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Editorial Office
Woodstock College
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To our readers . . .

Science today enjoys a universality of prestige unequalled in its history. Daily we read of the impact of science and mathematics on such varied and influential fields as industry, economics, politics and statecraft, advertising, social work, and law. Where the implications of science will appear next, it is hard indeed to say.

In the midst of this widening of the scientific frontier, Jesuits have recently been called upon to deepen the influence of science and mathematics upon a discipline central in the Society's educational tradition. Philosophy, taken in its full scope, has surely been profoundly affected by the advance of science. Yet regrettably our philosophical training in the Society has not always maintained enough contact with scientific thought, to say nothing of its systematic incorporation. This, at least, is the problem as Father General presents it in his *Instructio de Cosmologia* issued last fall. The program he proposes for its solution is set forth in the pages that follow.

How can we achieve excellence in a high school science program? The question is not peculiar to members of the Association; it occupies the minds of science teachers everywhere. In this issue of the BULLETIN and in others to come, we shall describe some of the steps outstanding public and private schools have taken towards attaining this goal. These schools, though usually differing from ours in basic aims and in the character and qualifications of their students, share many of our educational problems. The means by which they have sought to solve them are interesting to observe and may in certain instances prove useful to apply.

For our first subject in this series we have chosen a school of acknowledged excellence, Baltimore Polytechnic Institute. Its excellence has not come ready-made, but has been bought—as ours must be—at the cost of facing many difficulties and exploiting materials at hand.

This month's notice of the coming Association meeting reminds us to ask you again for comments on the BULLETIN and suggestions for future issues. We still welcome your letters, but no doubt many will find the personal contacts of the meeting a more convenient way to communicate their views. How can we make the BULLETIN more helpful to you?

A SCIENTIFIC APPROACH TO COSMOLOGY

THOMAS H. GREEN, S.J.

Cosmology, long the wan and sickly Cinderella of the philosophical family, is showing signs of a new glamour and a surprising vigor. Perhaps the most striking proof of this is a recent *Instructio de Cosmologia* by Very Reverend Father General Janssens. Since cosmology is the natural meeting point of philosophy and the sciences, it seems appropriate to call this document to the attention of Jesuit scientists in America.

While the philosophical horizon in secular American universities is dominated by the philosophy of science and by certain other areas of epistemology, until recently Catholic philosophical circles have been neither ready nor willing to cope with new challenges in the order of logic and the philosophy of nature. All too many Jesuits of a scientific bent have come away from the years of philosophy with very little respect for the quaint approach to science and to external reality offered them by their teachers and their textbooks. And those who would classify themselves as "non-scientific" have been confused by this strange and—to them—unintelligible world of science. Thus cosmology often has been, not the meeting point of the scientist and the philosopher, but rather the final and unregretted parting of their ways.

In this context, Father General's instruction has some surprising words for both groups.

Explanatory letter. The covering letter sent with the instruction by Father General is worth quoting in full. It tells how the latter came to be composed, and it also underlines the importance that Father General attaches to the instruction:

> In April [1960], a small group of cosmology professors gathered in Rome. Their purpose was to study the method employed in teaching this discipline in our scholasticates.
>
> The conclusions reached by the group are contained in the appended instruction. It is directed primarily to professors of cosmology, but it also concerns superiors, especially as regards the scientific studies that scholastics are to make before beginning philosophy, and as regards the proper training of professors of cosmology.
>
> For these reasons, the instruction has been sent to all provincials. They are to communicate it to the rectors of scholasticates, prefects of studies, deans of philosophy faculties, and to all cosmology professors. Extra copies, if needed, may be obtained from the Secretary of the Society.

> Furthermore, after one year, cosmology professors are asked to send me (either directly or through their prefect of studies) precise information concerning the difficulties they have encountered in implementing the instruction, and concerning the profit derived from its application.

The problem. Father General begins his instruction with a review of the problems that have made cosmology a source of "peculiar difficulty" in the philosophy curriculum. The first of these problems is the exceptionally rapid evolution of the natural sciences and the concomitant danger of "a gap between what is taught in cosmology classes and what is proposed by scientists." As Father General sees it, cosmologists, while adhering faithfully to the norms set down for them by the Church and by the Society, have not always been as successful in giving sufficient attention to the new problems raised by science. "Since contemporary science, especially physics and mathematics, is so important itself and so highly regarded, it is absolutely essential that our scholastics be grounded thoroughly in science and in the philosophical problems—cosmological, epistemological, metaphysical, and religious—that it raises." This is the special task of the cosmologist, because of the intimate link between cosmology and science.

The teaching of cosmology. In view of these contemporary demands, what norms may be set down to guide the teaching cosmologist? In the first place, cosmology must remain a strictly philosophical discipline, both in its method of inquiry and in its argumentation. In this sense it essentially transcends the positive sciences.

Yet it must, at the same time, take cognizance of the problems raised by science. Particular stress is laid by Father General on the philosophy of science. While this is, strictly speaking, an epistemological discipline, it may be treated in our scholasticates in either epistemology or cosmology, or as part of a course on scientific questions. If it is treated in cosmology—and to the present writer the cosmologist would seem the most likely to be equipped to handle it—the philosophy of science must not be allowed to supplant the properly metaphysical discipline of cosmology itself.

In the presentation of opinions (or "adversaries"), the cosmologist must give due attention to contemporary theories, particularly on the relationship between philosophy and science. Such contemporary views include logical positivism, language analysis, Hegelianism, neo-Kantianism, different types of realism, dialectical materialism, and phenomenology. While they are to be judged in the light of the principles of scholastic philosophy, the cosmologist must be able to assimilate into his own synthesis the valuable insights that they do contain. It is peculiar to our own age that the devotees of philosophy are relatively few, whereas the scientific

community grows daily in number. There is special danger to philosophy, and to religion itself, in the fact that many are led in the name of science to embrace as absolutes what are really the principles of materialism and positivism. Only the man well grounded in both philosophy and science can meet this threat to true Christian learning. The courses in cosmology and in scientific questions are the logical places to expose and combat these errors.

A number of basic revisions are required by this new approach to cosmology (*renovatio rerum tractandarum in cosmologia*). Terminology must be adapted to contemporary usage in scientific circles. More significantly, "superfluous and obsolete" questions in the present course must be eliminated. Such are philosophical speculations based on antiquated scientific theories, as well as certain subtle points of scarcely any contemporary relevance. And very brief treatment should be given to such sixteenth-century matters as the formal effect of quantity, *locus* and *ubi,* compenetration, reduplication, and the like.

What then of questions related to natural and dogmatic theology? In general, these problems (for example, philosophical questions relevant to the Eucharistic presence) should be treated, but only briefly, insofar as they are properly cosmological. Of special importance are the philosophical principles necessary for the discussion of miracles in fundamental theology, and also the questions of evolution and contingency that are presupposed when treating the arguments for the existence of God and for creation. (These latter, Father General suggests, are more properly handled in psychology than in "inorganic" cosmology.)

Scientific theories. Each and every question of contemporary significance in the evolution of the sciences must be treated either in cosmology or in scientific questions. Of greatest importance both to science and to philosophy are the problems of relativity and of quantum mechanics: space and time, matter and energy, causality and indeterminism, the wave and corpuscular pictures of reality, the current concept of the physical universe ("cosmology" in its ordinary English meaning), and the fundamental nature and method of scientific knowledge. Other questions having philosophical import, and thus to be treated by the cosmologist, include those from the more experimental areas of atomic and nuclear physics, thermodynamics, and electromagnetism. Mathematics offers the cosmologist the problems of quantity and the continuum, number theory, non-Euclidean geometry, probability, and the statistical nature of physical laws.

Such a line-up may well make the reader's head swim. One might ask whether this could be the same dull science of cosmology that so many colleges have virtually abandoned. Father General recognizes that the program is a large order, and that it may and should be handled in dif-

ferent courses by professors of various special competences. Furthermore, the students should have the necessary grounding in the sciences before they even undertake the study of cosmology. And, Father General suggests, it may be well to treat in detail one of the problems mentioned, after cosmology itself has been completed successfully. The purpose would be to illustrate for the student the proper method of approach to philosophico-scientific questions. This could be done in one of the special questions courses generally offered in third-year philosophy in our scholasticates. In addition, a professor skilled in biology should handle the philosophical questions pertaining to the levels and evolution of organic life, which are crucial to the refutation of contemporary materialism. These will generally be treated in one of the disciplines of psychology, either rational or experimental.

The scientific training of the student of cosmology. As is clear to the reader, the preceding norms demand that special attention be given to the training of the cosmologist and to the prior scientific training of scholastics about to take the general course in cosmology.

In regard to the scholastics, the existing requirements for admission to philosophical studies (*Rat. stud.*, nn. 119–20) are to be retained. Father General notes, however, that the classical training offered by many of our schools is quite inadequate as a basis for the fruitful study of this "new cosmology." To correct this, Father General gives, in an appendix to the present instruction, some norms on scientific training. This appendix is worth quoting in full:

> A list of the scientific disciplines that should ordinarily be presupposed before beginning the course in philosophy:
>
> *Mathematics:* Arithmetic, plane and solid geometry, algebra (up to and including quadratic equations), progressions and logarithms, trigonometry; the fundamentals of differential calculus and of analytic geometry.
>
> *Physics:* Mechanics (kinetics, dynamics, and statics), heat, sound, optics, electricity, and atomic physics. The approach should not be merely empirical and qualitative, but with at least the algebraic expression of the physical laws.
>
> *Chemistry:* The concepts and fundamental laws of chemical combinations and of various states of aggregation (*combinationum chimicarum et diversorum statuum aggregationis*); atomic and molecular structure; the elements of special chemistry, inorganic and organic, of crystallography, and of mineralogy.
>
> *Biology:* General biology, with the elements of anatomy, histology, physiology, and human genetics; zoology and botany.
>
> *Geography and astronomy:* Particular and general physical geography; the elements of geology, meteorology, and astronomy.

The training of the cosmologist. The man chosen to teach cosmology should have genuine talent in philosophy, and also natural scientific ability. He should have more than a mere popular knowledge of science;

that is, he should be able to understand properly scientific and mathematical treatises as well as the principal contemporary theories. In addition, he should understand scientific method. Such knowledge demands *at least three years of graduate study in science* (preferably during regency) in a reputable graduate school.

After theology, the cosmologist-to-be must take a biennium in philosophy, with special concentration in cosmology, under the tutelage of a competent director. When he has completed his training, the cosmologist should consider as his own the obligations of any conscientious and dedicated scholar. This means keeping up with scientific developments and assimilating them into his course. It also involves contributing by writing and publication to the advance of cosmology, and thus to the good of the Society and of the Church.

Conclusion. No one will deny that Father General has outlined an ambitious program for the cosmologist. Many have been agitating for such new and positive guidance for some time. They now have the authoritative leadership required. To the scientist readers of the BULLETIN this offers a special challenge. The implementation of this ambitious program can be accelerated greatly by active and constructive interest on the part of Jesuit scientists. They have much at stake, for the successful application of Father General's directives will mean a climate more sympathetic to the needs and interests of science among future generations of Jesuits. It will also mean an earlier start, and a more solid grounding, for the Jesuit scientists of the future.

WOODSTOCK COLLEGE

BALTIMORE POLYTECHNIC INSTITUTE

JOSEPH D. CIPARICK, S.J. AND J. A. PANUSKA, S.J.

Introduction. In a recent survey conducted among major American colleges and universities by the Geneva (Illinois) Citizens' Council, Baltimore Polytechnic Institute was listed in a group of forty-four top schools of the nation. "Poly," as it is known to faculty and students alike, is a boys' public high school, established in 1883. Though originally called Baltimore Manual Training School, Poly made no attempt, even in its early days, to teach trades. On the contrary, it has always been a specialized school whose graduates usually enter the fields of science and engineering after college.

Of particular interest to us is the advanced college preparatory course (curriculum A), whose subject and weekly class period specifications are given on page 40. In the following analysis, it should be kept in mind that this program is not the only element in the school's record of excellence. Its courses are good advanced courses, taught as they should be taught, with no special adaptation for high school students. What is unique about Poly is not the A course as such, but the spirit of the whole school, which contributes a great deal to the success of the graduates. It is true that our main interest as Jesuit scientists is in the science course on the high school level and the coordination of this program with the college curriculum. But a mere analysis of the courses would not reveal what it seems is more important to us as educators, namely, the atmosphere of learning that inspires students to go into such difficult fields of study as science and mathematics, both in their high school days and in their university training. We have the same talent among our students, and we have many other advantages in selection and motivation that a school like Poly does not have. Considering, then, that its initial advantage is not relatively great, we hope in the following analysis to see just how Poly does arrive at such outstanding results. The excellence of the Poly graduates, especially in the field of science, is due to a combination of many things, and it is this productive combination that we set out to investigate. The caliber of the student body, the faculty, curriculum, and physical plant are the major components in the survey. The final judgment will necessarily be an evaluation made on the basis of experience.

Advanced College Preparatory Course
(Curriculum A)

Term I		*Term II*	
First Year			
English	5	English	5
Elementary algebra	5	Elementary algebra	5
Plane geometry	5	Plane geometry	5
Modern foreign language	4	Modern foreign language	4
World history	5	World history	5
Mechanical drawing	2	Mechanical drawing	2
Shop practice	2	Shop practice	2
Physical education	2	Physical education	2
Second Year			
English	5	English	5
Intermediate algebra	5	Intermediate algebra	4
Modern foreign language	5	Solid geometry	5
Physics	5	Modern foreign language	5
Mechanical drawing	4	Physics	5
Shop practice	4	Mechanical drawing	2
Physical education	2	Shop practice	2
		Physical education	2
Third Year			
English	5	English	6
Trigonometry	4	Analytic geometry	3
Analytic geometry	3	Advanced algebra	4
American history	4	American history	5
Chemistry	5	Chemistry	5
Modern foreign language	3	Modern foreign language	3
Mechanical drawing	4	Shop practice	3
Health	2	Physical education	1
Fourth Year			
English	5	English	5
Differential calculus	5	Integral calculus	5
Analytic chemistry	5	Modern foreign language	3
Modern foreign language	3	Mechanical laboratory	4
Electricity	4	Electricity	4
Heat engines	4	Mechanics	5
Surveying	4	Descriptive geometry	4

Students and curricula. There are slightly more than three thousand students from the public and parochial schools of Baltimore at Poly, with some from other parts of the county and state. An average of 80% and an IQ of 110, along with a recommendation from his principal, are the basic requirements for a public school graduate of the eighth grade entering the first-year A class. He must also have a background in eighth grade algebra. It has been found that students from parochial schools, or from areas outside Baltimore county, must be given a special examination before admission.

The A course comprises only 23% of the student body. A second college preparatory course (curriculum B) is given to 63% of the students. The B course begins in second year; students who enter it come either from other schools or from the first-year A program at Poly. Its course prerequisites are ninth-grade algebra and the first year of a foreign language (French or German). The B program is less stringent in its core requirements: besides physical education, drafting, and shop courses, the B student takes four years of English, three or four of mathematics, three of social science (including American and world history), two or three of a foreign language, and one each of physics and chemistry. There is a third program, the technical course (curriculum T), to which students from the A or B courses may transfer upon recommendation of the counselor; graduates of the T program, however, are not certified for admission to college.

Of those boys who enter Poly in the A course, 38% graduate in the same program (the rest in the B or T curriculum), and 97% of these A course graduates enter college. (40% of those who enter the B course graduate from it, and 68% of them go to college. Many of the B and T students immediately take technical jobs, especially with the public utilities companies.) Upon recommendation, an A course student will be accepted for advanced standing by such universities as Lehigh, MIT, Cornell, Johns Hopkins, VPI, and Rensselaer. Johns Hopkins, MIT, and others will accept as freshmen those A course students who have completed three years of work and are recommended by the principal. A careful check is made on such students, and a spirit of cooperation between the colleges and the Poly administration guides the setting up of courses.

The students at Poly are given almost full responsibility in caring for the discipline of the school. A student government elected by the student body, a court, and a system of "spontaneous monitoring" have worked extremely well over the years. Of course, three thousand boys do have their problems, especially when faced with external pressures. At present, Poly is coping with the inadequacy of school lunch facilities, and with the

hardship of using a playing field separated from the school and set in an old residential neighborhood. But so far, at least, the spirit of freedom and responsibility that is instilled by the administration has had results.

Faculty and course content. There are two faculty members with the Ph.D. degree, but these are not department heads, and one of them is near retirement. Of the 118 teachers (111 of them male), the degree distribution, apart from education degrees, is approximately as follows:

Subject	*Bachelor's degrees*	*Master's degrees*
Mathematics	13	5
Sciences	10	1
Shop practice	11	2
History	11	2
English	10	2
Languages	6	2

The principal of Poly, Claude A. Burkert, is very frank in admitting difficulties in introducing new types of science courses. The School Mathematics Study Group program has been started in only one class; the Physical Science Study Committee course has also been tried. Neither of these, however, has received strong endorsement. No work to speak of has been done on the Chemical Bond Approach or any other new chemistry program.

The laboratory periods at Poly are carried out along the lines of the traditional laboratory manuals. The electrical engineering laboratories, however, provide an exception and seem to be the most advanced. There are no project laboratories, and it is difficult to arouse interest at the school in special laboratory projects.

The humanities are not neglected at Poly. An explicit effort has been made to attain quality in the English and history departments. Many of the English classes are held on the seminar model, and the senior course is the equivalent of a college English course. Languages, too, are stressed. A recent change in the language departments, made at the request of the colleges, was the introduction of a four-year course.

Poly has a large number of co-curricular activities. Sixteen of these are athletic; the remaining forty-two embrace at least as wide a range as is found in most Jesuit high schools, classics clubs excluded. The A course group has the remarkably high average of 5.5 activities per student.

The teacher at Poly has a class schedule of about twenty-five hours a week, with no study periods (since there are none at the school) and a minimum of clerical work. There are some large group instruction programs under way, where fundamentals of a subject are taught to all the sections at once and all these students are tested simultaneously.

Equipment. It can hardly be claimed that Poly "does it with mirrors," because there is little in the line of elaborate equipment in the school. It was only a few months ago that Poly's first overhead projector was installed, and in general, the science equipment is considerably dated—as, indeed, is the whole building. Plans have been drawn up for a new school, which, besides improved laboratory and shop facilities, will include large group instruction rooms and seminar-type study rooms. It should prove interesting to observe the effect of this new building on the school's academic quality.

Appraisal. There is a spirit at Poly that is hard to pin down. The fact that three thousand boys can govern themselves is to some visitors amazing in itself. Despite the fact that they are not all bright students, they seem to consider it an honor to be at the school. Because many of the courses are courses they want for their future in science, there is a spirit of free choice that definitely affects their attitude. At the same time, there is enough control to eliminate much of the corner-cutting that a free choice situation could produce. The courses are difficult, and yet there is a goal in view; this helps the students overcome the difficulty. They are busy as a result, and serious in their work. Hence, a lot of the basic disciplinary problems are eliminated.

Nor is the difficulty of the science courses a deterrent to the other courses. In fact, the spirit of excellence in the science departments seems to pervade the other areas as well. Graduates are, by and large, not narrow. Statistics show that they do quite well in liberal arts courses in college, and also in pre-medical programs, even though the curriculum at Poly includes no biology. Advanced work, advanced placement, and early college are not mere "extras," lying outside the scope of the student's "ordinary" schoolwork; they are attractions integrated into a standard curriculum of the school. When advanced courses are thus part of the school requirements, students take them and work successfully at them.

It is interesting to recall the separate provision made for parochial school students, as mentioned earlier, in the matter of entrance requirements. Somehow, these parochial school students do not "think the way we do," in the principal's phrase. Special norms are used for them, based on an entrance examination, because the standards of their schools differ from those of the Baltimore public schools. It seems clear enough that parochial school students manage to "think the way we do" in Jesuit schools; indeed, if Catholic education has any point at all, it should provide its students with distinctive basic views and ways of thinking. But has this differentiation carried over too much into areas of the academic —and in particular, scientific—sphere, where it is neither necessary nor useful, but perhaps even harmful?

Conclusion. It seems to be a spirit that makes Poly what it is. It is certainly not a large number of high-IQ students, or a minimizing of co-curricular activities. Nor is it a striking number of advanced degrees among the faculty, or large grants, elaborate facilities, or the like. The school seems to attain success by meeting the student halfway, giving him courses he can see some reason for, and yet making these courses as difficult as possible. The student himself does the rest.

WOODSTOCK COLLEGE

REPORTS OF SCIENTIFIC ACTIVITY

High Schools

Boston College High School. The annual school science fair held on March 23 and 24 attracted twenty-seven exhibits in chemistry and thirty-five in physics. The winners of the first three prizes will compete in the Archdiocesan Science Fair and the two best exhibits will represent the high school at the State Science Fair. The prizes were awarded for the following exhibits: "A crystal polarimeter" (Vincent Marier, senior), "The catalytic effect of the rare earth oxides" (Joseph Galerta, junior), and "Testing the density of oxide coats" (Robert Contrado, junior). A freshman medalist, Robert Faubert, was cited for a display on atomic energy.

Fr. Francis Buck, S.J. was chairman of the fair, with Mr. John Hanrahan, S.J. serving as moderator.

Brooklyn Prep. Under an NSF grant Fr. Joseph Musselman, S.J. will be working with the Chemical Education Material Study (CHEM) group at Cornell University this summer. This is one of the two major programs supported by the NSF for improving course content in high schools. The other, the Chemical Bond Approach (CBAC), is centered at Earlham College and is directed by L. E. Strong. The CHEM group is under the direct supervision of J. A. Campbell at Harvey Mudd College.

The latter group produced a rough draft of a text for high school chemistry along with an outline for laboratory experiments, both for trial use in a few high schools during the academic year 1960–61. On the basis of this trial experience, rewriting has been in progress during the year, and the final writing will be done this summer. Two summer institutes, one at Harvey Mudd College and the other at Cornell University, will have as their purpose an intensive investigation of the CHEM text (three volumes) and lab manual (two volumes) by the teachers who during the 1961–62 school year will be using the CHEM materials. In this latter connection Fr. Musselman plans to use the text and manual in one of his classes at Brooklyn Prep next year.

Fr. Musselman will also be working on a re-evaluation of the new chemistry syllabus in effect this past year throughout the Buffalo and New York provinces.

Fordham Prep. Nine students (juniors) currently enrolled in the college-level chemistry course took the advanced placement examination in May. About a dozen of the same class submitted applications for the NSF-

sponsored summer institutes for talented secondary school students. Of this same group, one student, Richard J. Lepre, has been nominated for the Chemistry Industry Council (of New York) Liebman Award, and John Fiscella and Richard McCarthy have been chosen to go on the New York Chemical Caravan sponsored by the same council to the laboratories at Yale University and the nearby Olin plant.

Richard McCarthy, a junior, is also taking a fifteen-week, thirty-hour course in geology, mineralogy, and crystallography given by Dr. Schuberth of the American Museum of Natural History. The course consists of thirteen two-hour lectures given at the museum, and two all-day field trips. Twenty students with good chemistry backgrounds were selected from among the best students in all the high schools of the city. Last summer six of the present juniors at the Prep attended a similar course in astronomy at the museum.

Mr. Raymond S. McCormick, S.J. was appointed to the executive council of the Catholic Science Council of the Archdiocese of New York. Mr. Robert Hawthorn will attend the institute for teachers of mathematics at Fordham University this summer.

Loyola High School. The School Mathematics Study Group (SMSG) program was introduced in all the freshman mathematics classes this past year. Next year it will be introduced in sophomore year, and so on, until all four years will be receiving the course recommended by the SMSG. The high school physics program of the Physical Science Study Committee (PSSC) was used this past year for both a junior and senior honors class.

Fr. Francis J. Nash, S.J. will attend an NSF-sponsored institute based on the PSSC course at the University of Colorado this summer. Fr. Richard Harper, S.J., on a similar NSF grant, will attend an institute for mathematics teachers at Boston College.

McQuaid Jesuit High School. Mr. E. J. Miller, S.J., (*Detr.*), a graduate student in radiation biology at the University of Rochester, spoke to the senior physics classes in December concerning the health hazards in the coming nuclear age. His emphasis was on the deleterious effects of radiation on bone material, and the uptake of radioactive nucleotides in skeletal matter.

Bausch and Lomb lectures. At the beginning of the 1960–61 school year, Dr. Coleman, head of research at Bausch and Lomb, Inc., one of Rochester's leading industries, offered the facilities and manpower of his company to supplement and deepen the science courses at McQuaid. While attending last year's meeting of the American Physical Society, Dr. Coleman was impressed by the possibility of professional industrial scientists' helping

in the field of education, to inspire and encourage our future scientists. With the approval of Fr. Cornelius J. Carr, S.J., principal of McQuaid, and Fr. William McBride, S.J., head of the science department, the coordinated work of school and industry became effective. In November, a series of lectures was begun for the science honor students. The first lecture, by Dr. Kreidel, head of chemical research at Bausch and Lomb, was on the structure of defective crystals. This was followed the next month by a lecture on the optical properties of thin films produced in a high vacuum. The speaker was Dr. Leon Bartels, whose work at Bausch and Lomb consists of research in this field. The third lecture, on the difference between crystals and glass, was given by Dr. Kreidel. These lectures have all been accompanied by demonstrations, using the equipment of the Bausch and Lomb company. Along with the lectures, there have been tours of the research laboratories to enable the students to see the industrial applications of science and to meet the men working in the field.

Joe Berg Science Seminar. Four seniors, four juniors, and one sophomore from McQuaid attend the weekly sessions of the Joe Berg Science Seminar. The seminar has a total of forty-two students from the six Catholic high schools in the Rochester area. A McQuaid senior, Gregory Maier, is this year's president. The lectures and study groups of the seminar range over mineralogy, aquatic biology, modern mathematics, psychology, radiation biology, photography, astronomy, and even the use of X-rays in crime detection. Local technicians, scientists, and teachers have been most generous in giving their time and talents; in fact, a number of them have asked the moderators if they could present a further lecture or study group session in their field.

Summer institute in physics and chemistry. With the cooperation of Bausch and Lomb, Inc., McQuaid High School will offer a summer institute in physics and chemistry for three weeks this July. The institute is designed to stimulate students of superior initiative and ability who desire further knowledge in selected fields of chemistry and physics. The purposes of the institute are to provide students with an opportunity to add greater depth to their present knowledge, to gain first-hand information about scientific techniques in the laboratory, and to discuss with an expert staff new lines of scientific thought that will reveal some of the many research areas still to be investigated.

The institute has been scheduled for July 5–21, 1961. Seventy-two high school students have been chosen for the program, thirty-six in chemistry and the same number in physics. Both programs, presuming a full year's study in the respective sciences, extend far beyond the normal high school course in content, experiments, and equipment available for use in the laboratory.

The laboratory period is one of the most attractive features of the program. It includes actual use of research equipment: recording spectrophotometers in the ultraviolet and visible regions, infrared spectrophotometers, colorimeters, interferometers, optical pyrometers, direct reading precision devices for length measurements, and hydrogen and deuterium sources. Experiments involving the use of this equipment have been planned, and the daily presence of eight laboratory instructors has been arranged to guide and direct participants in the full understanding and correct use of the instruments.

The initial lectures of the institute program are concerned with spectra and energy distribution, spectroscopy and spectrography, spectrophotometry, colorimetry, and the statistics of measurement and error. The subsequent chemistry program develops the theory treated in the initial lectures, applies it to various fields of chemistry, and advances further in such topics as the Beer-Lambert law, biochemical analyses, metallurgical analyses, photometric methods of titration, and determination of stability constants and the formula of complex ions. The physics program, which also follows upon the introductory lectures, examines in greater detail the topics covered in these lectures and advances in related topics proper to physics. Some of these topics are interference phenomena, use of the interferometer, direct-reading precision devices for measuring length, telescopes and microscopes as measuring instruments, precision measurements in mechanics and optics, and photographic and photoelectric methods for obtaining and recording spectra.

Further information on the summer institute may be obtained from Fr. McBride.

Applicants for NSF summer institutes. Several McQuaid sophomores, juniors, and seniors have applied for participation in NSF summer institutes for high-ability secondary school students. The programs involved are at Notre Dame (mathematics), Carnegie Tech (microwaves), Pan American College (astro-sciences), University of Miami (marine biology), Cornell (chemistry and physics), Northwestern (engineering), and several other colleges. Although costs run up to and over $100, both students and parents have responded enthusiastically.

Mr. Eugene Zimpfer, S.J. aroused interest in these institutes by writing for brochures and applications to about twenty of the 158 institutions offering such summer opportunities. Time was taken from a home-room period to explain the programs to an assembled group of selected students, and the brochures were posted on a special bulletin board.

Teachers' recommendations and lists of grades are required of the student's school, but the effort is small in comparison to the benefits to be reaped. Interested teachers should note that the NSF issues, around Janu-

ary of each year, a complete list of institutions offering such programs during the following summer.

Regis High School. The students have begun publication of the *Regis Science Bulletin.* The student editor cites a twofold aim: "To unite the student body in an effort to promote the exchange of scientific knowledge among themselves and in this way learn to understand the complex technological developments which have become an inseparable part of today's civilization . . . to create a tightly woven network of the science clubs at Regis." Besides reporting on these clubs, the first issue includes brief articles on: "How semi-conductors work," "Carbon-14," and "The basis of harmony."

The science clubs at Regis form an elastic group of activities, old ones being dropped and new ones organized in accordance with student interest. Active in the present year have been the radio club, the rocket club, the mathematics club (including a separate freshman club), and the chemistry club.

The radio club has as its purpose the training of members for ham radio licenses, with which they can then operate the school's transmitter and receiver unit. The rocket club has set as its aims: 1) to conduct experiments and research projects designed to teach its members something of the science of modern rocketry; 2) to promote an exchange of information with similar clubs; 3) to develop and establish safety procedures in the club itself. Activities include research projects in rocket instrumentation, courses in astronomy and the basic elements of rocketry, and a projected series of static test firings in the fall.

The mathematics clubs, under the direction of Fr. Timothy Reardon, S.J., present a guest lecture series as well as talks by club members themselves. They also offer a voluntary tutoring service in mathematics to any students desiring help before semester exams. Both clubs use the free services of the Mathematics Speakers' Bureau for Metropolitan New York Schools. (For further information send a card to Professor James N. Eastham, Director, The Cooper Union, Cooper Square 3, New York.) Among other speakers have been a number of faculty members, as well as Mr. John Costello, S.J. (Fordham) and Mr. Edwin Sherry, S.J. (Yeshiva).

St. Joseph's College High School. Fr. Francis Carmody, S.J. will attend an NSF-sponsored institute for teachers of chemistry and physics at the Oak Ridge Institute for Nuclear Studies. Fr. Stephen Garber, S.J. received a research participation NSF appointment for ten weeks at the University of Southern California. Fr. George Hohman, S.J. will spend the summer at Fordham University beginning work on his master's degree in physics.

Colleges and Universities

Canisius College. The college's third annual Gas Chromatography Institute was held April 4–6, 1961. This year, for the first time, elementary and advanced sessions were offered simultaneously. Special seminars were added for discussions of the following topics: recent developments in chromatography; columns and column packing materials; high temperature chromatography; detectors; and the use of chromatography for odors, flavors, and air pollution. During the institute the college laboratories were supplemented by instruments from the country's leading manufacturers. Company representatives conducted laboratory exercises using this equipment.

The fifth annual Infrared Spectroscopy Institute is scheduled for August 14–18, 1961.

Fr. James Ruddick, S.J., chairman of the physics department, proposed a course in modern physics for non-science majors at the February meeting of the American Association of Physics Teachers (AAPT). His paper discussed various types of courses for non-science majors. The details of the modern physics course are outlined here:

Modern Physics for Non-Science Majors

Texts: Semat-White, *Atomic Age Physics,* Rinehart.
Hughes, *The Neutron Story,* Doubleday Anchor, S-1.
Coleman, *Relativity for the Layman,* Mentor, MD-234.

1. Introduction: Pre-Notes on Basic Physics
1. Vectors
2. Newton's laws
3. Work, energy
4. Momentum
5. Rotational motion
6. Conservation laws
7. Electricity: Coulomb's law
8. Magnetism: effects on moving charges

2. Atomic Physics
1. Electrons: discovery, emission
2. Historical background for Bohr's theory: spectroscopy, Balmer and Rydberg, Planck, Rutherford's nuclear atom
3. Bohr theory (in moderate detail)
4. Energy levels, periodic table
5. X-rays: spectra, origin, absorption (including health aspects)
6. Waves and/or particles (Compton, De Broglie, Heisenberg)

3. Radioactivity: Natural and Artificial
1. Types of radiation (including health aspects)
2. Decay processes
3. Reactions and reaction equations

4. Nuclear Energy
1. Neutron physics
2. Reactor physics
3. Reactors for power generation

5. Relativity
1. The problem: motion, velocity of light
2. Special theory: relative motion, Lorentz transformation applications to mechanics, experimental verification

Fordham University. Fordham's chemistry and physics departments attracted attention this spring by both faculty and student activities:

Chemistry. The first physical evidence of life forms beyond our planet was reported by Dr. Bartholomew Nagy and Dr. Douglas J. Hennessy of Fordham's chemistry department, and by Dr. Warren G. Meinschein of Esso Research and Engineering Company. This evidence resulted from an analysis of the 97-year-old Orgueil meteorite; a study of the hydrocarbon fractions in the meteorite indicated that these hydrocarbons are similar to those occurring in living matter. The Orgueil project was initiated by Dr. Nagy as part of his research on organic matter in rocks. His research work during the past few years has centered on the study of petroleum composition. He obtained the sample after a two-year search and interested Dr. Hennessy, professor of organic chemistry, and Dr. Meinschein in the studies. The three scientists presented their findings before the Section of Chemical Sciences and the Section of Geological Sciences of the New York Academy of Sciences. Though their work on the fragment appears conclusive, they stressed the preliminary nature of their report.

Physics. Two seniors in Fordham College, John Mike and James George, have been awarded NSF pre-doctoral fellowships to work for their Ph.D. degrees in physics. Mr. Mike, who is from Bishop Loughlin High School in Brooklyn, expects to attend MIT in the fall. He is also the winner of a Woodrow Wilson Fellowship. Mr. George, who is from the University of Detroit High School, plans to attend Harvard University. Both Mr. Mike and Mr. George were members of the Fordham College Science Honors Program. The other three students in this program who were majoring in physics received honorable mention citations in the NSF fellowship competition. They are John Clark (Xavier High School), William Byrnes (Regis High School), and Richard Szypula (Bishop Loughlin High School).

Two graduate students at Fordham, Miss Anna Mae Walsh and Miss Loretta Glismann, also received honorable mention citations in the NSF competition. This record of two fellowships and five honorable mentions is the best of any physics department in a Catholic college or university in the country.

Dr. Kenneth M. Clarke, formerly of Yale University, has joined the physics staff at Fordham as assistant professor of physics.

Georgetown University. The second annual summer conference on recent advances in astro-geophysics will be held at Georgetown July 6–18, 1961. The conference is sponsored by the NSF for thirty-two college professors of physics and astronomy, and will be under the direction of Fr. Matthew P. Thekaekara, S.J., acting chairman of the physics department at Georgetown. Lecture topics include: the tools of modern astronomy, spectroscopic methods in astronomy, the solar system, radiation belts, cosmic rays, the structure and evolution of the universe, satellites and their tracking, the production of chemical elements and their distribution. Among the scheduled lecturers are Dr. Wallace Brode, Dr. John P. Hagen, Fr. Francis J. Heyden, S.J., Dr. Carl C. Kiess, Dr. Lyman Spitzer, and Dr. William J. Thaler.

St. Joseph's College. Students at the college have been the recent winners of a number of academic awards:

Mathematics. An NSF fellowship in mathematics was won by a senior, Joseph W. Jerome, who was also the recipient of a National Defense Education Act fellowship. He will attend Purdue University.

Physics. A senior in the department, Robert A. Morris, received an NSF fellowship in physics, specified for Harvard University. Another student, Philip Hasebauer, won honorable mention from the NSF in physics and has received a university fellowship from St. Louis University.

Biology. Fr. Francis J. MacEntee, S.J., assistant professor of biology, has been elected a member of the science curriculum committee of the Pennsylvania Three-Year Curriculum Study Program.

Dr. Carroll B. Nash, chairman of the biology department, and Mrs. Nash, assistant professor of biology, visited Antigua, Martinique, and Barbados during the Christmas vacation, observing some of the biological species indigenous to the area. Dr. and Mrs. Nash, along with one of their students, David Capuzzi, each presented a paper at the third annual convention of the Parapsychological Association in New York City.

Among the papers contributed by Dr. Nash from the parapsychology laboratory at St. Joseph's College in the past year were:

The effect of subject-experimenter attitudes on clairvoyance scores. J. Parapsychology, *24,* 189–98.

Two exploratory experiments in ESP: a summary of results. J. Amer. Soc. Psychical Research, *54,* 136–37.

A comparison of two agents in GESP and clairvoyance tests. Indian J. of Parapsychology, *2,* 60–64.

Can precognition occur diametrically? J. Parapsychology, *24,* 26–32.

Wheeling College. Continuing the science teachers' workshop series in the chemistry department, Professor Henry Frank of the University of Pittsburgh spoke in March on "The covalent bond." In April Professor Edward Haenisch of Wabash College discussed the "Quantitative aspects and semantics of chemistry" at the seventh and final workshop of this year's series. The science teachers who participated in the series met in May for a general discussion and summary of the work of all seven workshops.

A new series of the Chemistry for Industry program began on April 12 with computers as the topic for discussion. Mr. Clyde Huston, director of training, UNIVAC Division of Sperry Rand Corporation, was the first guest. He discussed "Elements and functions of electronic computers." On April 26 Mr. Musa I. Marto, process control engineer of IBM, lectured on "Computer control of industrial processes." The final guest for this series was Mr. Willard Reeves, sales engineer of Computer Systems, Inc., whose topic was "The electronic analog computer: present and future." These lectures were presented in cooperation with five chemical industries of the Ohio Valley and were designed specifically for chemists and chemical engineers. Fr. Joseph A. Duke, S.J., director of sciences, coordinated the program.

Dr. Robert L. Grob recently published the following article: "Thermal conductivity cell response and its relationship to quantitative gas chromatography," *J. Chromatog.*, 3, 545–53 (1960). In cooperation with Suzanne Polen, Fr. Duke presented a paper at the West Virginia Academy of Science meeting at Bethany College. The paper was entitled: "Reactive groups of myosin."

Fr. Duke has been awarded a renewal of his National Institutes of Health grant to study the non-enzymatic hydrolysis of ATP, and he has also been granted a research participant award by the AEC to work at Oak Ridge this summer. The latter work will be in preparation for the introduction of nuclear technology courses into the college curriculum in the fall of 1961. Fr. Duke has also lectured on science to students of six Ohio Valley high schools as part of the Visiting Scientist Program of the West Virginia Academy of Science Program under the auspices of the NSF.

Scholasticates

Shrub Oak. Mr. Louis M. Savary, S.J. (*Md.*) received an NSF graduate fellowship in mathematics to study statistics at Catholic University. Mr. Leo J. Gafney, S.J. (*N.Y.*) received an honorable mention in mathematics.

Under the guidance and inspiration of Fr. Albert Rooney, S.J., an

amateur radio shack has been set up in Gonzaga House, and ham licenses have been acquired by Mr. Robert C. Collins, S.J. (*N.Y.*), Mr. Peter C. McNamee, S.J. (*N.Y.*), and Mr. John A. Walsh, S.J. (*Buff.*). A knowledge of this hobby has already been of use in contacting missionaries, and should also be useful in the high schools where radio clubs are a source of interest for the students (see the above report from Regis High School).

Weston College. The second of two articles by Mr. Edward MacKinnon, S.J. appeared in *The Modern Schoolman* for January, 1961. The first article had traced the development of quantum theory and the various interpretations "drawn out of it" or "read into it," and the second article considers the same problem, the ultimate constitution of matter, from a philosophical viewpoint. The articles are:

"Atomic Physics and Reality," *The Modern Schoolman*, 38 (November, 1960): 37–59.

"Thomism and Atomism," *ibid.*, 38 (January, 1961): 121–41.

Graduate Studies

Mr. William H. Millerd, S.J. (*Md.*) has won an NSF fellowship renewal in physics. He is studying at Johns Hopkins University.

At Catholic University, Mr. James Gilroy, S.J. (*Wisc.*) has received a renewal of his National Defense Education Act fellowship in statistics, while Mr. Florian Muckenthaler, S.J. (*Mo.*) and Mr. J. Patrick Macnamara, S.J. (*Wisc.*) have been awarded NSF fellowships for the coming year to continue their study of biology.

At the University of Maryland, Mr. James Schecher, S.J. (*N.E.*) has completed work for his master's degree in physics. His thesis research was carried out in the university's Institute of Fluid Dynamics; it involved a study of the characteristics of low-power electromagnetic shock tubes.

An NSF fellowship in mathematics has been awarded to Mr. Lawrence Conlon, S.J. (*Mo.*), and another in physics to Mr. Albert A. Cone, S.J. (*Md.*). Both are studying at Harvard University.

At MIT, Mr. Donald J. Plocke, S.J. (*N.E.*) is completing his dissertation in biophysics, entitled "Alkaline phosphatase of *E. coli*: a zinc metalloenzyme," and Mr. Donald Merrifield, S.J. (*Calif.*) is finishing his work in physics. His dissertation was a theoretical investigation of the energy levels of the water molecule, written under the direction of Professor J. C. Slater, of the solid state division.

Interdisciplinary seminars, open to all members of the community, are being held every other week at St. Andrew Bobola House. The topics that have been discussed include biophysics, musicology, comparative linguis-

tics, mathematics, social work, far-eastern studies, and physics. At each meeting, the speaker gives a twenty-minute presentation of some aspect of his field; then the topic is put before the other members for discussion. Though each member of the group is studying a different field himself, the discussions have been quite lively.

At St. Louis University, Mr. Robert Baumiller, S.J. (*Md.*) has won an NSF post-doctoral fellowship in medical genetics, specified for the University of Wisconsin. Mr. Robert Brungs, S.J. (*Md.*) is completing his work for a doctorate in physics, and Mr. Robert O'Brien, S.J. (*N.E.*) is beginning his doctoral research in the same field. Mr. Brungs studied the physical properties of meticulously prepared single crystals of boron. Mr. O'Brien will work in the field of nuclear magnetic resonance and electron spin resonance (NMR and ESR). Fr. John Burns, S.J. (*Md.*) is completing his doctoral work in boron chemistry.

Mr. Edwin J. Sherry, S.J. (*N.Y.*) has won a cooperative fellowship in mathematics at Yeshiva University. An honorable mention in mathematics was attained in the NSF fellowship examination by Mr. Edward F. Cavey, S.J. (*Md.*), who teaches at Georgetown Prep.

OFFICIAL REPORTS AND NOTICES

Notice of Annual Meeting

The thirty-sixth annual meeting of the American Association of Jesuit Scientists (Eastern States Division) will be held at Fordham University on Wednesday, Thursday, and Friday, August 30 and 31, and September 1, 1961.

Since there will be sessions for contributed papers in each section, authors of papers should contact sectional chairmen as soon as possible.

All members of the Association are urged to attend.

CLARENCE SCHUBERT, S.J., *President*

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