought back to normal health after being permitted to go so far as to become prostrate from lack of the extract. Other investigators report the same findings and suggest in conclusion that the adrenal cortex is concerned in the steady maintenance of certain body functions, while the medulla brings about rapid adjustments in the same direction under emergency conditions.

The nature of the secretion furnished by the cortex and its normal functional values are at present merely matters of speculation. Chemical examination of the cortex shows the presence of much liquid material and it may be that through this material the tissue influences the metabolism in other parts of the body. It has also been suggested that the cortex produces a hormone that neutralizes toxins, and that after removal of the cortex such toxins accumulate and cause death. For further enlightenment we must await the results of future investigation.

INSULIN AND ITS ANTAGONISTS

Joseph G. Keegan, S.J.

Two views have been advanced in explanation of the metabolic disturbances concerned in pancreatic diabetes. In one instance it is claimed that there occurs a failing power of sugar utilization on the part of the tissues. In the other view there occurs an increased output of sugar (glucose) on the part of the liver (glycogenesis). In either case successive steps would be, first a rise in the blood sugar concentration in excess of the normal 0.14-0.17 per cent, or hyperglycaemia, and secondly rapid elimination of the excess sugar via renal excretion. This latter constitutes a condition named glycosuria, or the presence of sugar in the urine.

After depletion of the glycogen store of the liver, sugar still appears in the urine, being derived evidently from proteins. Obviously then, on the theory of deficient utilization, the tissue undergoes a sugar starvation, although literally bathed in a sugar medium. And the pity of it is, that all the while good protein is being mobilized to this unavailable sugar form.

According to the theory of increased glycogen reduction, the deficient utilization is not denied but regarded as a secondary factor, and due to the overloading of the blood with sugar.

Now the administration of insulin provides the missing factor and unless the course of diabetes is well nigh run, the symptoms can gradually be eliminated. Insulin or its equivalent is essential, it would seem, to a balanced metabolism.

But whence comes this healing balm or opiate? It has its origin in the pancreas. It has come to be a generally recognized fact that the pancreas exercises a two-fold function. It is at once a gland of external and of internal secretion. After ligature of the ducts, the secreting acini (produce intestinal zymogens) atrophy. But there are certain areas in the pancreas which remain intact. They are the so-called islands of Langerhans, tiny epithelioid groups of cells which contain characteristic zymogen granules. These constitute the insular tissue and in the pancreas of the pig as many as 56,000 have been counted. Structurally they represent something distinct from the acinar tissue of the pancreas.

It was as early as 1889 that Von Mering and Mankowski found that total removal of the pancreas was followed by severe diabetes. Still however, might not the loss of the acinar cells and the external secretion have something to do with these symptoms? More refined methods were introduced and simultaneously with the removal of the pancreas a subcutaneous graft of pancreas was made elsewhere in the body. With such transplantation diabetes did not ensue, even though there was no longer an outlet for the digestive secretion of the pancreas. Subsequent removal of the subcutaneous graft was followed rapidly by diabetes. The case was complete. A new function has been found for the pancreas and that function was traced to very definite areas in the pancreatic tissue. The gist of the matter is that in the island of Langerhans is formed a hormone quite necessary for the metabolism of carbohydrates and fats.

This pancreatic hormone, although already named insulin in 1916 by Schafer, was quite hypothetical until 1922, when Best and Banting working in McLeod's laboratory, succeeded in making an extract of the hormone in concentrated form. 'In order to prepare insulin, the fresh pancreas is finely minced and extracted with several changes of alcohol which, diluted with water contained in the gland, is evaporated to a small bulk and poured into absolute alcohol. A white precipitate is produced which represents the crude insulin.' (Starling) Addition of sodium carbonate to the alcohol in the first instance seems to increase the yield. Prepared insulin is a white powder easily soluble in water and in dilute alcohol, but insoluble in the ordinary fat solvents. To give an idea of the success of extracts, in one instance from a total weight in insular tissue of 1.5 gms., 12 cc. of extract after removal of the alcohol, was obtained. The injection of 2 cc. of this into a normal rabbit lowered the blood sugar from 0.018 to 0.024 within two hours.

There is another interesting item, which shows how an anatomic feature has been commercialized. Previously sheep and beef pancreas had been used to obtain the insular hormone. The extract was freed chemically from the acinar elements. But it was discovered that the islands are not always the sources of the hormone. In some of the fishes the insulin-producing tissue was found not to be encapsulated in the pancreatic tissue and therefore easily separable from the tissue which is not desired for insulin extract. Since this discovery the manufacture of insulin commercially is made from the tissue of the cod.

The chemical analysis of insulin has presented difficulties and its exact nature is not certain. Besides histidine and lysin, insulin contains a considerable amount of arginin and leucin. Therefore a polypeptid-like guanidin linkage is believed to be present.

Independently of any unity based on a method of secreting hormones directly into the blood stream, there are certain of the ductless glands which check and counterbalance each other with mathematical precision and constancy. As instances to the point we may cite the compensatory natures of the thyroid and the adrenal bodies with reference to the particular endrocine organ which we are now considering. Redinger and the Vienna school first attached any importance to this relationship. I think that we shall do very well if we confine our attention to recent experiments directed along the lines presented by the mutual relations of these glands.

The root-factor which determines the interaction of these glandular activities is the regulation of sugar metabolism. To maintain a constant proportion of 0.1 to 0.17 per cent of sugar in the blood at all times, both in the fasting condition and immediately after carbohydrate meals requires a nicety of functioning on the part of the body mechanism. Directly after such a carbohydrate meal a large amount of glucose must be converted into glycogen. In the fasting condition the glycogen reserves must be mobilized to keep constant the normal blood sugar. In the absence of sugar in the diet and after the glycogen stores have been depleted, the body is equipped to manufacture sugar at the expense of the proteins of the body tissues.

When insulin is injected into the normal individual there follows a steady fall in blood sugar concentration. Characteristic pathological symptoms ensue when the concentration falls to 0.045 per cent. If glucose is injected the pathological conditions disappear promptly. The majority of experiments point to two factors in this reduction: first, acceleration of sugar oxidation and secondly, regulation of sugar formation from glycogen and especially from non-carbohydrate sources.

All along the line we note the antagonistic effects of adrenaline. Adrenaline raises the blood sugar. Contrary to the action of insulin, it stimulates the glycogenic function of the liver. Again, adrenaline increases the amount of fat in the blood whereas the injection of insulin is followed by a fall in the fat content. In severe diabetes which is equivalent to insulin starvation, the blood of the patient is so replete with fat as to resemble strawberries and cream. Adrenaline increases the lactic acid content, whereas a fall in lactic acid attends the injection of insulin (according to the experiments of some investigators, but others find negative results.).

Another recent experiment emphasizes the antagonism. In normal rats administration of insulin in doses insufficient to produce convulsions, caused within two hours a decrease of 15 to 20 per cent in heart rate. This is interpreted as due to insulin's depressing effect on parasympathetic system. This is surely contrary to the effect of adrenaline.

From the work of Esteban Turcatti in the experimental extirpation of the pancreas and the suprarenals performed on dogs the following conclusions are provisional: Total ablation of the suprarenals before pancreatectomy or simultaneously with it, tends to prevent diabetes; nerve section has no effect on it. Removal of the medulla of the adrenals does not affect hyperglycaemia. There is no reason to identify suprarenalectomy in its effects (still less the effects of nerve section with epinephrine deficiency, since these operations do not supress the entire chromaffin substance. Hyperglycaemia may be produced by pancreatectomy in the absence of the adrenal medulla, not in the absence of the cortex. The greater importance pertains to the cortex, whether by direct influence on carbohydrate metabolism or by cooperation with epinephrine. Probably the cortex influences metabolism through the vagus, since it has been otherwise shown that the cortex has a vagal function.

The antagonism of these two hormones is too evident to escape notice, and the salient factor in this antagonism is this, that while adrenaline checks the oxidative process of carbohydrates, insulin accelerates it. Normally the action of insulin and thyroxin on the one hand and of adrenaline on the other maintain equilibrium. In the light of these facts extirpation of the pancreas (pancreatectomy) would give full sway (or nearly so) to the action of adrenaline. This would induce pancreatic glycaemia and glycosuria. Again, in the presence of the pancreas, excessive adrenaline secretion would induce glycaemia and glycosuria. But, between adrenaline glycosuria and that which is present in pancreatic diabetes, there would be this difference that the former condition would cease with the depletion of the glycogen store, whereas pancreatic glycosuria continues until the death of the animal.

With the fall in sugar oxidation induced by adrenaline, the accumulation of fat is practically a corollary, since fat combustion presupposes the oxidation of sugars. Insulin after a dose of adrenaline prevented the rise of sugars and fat, and if given in excessive amounts, actually, as we have noted, gains the upper hand and reduces the sugars. This gives us some idea of the trend of experiment at the present time with reference to insulin. Aside from the constant efforts being made to fathom the real nature of insulin, a decided attempt is being made to study insulin in conjunction with its antagonists, chief among which is adrenaline.

Mansfield in the Archives of Experimental Pathology and Pharmacol. reports some interesting experiments. The interest here lies not in any relation to another hormone, but rather in the fact that his experiments seem to open a discussion which had evidently been consigned to the limbo of forgotten things. He made the attempt through occlusion of the pancreatic duct to increase insulin production. As early as 1910 Bensley with seeming conviction scouted the possibility of such conversion of function as the experiment seems to suppose. In these new experiments, carried out on dogs, only half of the pancreas was tied off, in order to retain the digestive secretion. Results were checked by blood sugar tests, and after 1 to 2 days' abstinence, blood sugar fell to 0.04. This was ascribed to increased insulin production. This condition of increased production was observed over a period of three years. After extirpation of the ligated portion of the pancreas, the fasting blood sugar level rose to normal, and abstinence glycocaemia disappeared. Incidentally, in the histological examination of the extirpated pancreas a considerable increase of islands was demonstrated. If these experiments were carefully conducted and the results interpreted as they should be, there would seem to be prospect of operative treatment for diabetes. This aspect is not only interesting, but inspiring.

THE MANILA OBSERVATORY

(*Continued from Page* 183)

continuous magnetic observations have been carried on there ever since. The equipment consists of the usual variometers, declination, horizontal intensity, and vertical intensity. Absolute measurements are made twice a month with an Elliott magneto-meter and a Dover Dip Circle. A Schulze Earth Inductor has just been obtained to replace the Dip Circle. The absolute observation house is to be enlarged to provide convenient observation space for the Inductor. Annual reports are printed and these are well up to date, as magnetic reports go. The report for 1930 is ready for the press. The Coast and Geodetic Survey take their instruments to Antipolo for comparison tests after each surveying cruise.

The Library of the Observatory is rather spacious but somewhat warm during the hot season. The shelves are of the old style ornate type, made when libraries were looked upon as ornaments rather than mere tools to assist in particular lines of work. A very rough count places the number of books at about 5000. This includes series of monthly and annual reports and bound periodicals. Father Depperman has done a very valuable work in rearranging the library and commencing a new index.

MATHEMATICS

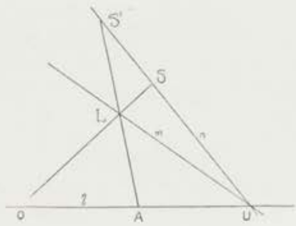
THE CONCEPT OF DISTANCE

Rev. Frederick W. Sohon, S.J.

An understanding of the concept of distance is so important before one can criticize the speculations of modern physics, that we may be pardoned a brief glance at such a difficult concept. If the fundamental mathematical truths that are presupposed are not known, the difficulties that this ignorance creates are unjustly attributed to the speculations themselves, so that the methods appear rather high-handed. We have seen that the metrical properties of geometry rest on postulates that are contingent, and are not knowable antecedent to experience. They cannot be obtained by mere imagination, and an intelligent inquiry into what is objectively possible seems to be the only logical beginning. The process of showing that non-Euclidean geometry is possible by reducing it to Euclidean (see Lectures on Fundamental Concepts of Algebra and Geometry by John Wesley Young, Macmillan, 1911, Lecture II) may lead one to assume a false position for Euclidean geometry and to assume its contingency to be mere speculation and its objective uncertainty to be a doubtful conjecture.

Defining distance is like defining intervals and ratios in arithmetic. Both intervals and ratios are relations between numbers, but to distinguish between them involves setting up criteria of equality, and this implies bringing two more numbers into each definition. As regards distance, the criterion of equality is superposition. Sophus Lie pointed out that these superpositions form a group of finite continuous projective transformations. Hence it is necessary to investigate finite continuous projective transformations in geometry without presupposing any metrical properties. (See Encyc. Britt. 11th ed. vol. 11 page 732 and 734.

Non-metrical geometry is obtained by dropping all metrical postulates and their consequences from an ordinary geometry. It is still concerned with quantities, i. e. concepts capable of being measured, but no measurements are either made or presupposed. This is important, because any other procedure involves a vicious circle. Non-metrical geometry has been elaborated at great length, and is very interesting on account of its generality, (e. g., a property proved for a circle necessarily holds for an ellipse, parbola or hyperbola without distinction, for such a distinction presupposes measurement.) But the question must be answered, what are we to understand by the lines and planes of non-metrical geometry. The answer is that they are simply arbitrarily preferred loci or classes of positions for which the postulates are valid, and in the absence of a metrical criterion any "straightness" that may be claimed for them is illusory. Since nothing depends on their "straightness' they may without loss of generality and with much convenience be assumed in such a way that we may hope ultimately to call "straight". But whether or not this is done is of no importance in the sequel.



Numerical names can be assigned to the points of non-metrical geometry in such a way that the favored loci will be represented by linear equations. This is done most easily by a construction called F Schur a prospectivity. If from an arbitrary point S we project the points of a given line l on an auxiliary line m, and then from a second point S' reproject the points back on l, we get the transformation of l into itself. If the point U is the intersection of the given line l with the auxiliary line m, then U will remain unaltered. In order that U may be the only point of l that is transformed into itself, the second point S' is taken on the line on which joins the original center of projection S with the double point U. If we select three arbitrary points O, A and U on any given line, and require a prospectivity that will transform O into A and U into U, S can be chosen arbitrarily. S' can be chosen anywhere on the line SU. If OS meets S'A in L, then the auxiliary line m must be drawn through LU. The indetermination as regards S and S' is of no consequence, because the final result can be proved to be independent of the selection of these points, provided, of course, the conditions just indicated be satisfied. Holding S, S' and the auxiliary line m fixed, the prospectivity is repeated. Thus O is brought to A, A to another point B, B to another point C etc. We then assign the names O to O, 1 to A, 2 to B etc. Negative numbers and fractions are easily taken care of but we need not go into the details.

The extension to space of three dimensions is easily made by assuming three concurrent non-coplanar lines, and numbering them so that their common point is called O in all three cases. A plane through two of the double points is called I in all three cases. A plane through two of the double points and any given point in space P will in general intersect the third line in a numbered point. Thus passing planes through the point P and the double points in pairs, three numbers are obtained which supply three coordinates for P. In this way we have a non-metrical analytical geometry. It may be objected that this is in effect the introduction of a system of measurement, but the objection does not stand because the coordinates thus introduced may be curvilinear.

We are seeking a property that remains the same during the process of superposition, that is, an invariant under a group of transformations of space into itself. Lie laid down four conditions that a proposed congruence group must satisfy. It must be a one-one transformation, must transform preferred loci into preferred loci, any definite line must be capable of serving for an axis of rotation in which at least one point of the axis remains fixed, and there is to be no shearing. The only available property is a function of the anharmonic ratio of four points, and the latter can be defined in terms of our non-metrical coordinates. Thus if the coordinates of Pr are

$$x_s = \frac{\lambda_r a_s + \mu_r b_s}{\lambda_r + \mu_r} \qquad \begin{matrix} r=1, 2, 3, 4 \\ s=1, 2, 3 \end{matrix}$$

the anharmonic ratio is defined as

$$\frac{(\lambda_1 \mu_2 - \lambda_2 \mu_1)\ (\lambda_3 \mu_4 - \lambda_4 \mu_3)}{(\lambda_1 \mu_4 - \lambda_4 \mu_1)\ (\lambda_3 \mu_2 - \lambda_2 \mu_3)}$$

To make distances additive, Klein suggested using the logarith of the anharmonic ratio. Cayley proposed that two of the four points be kept fixed, showing that in all these transformations there is a local real or imaginary but in general a quadric that either remains fixed or is transformed into itself, and suggested that the expression for the distance between two points be made to include the two points in which their lines produced would pierce the absolute. The only possible a priori definition of distance thus contains an arbitrary extrinsic element, the configuration of the absolute, determined by the choice of congruence-group. For further discussion the article on Geometry in the Encyclopedia Britannica may be consulted, but two remarks by Whitehead deserve to be quoted:

"The above results have led to the doctrine that it is intrinsically unmeaning to ask which system of metrical geometry is true of the physical world. Any one of these systems can be applied, and in an indefinite number of ways. The only question before us is one of convenience in respect to simplicity of statement of the physical laws. This point of view seems to neglect the consideration that we have, in fact, presented to our senses a definite set of transformations forming a congruence-group, resulting in a set of measure relations which are in no respect arbitrary. Accordingly our physical laws are to be stated relevantly to that particular congruence-group. Thus the investigation of this special congruence-group is a perfectly definite problem to be decided by experiment.

"Assuming a definite congruence-group, the investigation of surfaces with geodesic geometries of the form of metrical geometries of other types of congruence groups forms an important chapter of non-Euclidean geometry. Arising from this investigation there is a widely-spread fallacy that the possibility of the geometry of existent three-dimensional space being other than Euclidean depends upon the physical existence of Euclidean space of four or more dimensions. The foregoing exposition shows the baselessness of the idea.''

Our conclusion is that the concept of distance in the abstract does not favor one system of geometry rather than another, but in the concrete the empirical rigidity to which physical bodies approximate does not favor a particular system of geometry. What that system is we shall probably never know exactly, but within the compass of human activity it does not differ perceptibly from Euclidean geometry.

In these five papers we have only touched on such matters as have a direct bearing on cosmology, and from the standpoint of the mathematician most superficially. With the mathematical foundation thus indicated, if not actually built, it is hoped that an analysis of some of the fundamental concepts of physics may not prove too difficult.

THE SIXTY-FOUR CELL PERFECT MAGIC SQUARE

Rev. Frederick W. Sohon, S.J.

The construction of the 64 cell magic square by the method of association is described. It is not known whether perfect magic squares can be constructed by other methods that cannot also be constructed by this method. Moreover, using the method of association, it is possible to get the same solution in more than one way, so it is not easy to estimate the actual number of possible solutions that are to be obtained. Although the method has been previously described in connection with the 36 cell square, it may be well to review the procedure.

Two numbers diametrically opposite and equally distant from the center, must, in the finished square, add up to a constant (65). Such numbers are called complementary. Columns that are to contain complementary numbers are called complementary columns, and similarly for the rows. Numbers in the same column but in complementary rows are called vertical alternates, those in the same row but in complementary columns are called horizontal alternates.

A fundamental square may now be defined. It is a square made up of the first 64 integers so arranged that complementary numbers are diametrically opposite and equally distant from the center, while in any given column or row the sum of any pair of alternates will be a constant for that particular column or row. From this definition it can be shown that the tabular differences for any given row are respectively equal to the tabular differences of any other row, that the same property holds for the columns, and that in any column or row the tabular differences are symmetrical. In order to reduce the number of duplicates, standard positions are adopted for the numbers in a fundamental square, and it can then be proved that there are only ten 64 cell fundamental squares. The first, third, fifth and seventh differences come out all alike, the second and sixth are alike, and the odd horizontal differences are all unity, and the number in the upper left hand corner is itself unity. The ten fundamental squares can then be described by giving for each case five tabular differences.

No.	Formation	Horizontal		Vertical		
		2nd	4th	1st	2nd	4th
1	Rows	1	1	8	8	8
2	Half-rows	1	29	4	4	4
3	Quarters	1	13	4	4	20
4	Oblongs	1	5	4	2	12
5	Columns of Pairs	15	15	2	2	2
6	Rows of Half-columns	7	7	2	2	26
7	Pairs of Half-columns	7	23	2	2	10
8	Rows of Squares	3	3	2	14	14
9	Pairs of Squares	3	27	2	6	6
10	Quarter of Squares	3	11	2	6	22

Having defined and enumerated the fundamental squares, we must next explain the process of association and enumerate the standard association patterns. Keeping within the upper left hand quarter of the square, we associate with each number two others, one in the same column, the other in the same row. In this way, each number forms part of a chain of associates consisting of 4, 6, 8, 10, 12, or 16 numbers. Associates are selected by means of association patterns. These are divided into seven schemes according to the lengths of the constituent chains. Two association patterns that can be derived from one another by a permutation of columns and rows are considered different positions of the same standard pattern. In order to describe the 24 standard association patterns, a letter is assigned to each cell in the upper left hand quarter of the square

A	B	C	D
E	F	G	H
I	J	K	L
M	N	O	P

The 24 standard association patterns are then

Rectangular Scheme

(1) ABFE, CDHG, IJNM, KLPO
(2) ABFE, CDLK, IJNM, GHPO

Semi-octagonal Scheme

(3) ABFE, CDHG, IJNOKLPM
(4) ABFE, CDHG, IKONJLPM
(5) ADHE, BCKJ, FGOPLIMN

Hexagonal Scheme

(6) ADPM, BCGEIJ, FHLKON

Dodecagonal Scheme

(7) ADPM, BCGHLKONJIEF
(8) ADPM, BCGHLJNOKIEF
(9) ADPM, BCGFNOKLHEIJ
(10) ADPM, BCONFGKLHEIJ

Decagonal Scheme

(11) ABJKGE, FHDCOPLIMN

Octagonal Scheme

(12) ABFGCDHE, IJNOKLPM
(13) ABFGCDHE, IKONJLPM
(14) ABFGCDHE, IJNPLKOM
(15) ABJKCDHE, FGOPLIMN
(16) ABJKCDHE, FGOMILPN
(17) ABFGKLPM, EHDCONJI

Quarterly Scheme.

(18) ADHGCBFEIJNOKLPM
(19) ADHFBCGEIJNOKLPM
(20) ADHGCBJIEFNOKLPM
(21) ADHEIJNOCBFGKLPM
(22) ADHEIJBCONFGKLPM
(23) ADHFNOGEIJBCKLPM
(24) ADHGONJIEFBCKLPM

Having chosen our fundamental square, we next choose one of the standard association patterns, interchanging its columns and rows to suit our fancy. The next possibility of variation comes in the coordination of associates. We call the number 1 an R number. Both of its associates are called S numbers. All associates of S numbers are R numbers, and all associates of R numbers are S numbers. If the quarterly scheme is used, the whole quarter is exhausted and there are no other numbers. If some other scheme is used, we define the second chain to consist of T and U numbers. There may be a further chain of V and W numbers, and in the case of the rectangular scheme of X and Y numbers. The S numbers will be interchanged with their complements. If there is more than one chain, we have the choice of treating either the T or the U numbers, and either the V or the W numbers, and either the X or the Y numbers as we did the S numbers. Each choice we are allowed increases the number of squares we can construct.

By whatever patterns the associations were formed, after complementing the patterns by interchanging half the numbers with their complements, the numbers are returned into a square by means of one of the 24 standard patterns. Here it should be pointed out that unless something is done to distinguish the associated numbers from the non-associated numbers, it will not be possible to tell from the finished square which numbers were actually associated. If the ambiguity exists in both columns and rows we have what are called homogeneous squares. If it exists in columns alone or in rows alone we have semi-homogeneous squares. These squares can be made by more than one method of association. There are, however, processes that can be used to increase the variety of the possible solutions and which leave the associates clearly marked in the final square. These processes include

Partial Alternation—in which a number and its vertical associates are simultaneously interchanged with their respective horizontal alternates, or the horizontal associate may accompany the number in replacing their respective vertical alternates;

Partial Rotation—in which all the members of a chain are rotated in cyclic order, with or without reversal; and

Transposition—in which chains of the same length are interchanged.

Finally the number of solutions can be multiplied by 294912 by permuting and interchanging columns and rows. Thus it will be seen that the number of squares that can be constructed by this method is exceedingly great, but owing to the fact that the elimination of duplicates has not been completely solved, no attempt at a total numerical estimate will be made.

Example.

Fundamental Square No. 3—Quarters

1	2	3	4	17	18	19	20
5	6	7	8	21	22	23	24
9	10	11	12	25	26	27	28
13	14	15	16	29	30	31	32
33	34	35	36	49	50	51	52
37	38	39	40	53	54	55	56
41	42	43	44	57	58	59	60
45	46	47	48	61	62	63	64

Upper left hand quarter

A= 1, B= 2, C= 3, D= 4
E= 5, F= 6, G= 7, H= 8
I = 9, J=10, K=11, L=12
M=13, N=14, O=15, P=16

Adopted Association Pattern
Hexagonal Scheme No. 6—Standard Position

ADPM, BCGEIJ, FHLKON
RSRS, TUTUTU, VWVWVW

R T U S
U V T W
T U W V
S W V R

It is permitted to displace the pattern before applying it to the fundamental square. Let us interchange the first and third rows.

T U W V
U V T W
R T U S
S W V R

The chains are

R S R S, T U T U T U, V W V W V W .
I M P L, A E G K J B, C D H F N O

and applied to the fundamental square they become

9 13 16 12, 1 5 7 11 10 2, 3 4 8 6 14 15.

Coordinate T and V with R, and complement the pattern

9 52 16 53, 1 60 7 54 10 63, 3 61 8 59 14 50.

To apply partial alternation, note that the vertical associate of 9 is 52, and their respective horizontal alternates are 28 and 33. Let us also rotate the second chain. The results are placed over the standard pattern

28 33 16 53, 60 7 54 10 63 1, 3 61 8 59 14 50
A D P M, B C G E I J, F H L K O N

so that we may fill out the quarter, and then finish the square by adding the horizontal and vertical alternates and complements.

28	60	7	33	13	22	41	56
10	3	54	61	48	39	18	27
63	1	59	8	21	42	20	46
53	50	14	16	36	31	35	25
40	30	34	29	49	51	15	12
19	45	23	44	57	6	64	2
38	47	26	17	4	11	62	55
9	24	43	52	32	58	5	37

Further variations may be introduced by interchanging columns and rows in the final square.

PHYSICS

LOW GRADES IN PHYSICS

REV. EMERAN J. KOLKMEYER, S.J.

The difficulty of the study of physics is a byword and an axiom among Juniors of the A. B. and Ph. B. courses and it has been growing on them since the second month of the freshman year. Teachers have often wondered at the low grades achieved by Juniors in the one year undergraduate physics course. Deans are distracted by the cries of the students and dismayed by the reports of the physics department staff. Why is physics the difficult course in college? There have been many explanations of these troubles of such a large group of the inhabitants of the campus: so many and so various that certainly all of them cannot be correct. Perhaps there is a modicum of truth in many of them and much guess in all of them.

Most general is the exclamation against the mathematics required in the course. To one who has taught the classes of Junior in this branch such an objection is almost too absurd to require an answer. The mathematics is confined to simple arithmetic, a few equally simple ideas about equations and the use of symbols from alegbra and geometry, and finally some half dozen concepts about angles taken from trigonometry. One might add that the idea of rates is also used, and this might be dignified by the pedantic title of a part of the differential calculus but is better expressed by the more natural and common sense term of speed.

Nevertheless mathematics requirements, little as they are, do constitute a menace for the ordinary run of students in the Junior physics classes. Their difficulties begin with the multiplication tables. That this is no wave-of-the-hand analysis of the difficulty is apparent to any one who has attempted to begin the year with simple problems; or who will read the more honest laboratory instruction sheets given to such classes (e. g. the first manual issued to the students of physics in that department at Northwestern University); or who will listen to gatherings of physics teachers such as were held at the last meeting of the A. A. A. S.; and last but not least to one who will read the reports made some years ago in this Bulletin by Father Gipprich on the simple mathematics test he held for beginners in physics at Georgetown. Whether the student has forgotten his mathematics or has never been properly taught is beside the question here. At the moment of entering the Junior physics class he doesn't know how to add a pair of fractions. He has 'passed' all that and resents a call on a sixth grade grammar school question.

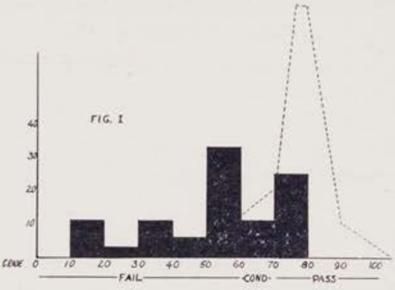
But it seems that mathematics or misuse of the multiplication table should not shoulder all the blame. There are also such troubles as the technical language of the text, the patent 'uselessness' of the subject for a philosopher or an educated bond salesman, frightfully involved concepts, etc., etc., up to and including the quality or the ability of the teacher.

The difficulty of language seemed worthy of test. For several years we have been conscious of a growing conviction that many of the students were hampered not so much by the intricacies of dividing by a fraction as by the more fundamental need of knowing the language of the text and the lecture. In verbal and written quizzes and in tests words were used so loosely, were so glibly drafted to fill a paper or the atmosphere unencumbered with thought or meaning that we no longer suspected the source of trouble in the course: we thought we knew. It was only necessary to get the evidence that would convict. In a somewhat unfair test we had a class testify against itself.

The nearness of the term examinations provided the occasion, and a very simple test was applied to one of the sections of the Junior class. No warning of the type of examination was given and each student prepared for the usual term examination in the manner he chose for himself. No particular matter was prescribed. Nothing whatever was said about the test except that it would be held on a certain day at a definite hour. At that time the student was asked to give the definitions for 100 words 'in the sense in which they are used in physics.' The words were all taken from the first 163 pages of the class text: General College Physics by Randall, Williams and Colby. The time allowed was the time of the regular term examination, viz., 105 minutes. A copy of the test is given at the end of this article.

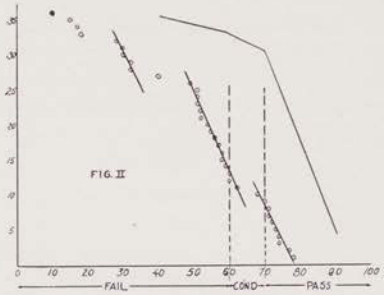
Members of the staff and of other departments thought unanimosuly that the test was too long, and almost persuaded us to make a change at the last minute. Fortunately no change was made as the class with a like unanimity welcomed the paper with smiles in the examination room and expressed loud satisfaction with it after the period—until the results were posted. All but one student out of the class of 36 finished the paper although some had to hurry. But that was expected: there was to be no time for long discussions. It was intended to find out what facility the student had acquired in accurate statement and in the concise expression of the meaning of words he had been using during the past few months.

The results are interesting to say the least: 25% of the class reached a passing mark of 70; 11%, with a grade between 60 and 70, were conditioned; the other 64% with marks under 60, failed. The data obtained from the test were tabulated, graphed and posted—to the dismay of the college bulletin reading public:



"No one knew 4 out of 5 words
25% knew 7 out of 10 words
11% knew 6 out of 10 words
33% knew 5 out of 10 words
6% knew 4 out of 10 words
11% knew 3 out of 10 words
3% knew 2 out of 10 words
11% knew 1 out of 10 words

These data are given graphically in FIG. I, the area under the broken line is the place where all the black should be found in a normal class.



Plotting the student's standing in the class against the grade he obtained in the test (FIG. II) shows a curve or a pair of curves with slopes very near what the 'average class" should show (indicated by the light line at the right), excepting a group of stragglers at the tail end of the class. The plotted curves are evidently too near the lower end of the grade scale, indicating that the test was too difficult for the class. That, of course might be due either to the class or to the test. It seems safe to conclude that the class was at fault in this instance because it was not being tested on any deep question but merely on its ability to define words correctly, words it has read, heard, used, and would have had to understand in order to pass any other type of mid-year examination in physics. All these students had been subjected to a course in formal logic where the elements of a good definition were surely propounded and stressed with repetition; all had text books; all were within hailing distance of a dictionary several times each day; all had been given two years' credit for college training and presumably were capable of reading and understand what they read. The test, while not a fair index of the work accomplished by the class, does seem fair for the purpose for which it was designed.

Here, then, is an instance where college Juniors have demonstrated that they do not know enough to demand of themselves an understanding of word-meanings before they decide that a sentence is clear and conveys to them a valid judgment. It seems safe to conclude that sometimes the difficulty with physics is not so much physics or mathematics as the want of habitual precise and concise definition of words or as the growth of a habit of using words so loosely that they may be said to be meaningless. Every teacher of physics has read in his own class papers some of the most horrible of howlers and there is no need to repeat any here.

But why insist on "Juniors" and stigmatize them with the inability of stating things with scientific accuracy? Because they are the chief offenders in our experience. It is an unpleasant but remarkable fact that in our physics classes here at Georgetown the Freshmen (B. S.) taking a first course in physics can assimilate an idea in about one-third the time it takes the average Junior who is also taking a physics course for the first time but who has the advantage of two years of college train- The Junior of whom we are speaking does not pretend that he will be a scientist: all he (or the school) expects of such a student is a 'gentleman's knowledge' of science, something on which to base his philosophy. To us that means that he will be able to read a scientific paragraph intelligently and form a judgment of its validity. Can he grasp an author's sentence when he does not know the meaning of the author's words?

What to do about the situation is another question. When asked about it at the last meeting of the Association of Teachers of Physics in Colleges and Universities in December, a representative of the Department of Physics at the University of Chicago said his school turned such students over to the English Department, delinquents in mathematics were sent to the Mathematics Department. Professor Herbert Brownwell in his text PHYSICAL SCIENCE publishes a four page appendix of terms used in each chapter; which terms are to be checked by the student when "you can concisely and correctly define beyond question, and can use with precision in speaking and writing" the term so checked. Quiz classes might hammer the need of accurate definition and precise habits of speech and writing. Whatever the solution, the difficulty is one that exists, and exists outside the one group on which the test herein described was made.

It has been noticed in my classes for some time and it seems far more fundamental than merely forgetting how to add. There may be some excuse for inability to cipher, there is none for the inability to read or write a simple sentence. Many students do not have to use more mathematics than counting change at a filling station, but it is difficult to see how any student can pass any course requiring rigorous thinking without a habit of using words accurately.

It is true that physics has developed its own terminology and has often restricted the meaning of words borrowed from common usage to limits required by exact scientific thinking. But every science, physical and metaphysical does the same thing. Are other courses suffering from the same malady in their students?

Name......................................

DEPARTMENT OF PHYSICS

Fr. Kolkmeyer	Term final
Time: 10:30 to 12:15	Junior III
Return this sheet.	January 28, 1932
	Mechanics.

Define all the following terms as used in Physics. Give your definitions in the order below.

1. Machine
2. Centroid
3. Lever
4. Pulley
5. Screw

6. Impulse
7. Joule
8. Erg
9. Foot poundal
10. Work

11. Metric System
12. Derived unit
13. Fundamental unit
14. Unit
15. Physics

16. Gravitation
17. Momentum
18. Uniform acceleration
19. Range (of projectile)
20. Atwood's machine

21. Perfect gas
22. Mechanical efficiency
23. Mechanical advantage
24. Lever arm
25. Fulcrum

26. Cosine
27. Equivalent simp. pendulum
28. Simple pendulum
29. Pendulum
30. Physical pendulum

31. Elastic limit
32. Coefficient of elasticity
33. Young's modulus
34. Tension
35. Barometer

36. Simple harmonic motion
37. Amplitude of S. H. M.
38. Period of S. H. M.
39. Centripetal force
40. Center of suspension

41. Elasticity
42. Stress
43. Center of oscillation
44. Centrifugal force
45. Strain

46. Gram
47. Second (time)
48. Meter (length)
49. Mass
50. Volume

51. Shearing stress
52. Specific gravity
53. Capillarity
54. Rigidity
55. Equilibrium

56. Center of fluid press
57. Fluid pressure
58. Power
59. Buoyancy
60. Hydraulic press

61. Inertia
62. Moment of Inertia
63. Torque
64. Angular acceleration
65. Surface tension

66. Density
67. Horsepower
68. Liquid
69. Center of gravity
70. Mechanical couple

71. Center of mass
72. Mechanics
73. Viscosity
74. Fluid
75. Gas

76. Area
77. Motion
78. Velocity
79. Acceleration
80. Angle

81. Floating
82. Metacenter
83. Hydrometer
84. Rotation
85. Watt

86. Diffusion
87. Kinetic energy
88. Power
89. Potential energy
90. Dyne

91. Energy
92. Poundal
93. Weight
95. Gram of force

94. Vector quantity
96. Force
97. Radian
98. Pound of force
99. Time
100. Scaler quantity

SEISMOLOGY

THE SEISMOLOGICAL VALUE OF THE MANISTIQUE BLAST

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

Considerable interest, both scientific and popular, was aroused by the explosion of 220 tons (440,000 lbs.) of dynamite in the quarry of the Inland Lime and Stone Co., about eight miles from the little town of Manistique, Northern Michigan, at 3 hrs., 2 mins., 0.96 sec. P. M. Central Standard Time, March 16, 1932.

The daily press carried accounts of the blast, noting that records of the same were obtained on seismographs at East Lansing, Madison, Buffalo and Washington. Science News letter also carried an article, showing the record obtained at Canisius College, and stating that, as far as is known, the Georgetown instruments have set a record for distance in perceiving the effects of an explosion.

It may be of additional interest to readers of the Bulletin, who are not themselves seismologists, to learn the value of such an event in seismic work.

The energy for the usual laboratory experiment of the seismologist comes from nature, in the form of an earthquake. In such cases we know neither the exact time of the release of this energy, nor its precise point of release. To determine these we must use other emperical data, which are frequently inadequate.

A man-made earthquake, in the form of an explosion, releases it is true, much less energy, but gives us the advantage of being able to fix definitely both time and place of origin.

The Manistique blast consisted of 5000 charges, planted over an area one miles long and 200 ft. wide, and connected by seven miles of TNT fuse. The purpose, commercially considered, was to dislodge a year's supply of limestone,—1,250,000 tons.

The blast was unique first because it was the largest ever set off intentionally, and secondly, because, through the cooperation of the Bureau of Mines, notice was given in advance, so that necessary preparations could be made for taking advantage of its occurrence.

The U. S. Coast Survey detailed one of their men in the vicinity for the work of determining the time of denotation to 1-100 sec. This was done by making use of Naval Observatory time signals, and radio longitude equipment of the Survey.

Time signals from Annapolis and blast s'gnal were both recorded on the same chronograph.

Steps are now being taken to determine the exact coordinates of the quarry.

When this work is completed and arrival times of all phases recorded at the various observatories become available for study, an exceptional opportunity will be at hand for the determination of the validity of Jeffery's hypothesis concerning the upper layers of the earth's crust, on this continent.

After a study of the Oppau explosion, in the Bavarian Palatinate, in 1921, as well as the records of several other earthquakes which were recorded on seismographs less than 800 Kms. from the origin, Dr. Jefferies, of Cambr'dge, identified six sets of waves,—three compressional, and three distortional—each of which travelled with a different, but constant velocity.

We may sum up his interpretation of these phases by saying that he proposed three surface layers; 1st the granitic, about 10 to 15 kms. thick, 2d. an intermediate basaltic layer, probably 20 to 25 kms. thick, and 3d. an ultrabasic rock, probably dunite.

Accord'ng to his theory, a disturbance (earthquake or explosion) would be propagated in such a way that one set of compressional waves would have a path entirely in the upper granitic layer. This he called Pg.

A second compressional wave group would travel down till striking the basalt it would be propagated along the upper boundary of this intermediate layer. This was called P*.

A third set of compressional waves would pass below both upper layers and be propagated along the upper boundary of the dunite. This is the normal P, called in his notation Pn.

Similar paths with analogous notat'on were determined for the S or distortional waves, as may be seen from the accompanying diagram.

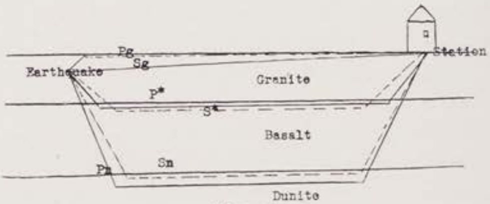


FIG. I

Diagram showing probable paths of six pulses observed in near earthquakes. Verticle scale greatly exaggerated. (Modified, after Jeferys.)

The result of a quite rough preliminary computation of the wave velocities determined from the arrival times at Madison and Georgetown seems to be in accord with the above assumptions, although nothing definite can be stated till the measured distances between the stations and quarry are more accurately known.

At Georgetown what appears to be S* was the only phase registered.

This appeared on the Verticle Galitzin at 7 m. 3 sec. past the hour, giving a travel time of 5m. 2 sec. The East component showed a phase 10 sec. later.

Taking the measured distance as 10° (1111 Kms.), we find a velocity of 3.7 kms./sec., allowing of course for travel times down and up through the granitic layer.

A letter from Dr. Sharpe at the University of Wisconsin states that all three S phases were recorded at Madison, with computed velocities as follows:

Sg=3.21 km/sec. S*=3.64 km/sec. Sn=4.4 km/sec.

The Sg value checks with that obtained by Wood and Richter in California. So far as is known no compressional waves were recorded.

This latter fact is certainly at variance with results obtained from the study of records of the Oppau explosion. Pg was recorded in that case at five different stations, as far away as DeBilt, which was 356 kms distant.

Although a larger percentage of energy is carried by the S waves, Jeffries found S* the most difficult to identify.

As the actual ground motion at Georgetown was below the normal microseismic amplitude level the arrival of the explosion wave train could be recognized only by its shorter period. Further investigation will be necessary to confirm this identification.

Correspondence with the Vice-President of the Company responsible for the blasting gives us assurance that there will be "bigger and better blasts" each year,—that is if business conditions improve so as to increase the demand for building tone. So we may be beginning a new era in this type of seismic investigation, as he assures us of complete cooperation in all future work.

RECENT BOOKS

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

BIOLOGY

A Textbook of Human Physiology, by August Krogh and Katherine Drinker. Lea & Febiger, Philadelphia, Pa.

Life of Mendel, by Hugo Iltis. W. W. Norton Co., N. Y.

Outline of Comparative Embryology, by A. Richards. John Wiley & Sons, Inc., N. Y.

Neoplasms of Domestic Animals, by William H. Feldman. W. B. Sanders Co., Philadelphia, Pa.

CHEMISTRY

Industrial Chemical Calculations, by O. A. Hougen. John Wiley & Sons, Inc., N. Y.

Outlines of Theoretical Chemistry, by Getman, Farrington and Daniels. John Wiley & Sons, Inc., N. Y.

Electrochemistry, Principles and Practice, by C. J. Brockman. D. VanNostrand Co., Inc., N. Y.

General Chemistry, by E. P. Schoch and W. A. Felsing. VonBoeckmann, Jones Co., Austin, Texas.

Introduction to Agricultural Biochemistry, by R. A. Dutcher and D. E. Haley. John Wiley & Sons, Inc., N. Y.

Inorganic Chemistry, 2nd Edition, by T. M. Lowry. Macmillan Co., N. Y.

Industrial Chemistry, 2 Volumes, by Allen Rogers. D. Van Nostrand Co., Inc., N. Y.

The Practice of Spectrum Analysis with Hilger Instruments, by F. Twyman. Fifth Edition. Adam Hilger, Ltd., London.

Organic Chemistry, New Edition, by Perkin and Kipping. J. B. Lippincott Co., Philadelphia, Pa.

Chemical Calculations, Third Edition, by Long and Anderson. McGraw, Hill Book Co., Inc., N. Y.

Introduction to the Principles of Physical Chemistry, by Maass and Steacie. John Wiley Cons, Inc., N. Y.

PHYSICS

The Physical Significance of the Quantum Theory, by F. A. Lindemann. Oxford at the Clarendon Press, London.

An Historical and Critical Examination of English Space and Time Theories from Henry Moore to Bishop Berkley. Sarah Lawrence College, Bronxville, New York.

(Article) The Physical Aspect of the Universe; Journal of British Institute of Philosophy, April, 1932.

BOOK REVIEWS

INORGANIC CHEMISTRY

T. Martin Lowry, C.B.E., M.A., F.R.S., Professor of Physical Chemistry in the University of Cambridge. Second edition The Macmillan Company, New York City, 1931. xiv+1101 pp. 286 Figs. 22×14 cm. $8.40.

This comprehensive book was first published in 1922. It is divided into four parts, namely:

Part I. Historical and Introductory.
Part II. Non-Metals.
Part III. The Metals: Typical Series.
Part IV. The Metals: Non-Typical Elements.

As stated in the preface, "Since, however, it was necessary to reset the whole of the text, a much more far-reaching process of reconstruction became possible, although this did not affect the earlier and introductory and historical chapters."

This new edition of an excellent and well-known book sets a high standard from every standpoint. The printing, paper, and binding leave nothing to be desired, and the text is richly illustrated.

The book contains an enormous amount of information, being considerbly larger than the earlier edition. The facts and principles are clearly stated, and the treatment of subjects is modern. For instance, one finds the "electron theory of valency," the "theory of complete ionization of strong electrolytes," and many of the most recent discoveries in the field of chemistry. "An acid is now defined as a substance which will give up a hydrogen nucleus or proton, and a base as a substance which will accept it" (p. 219). Also, some attention is paid to "excited" atoms, such as those of nitrogen (p. 414).

The newest development regarding mineral silicates is given. "The structure and composition of the crystalline silicates are also dominated by a second factor, which depends on the quadrivalency of silicon, but has been established by examination by X-rays—namely, that *every atom of silicon in a silicate is surrounded by four atoms of oxygen*" (p. 575). It is shown that the silicon atoms of anions are linked up into structures of increasing complexity, in the worm of chains, rings, and sheets.

A modern classification of the elements is shown in Table 63, p. 626. In this classification, column 0 is placed between columns VII and VIII. Hydrogen and helium are placed in Period I, the former element occupying a position in column VII, just above fluorine.

"Inorganic Chemistry" is an excellent reference book for teachers and students of chemistry, and is a good textbook for the advanced student. It should be in every chemistry library.

A few minor criticisms and suggestions might be offered. The author treats glass according to the older notion, namely, that it is regarded as a liquid which has acquired a high degree of viscosity on cooling (pp. 3 and 190). Recent investigation has shown, however, that the properties of glass do not, as had been assumed, go over gradually to those of the molten state. The changes which take place when glass is softened by heat are actually parallel to those in a melting crystal. There is a discontinuity in the curves of all properties of glass thus far examined. [E. C. SULLIVAN, Glass Industry, 12, 215 (1931).]

The author does not differentiate between true peroxides, such as sodium peroxide, and dioxides, such as manganese dioxide (p. 260). Some writers do not regard the latter compound as a peroxide because it does not yield hydrogen peroxide when treated with an acid.

The author evidently assumes that the reader knows something about atomic structure, for it would be rather difficult to follow some of the statements relating to valency unless one possessed considerable knowledge concerning the structure of atoms. In the opinion of the reviewer, an early and thorough chapter on the structure of matter would be very helpful, especially to younger students of chemistry.

These are minor criticisms, however. The reviewer extends hearty congratulations to the author as well as the publisher on the excellency of the second edition. The book is a very valuable contribution in the field of inorganic chemistry, and should be well received by chemists, students, and teachers.

W. F.

OUTLINES OF THEORETICAL CHEMISTRY

FREDERICK H. GETMAN, Ph. D., formerly Associate Professor of Chemistry in Bryn Mawr College, and FARRINGTON DANIELS, *Ph.* D., Professor of Chemistry, University of Wisconsin. Fifth edition, John Wiley and Sons, Inc., New York City, 1931. ix+643 pp. 180 Figs. 15×23 cm. $3.75.

To friends of earlier editions a casual thumbing of the pages of this revised "Getman" will reveal that Dr. Daniels has closely adhered to the original organization and readable presentation of material, and they will lay the volume aside with a feeling of reassurance that it is their old friend still. A more critical inspection, particularly of the last half of the book, will disclose the touch of a new, though sympathetic hand. No chapter but has undergone some change, many are entirely rewritten. Much new material has been introduced and a distinctly modern flavor permeates the book.

In the junior author's preface the following felicitous paragraph appears. "To introduce recent advances without offending old friends who cherish the foundations of a successful past; to keep pace with present tendencies toward the mathematical viewpoint without driving away students who are inadequately prepared; and to sift out the permanent from the trivial are the privileges and responsibilities of this revision."

To make room for new material and keep the book within bounds the author has found it necessary to delete portions appearing in the fourth edition. This process constitutes a considerable part of the revision of the earlier chapters. The task of choosing and rejecting seems to have been done with discriminating care. In the later chapters the junior author has exercised his "privilege and responsibility" with greater boldness and freedom and has written with an enthusiasm born of familiarity with his subject and his genius as a teacher, and has shown a commendable sense of balance and proportion. The conventions of Lewis and Randall have been introduced throughout the book, including, happily, the chapter on thermochemistry. Many new problems with some answers follow each chapter. The book is decidedly more advanced and difficult than previous editions.

The reviewer finds little of major importance to criticize. Perhaps the least useful of the additions is the chapter on "Chemical Thermodynamics," not because of lack of importance but because the author has undertaken entirely too much. He has, however, thoughtfully forestalled adverse criticism by a footnote relative to this chapter. One could wish that in the revision the author could have found room for more such historical introductions as the opening of chapter twelve, relating say, to conduction of electrolytes, the theory of electrolytic dissociation, thermochemistry, or the periodic table, to cite a few examples.

Attention may be called to the following minor criticisms for the sake of subsequent editions. Page 24; the term "heat content" is used in a misleading sense and is inconsistent with the use of the same term on page 113, for example. Page 56; the constants of equations 28 and 29 are different, contrary to the statement at the bottom of the page. Page 37; the derivation of van der Waal's equation of state should be clarified. Attention should be called to the fact that the constants *a* and *b* are dependent on temperature. Page 85, Problem 2; it would be simpler to refer to this crystal as simple cubic. Page 96; the very simple derivations of the equations for specific rotatory power are entirely obscured. Page 123, line four from the bottom; the word "absorbed" should be replaced by the word "converted". Page 134; in the reviewer's opinion the Principle of Le Chatelier deserves far more emphasis than is here accorded it. Page 249; the example given is too involved to have pedagogical value. Page 252, line four; there is an unfortunate use of the term "differential heat of solution." Page 568; Moseley used a crystal of potassium ferrocyanide. A crystal of sodium chloride was used merely for calibration. Page 601, middle of page; the phrase "of solid elements" should follow the word "crystal".

In the opinion of the reviewer Dr. Daniels has accomplished in a brilliant manner what he set out to do, and this edition of this popular textbook is now without a rival. It merits a cordial reception.

F. L. S.

NEWS ITEMS

BOSTON COLLEGE—THE COLLOID SYMPOSIUM

A Colloid Symposium has been introduced as a supplement to the course in Colloid Chemistry. Its purpose is to enlarge the scope of the student's knowledge concerning colloids, and also to review the more important fundamental principles given in the introductory course.

The Symposium consists of a number of papers dealing with particular aspects of the colloidal state. Each paper is prepared and delivered by the student. The student is marked on resourcefulness, individuality, thought and ability to interpret and answer questions.

The results, to date, have been very gratifying, and indications point to the successful institution of the Colloid Symposium at Boston College.

Subjects chosen for this session are:

"The Colloidal State"
"The Determination of Particle Size"
"Interfacial Tension"
"The Phenomenon of Adsorption"
"The Donnan Equilibrium"
"The Coagulation of Colloidal Particles"
"The Thermochemistry of Colloidal Systems"
"The Formation and Stability of Emulsions"
"The Phenomenon of Rhythmic Banding"
"Gels"
"The Colloid Chemistry of the Proteins"
"Colloid Chemistry and Disease"

To date some interesting results have been obtained, some of which, we hope, will be worthy of publication in the near future.

FELLOWSHIPS IN THE CHEMISTRY DEPARTMENT

Numerous applications for the Fellowships in the Chemistry Department were received prior to the date of closing, April 1. Colleges as far west as Oregon, as far north as Halifax, as far south as Alabama, were represented in these applications. Several of the applicants were of exceptionally high calibre and we have reason to expect that the holders of these Fellowships of 1932-33 will be a real asset to our Chemistry Faculty.

RADIO BROADCASTS

Professor David C. O'Donnell, Ph. D., in charge of Organic Chemistry, delivered two broadcasts over the Yankee Network, February 18 and February 25 of this year. The titles of his talks were: 1st "Non-alcoholic Fermentations", and 2ndly. "The Numerous Sugars". That the talks of Boston College Professors have been received quite favorably is evidenced both from the volume of the fan mail received and also from cordial invitations from the Broadcast Committee to appear on the air again.

CARDIOID ULTRAMICROSCOPE

A Zeiss-Siedentopf Cardioid Ultramicroscope has been installed in the Colloid Chemistry Laboratory of Boston College. This instrument has distinct advantages over the older slit ultramicroscope. An intensely bright image is obtained, and the ultramicroscopic particle is seen in all its natural coloring.

The heart of the instrument is the cardoid condenser, which is an aplantic and anastigmatic darkground condenser. Specially ground quartz slides and cover glasses, as well as Szegvari azimuth stop, are used in conjunction with the condenser.

The Cardioid Ultramicroscope was found to be very satisfactory in a study of colloids in liquod media, bacteria, particle size, finely divided precipitates, and chemical reactions.

Since both the objective and condenser require glycerin immersion, manipulation is somewhat impeded. The quartz chambers are very expensive, and when mounted are easily broken through shock or undue pressure.

RESEARCH AT BOSTON COLLEGE

At present five members of the faculty and six candidates for the Master's degree are engaged in various items of research in this laboratory. The subjects being investigated cover a rather wide range of endeavor including Colloids, Catalysis, Inorganic, and Organic Chemistry.

LOYOLA COLLEGE, Baltimore, Md. On Tuesday, March 15th, Dr. William M. Thornton, Associate Professor of Chemistry of Johns Hopkins University delivered a lecture to the Loyola Chemists' Club. His topic: "The More Powerful Reducing Agents in Volumetric Analysis." The lecture was illustrated with experiments and slides. — The regular seminar of the Chemists' Club was held on April 5th; the subjects discussed: "Chromium vs. Corrosion", and "The Vagaries of Nitrogen." — Dr. Francis O. Rice, Professor of Chemistry at Johns Hopkins University gave a lecture at Loyola College on the subject: "Free Radicals in Organic Chemistry."

WOODSTOCK COLLEGE. The following members of the A. A. J. S., will be ordained to the Priesthood in June: Messrs. C. A. Berger, L. A. Cullum, F. A. Doino, A. V. Dowd, L. C. Gorman and J. W. Tynan.

To the Editor of the Bulletin:

In the News Items of the last issue of the Bulletin, Canisius College announces the introduction of a new course in 'Biology and Evolution'. Some questions that arise naturally from this announcement are: What is the aim and scope of the course? What are the reasons for its introduction? What is the subject matter and what text, if any, is used? I am sure many readers of the Bulletin would be interested in more detailed information about this course.

Charles A. Berger, S. J.

Woodstock, Md.

FORDHAM UNIVERSITY. Chemistry Department. There are six candidates for the doctorate in chemistry and four for the masters degree. — The Chemists' Club had an interesting discussion of: "The Hydrogenation of Oils", and one of the students demonstrated the process by experiment. — A moving picture was taken in the chemistry department illustrating in detail the use of the chemical balance. Other films may be made of the important methods of technique.

PARIS, France. A mounted Republican Guard stopped his horse before the door of 42, rue le Grenelle, headquarters of the Jesuit Missions, and asked for Father Louis Froc. He brought him a personal message from the President of the Republic.

Father Froc, known in the Far East as "Father of the Typhoons," had been named officer of the Legion of Honor.

This story of this picturesque missionary is unusual.

The China seas are continually swept by typhoons. Sometimes twenty or more of these storms attaining a velocity of fifty knots wipe out everything in their path.

In 1872 the Jesuits established an observatory and an information service for sailors near Shanghai. Father Froc was director of this observatory from 1892 until 1931.

To discover the approach of storms by barometric observation and to transmit the results of these deductions was the task and the responsibility of Father Froc.

One can imagine the emotion of the priest when he knew his warnings were guiding the captains grouped about him and asking whether they could venture to sea. Outside, squalls and adverse winds raged; the priest leaned over his maps and sometimes, for anguished hours, followed the progress of the typhoon. At a telephone call from him, the master of the port would sound the warning cannon. One can imagine the thousands of lives and the vast quantity of merchandise saved through the labors of the "Father of Typhoons".

President Doumer did not forget the services he had rendered him. In 1899, when he was governor-general of Indo-China, he entrusted to Fother Froc the selection of a site for an observatory, which the missionary finally installed between Hanoi and Halphong. The Chief Executive saw fit to recompense him with the red rosette.

SCIENCE CONVENTION 1932—Tentative Program of Biology Section

SUGGESTED TOPICS FOR THE HEREDITY SYMPOSIUM

INTRODUCTION:

No. 1. Life of Mendel.

No. 2. Variations, heritable and non-inherited; Acquired Characteristics.

FUNDAMENTALS OF GENETICS:

No. 3. The Six Principles of Mendelian Heredity.
(Segregation, independent assortment, linkage, crossing-over, interference, linear order of the genes.)

No. 4. Heredity and Environment.

No. 5. Sex-linked and Sex-limited Inheritance.

SPECIAL CASES OF GENETICS:

No. 6. Non-disjunction and Attached-X Chromosomes.

No. 7. The Chromosome Theory of Heredity.

No. 8. Multiple of Allelmorphs, Multiple and Modifying Factors.

No. 9. Pure-lines, the Effect of Selection and the Stability of the Gene.

No. 10. Gynandromorphs and Mosiacs.

No. 11. Polyploidy, Intersexes and Supersexes.

No. 12. Deficiencies, Duplications and Translocations.

SPECIAL PROBLEMS OF HEREDITY:

No. 13. Limitations of Mendelian Heredity.
a) Is all inheritance particulate?
b) Non-Mendelian Inheritance.

No. 14. Causes of Mutuations; X-rays.

No. 15. Genetics and Evolution.

No. 16. Human Heredity.

No. 17. Eugenics.

ZIKAWEI OBSERVATORY

(*Continued from Page* 177)

The Department of Astronomy of the Zikawei Observatory maintains a large observatory at Zo-Se. The principal accomplishments at this observatory, since 1900, are: twelve thousand photographic plates were made to study the sun spots; over seven thousand drawings of protuberances; the determination of the position of more than fourteen thousand stars; studies of about one thousand two hundred small stars and groups of stars; and the calculation of the disturbances set up by Jupiter in the path of a hundred planets. This department also published an atlas of the moon with fifteen plates, 24x30, the text in Chinese; a catalogue of the stars taken from old Chinese sources; and a Chinese publication on the subject of sunspots.

The Department of Magnetism and Seismology are also very active. The research work in Magnetism is done at the observatory at Loh-Ka-Pang, situated about thirty miles from Shanghai. The work in Seismology is carried on at Zikawei Observatory. They are equipped with a Wiechert horizontal pendulum and a Galitzin vertical seismographic recorder. It regularly publishes its observations and cables its principal data to the International Union.

The scientific work of the Society in China has been remarkable and the present staff is nobly continuing the work of their illustrious predecessors. The three founders of the three observatories at Zikawei, Zo-Se and Loh-Ka-Pang are Father Chevalier, Father De Moidrey and Father Froc. In Paris on February 1, Father Louis Froc was honored by the President of France, and received the distinguished service medal of "Officer of the Legion of Honor", for his remarkable scientific work of thirty-nine years at Zikawei Observatory.

(*Editor's Note*: We are indebted to Father Ernest Gherzi for sending us the facts of the Zikawei Observatory.)

BULLETIN OF THE AMERICAN ASSOCIATION OF JESUIT SCIENTISTS

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