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JAMES F. SMITH, *Editor*
CHARLES L. CURRIE, *News Editor*

Associate Editors

JAMES GAFFNEY   FRANCIS A. GREENE

Editorial Office

Woodstock College
Woodstock, Maryland

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To our readers . . .

At Weston Observatory, projects in a newly adopted area of research are getting off the ground—literally. Nose cones destined for rocket-borne experimentation in measuring terrestrial magnetism are now under preparation as part of the Observatory's current schedule of geomagnetic investigations.

To bring our readers up to date on this new field of Jesuit research, we have included in this issue an article by Mr. Joseph B. Pomeroy, S.J., presenting an account of the Weston program. Mr. Pomeroy tells why the observatory, well known for its seismological studies, has undertaken investigations of the earth's magnetic field as well. Readers will find that this research program, of which the rocket experiments are but a part, uses instrumentation functioning by an optical pumping technique, itself an object of considerable current interest.

We seem to have started something last fall by reprinting Professor Edwin Moise's article on "The Proposed Doctor of Arts Degree" in mathematics. This degree has been the object of much discussion and controversy for the past year. To bring the question closer to the present moment, now that we have raised it, our second article this month discusses some of the criticisms cast up against the Doctor of Arts program. Since the aim in proposing this degree was to alleviate the shortage of college mathematics teachers having advanced training, the entire question involves the general problem of attracting college graduates into studies in higher mathematics. For this reason, we include here an account of an opinion, widely held today, that sees the development of undergraduate research as a way to arouse permanent interest in mathematics.

The chief advantages of advanced placement programs lie in providing good students with conditions favoring serious work from the outset of their college careers, and in reducing the dismaying length of time required to prepare for professional and scholarly vocations. In the high schools also, preparation for advanced placement, by presenting an attractive challenge to the more talented students and teachers alike, can notably raise the academic tone of departments that undertake it. All of these gains are especially desirable in the education of scientists, where improvement of secondary schooling, stimulation of student interest, and economy of time have been matters of widespread concern. The third article this month, a survey by Fr. Francis A. Greene, S.J., reports on advanced placement programs in our college science departments.

A NEW RESEARCH PROGRAM AT WESTON OBSERVATORY

JOSEPH B. POMEROY, S.J.

Weston Observatory is perhaps best known for its work in the field of seismology. Recently, however, the observatory has added another aspect of geophysics to its research efforts. In addition to the investigation of the earth's mechanical nature and characteristics as studied in seismology, research is now in progress concerning the electrical and magnetic character of the earth. This is the study of geomagnetism.

Aims of geomagnetic research. The earth and, as far as is known, all major heavenly bodies have a magnetic field surrounding and permeating them. In addition to the general scientific goal of learning more about the universe we live in, the study of the geomagnetic field has other more immediate aims. Information about the geomagnetic field will enable scientists to find out more about the ionosphere, for there seems to be a direct connection between ionospheric events and disturbances in the earth's magnetic field. Information about the sun and its constitution will also result from these magnetic studies, since solar flares, sun spots, and other solar events show correlation with geomagnetic events. Perhaps more practical, though not immediately so, is the application of geomagnetic investigations to space travel. Since all heavenly bodies evidence magnetic fields, United States Air Force personnel are of the opinion that a magnetic system of space navigation might be feasible. Such a system, though impractical at low altitudes around the earth because of anomalies in the field, should be possible in outer space, where the anomalies could be expected to smooth out. Obviously, for such an arrangement to become a working reality, much more detailed data concerning the earth's magnetic field are needed. Until recently, there were only two stations in the continental United States assembling such data, both operated by the United States Coast and Geodetic Survey, at Fredericksburg, Virginia, and Tucson, Arizona. Scientists at the United States Air Force Cambridge Research Laboratories, Bedford, Massachusetts, decided that it would be valuable to provide for themselves geomagnetic information from a nearby source, thus increasing their data on the northeast section of the country. The Weston Magnetic Observatory program was the result. It is under the direction of Fr. Daniel Linehan, S.J., who is assisted by Fr. Francis J. Donohoe, S.J., along with a number of the Weston College theologians, whose work at the observatory is carried out during their times of recreation. Perhaps the most important reason for the selection of Weston for this project was the availability of test and assembly facilities for the magnetometers used in rocket-borne experiments on geomagnetism. But more about these experiments later.

Investigation of the local geomagnetic field. The first project in the observatory's new geomagnetic research consists mainly in the study of methods of determining and recording the magnetic field of the earth. Briefly, this field may be described as that resulting from a large fictitious bar magnet within the earth, with its axis along the line from the north to the south magnetic poles, both of which are offset slightly from their geographical counterparts. The simple field at any point on the earth is thus a vector with amplitude and direction. This vector has vertical (Z) and horizontal (H) components. The difference between the direction of the horizontal component H and astronomical north is known as the declination (D) and is the ordinary compass correction. These three values, H, Z, and D, uniquely represent the field at any point on the earth. The total intensity (F) is also of convenience.

These components are not constant values. A table of typical average values and normal daily variations at Weston is given below:

Component	*Average value*	*Daily variation*
F	57,300 gammas	50 gammas
Z	54,800 gammas	50 gammas
H	16,000 gammas	50 gammas
D	15°40′	30′

In the above tabulation, one gamma is one hundred-thousandth of a gauss. Magnetic storms cause wide variations, as much as 1000 gammas for F.

Techniques of measurement. Obviously, to measure variations so small when referred to the average, careful techniques must be used. At Weston these components are all measured with an accuracy of about one gamma. Relative values of H, D, and Z are measured with sophisticated versions of the ordinary compass, having quartz fibers suspending the magnets; mirrors are attached to these magnets in such a way as to record the variations optically on sensitized paper wound on drums that rotate once a day. In this way, daily records of the relative values of these components are obtained. The absolute values or base lines for these records are determined by the use of instruments that measure the absolute value of the component under consideration. The determinations are made at intervals to maintain the accuracy of the base line values of the variometer records.

Instruments measuring absolute values. Two absolute instruments are used. The theodolite magnetometer determines the horizontal intensity from the period of oscillation of a suspended magnet; declination is determined from the difference between the position of the suspended magnet at rest and an accurate reference direction. The angle between the field vector and the horizontal is measured by means of an earth inductor. From this angle and H the vertical intensity can be calculated. More frequently, however, another technique is used at Weston: the absolute values are determined with an Askania universal torsion magnetometer, in which the amount of torsion required to return a suspended magnet to a known orientation is measured, and thus the horizontal and vertical force determined. The sensitivity of the variometers is measured by application of a known field associated with a pair of Helmholtz coils.

Instruments measuring total intensity. To determine the total intensity, two other and totally different types of instruments are used. The first of these is the proton precession magnetometer, in which hydrogen molecules are lined up perpendicular to the earth's field by a polarizing solenoid electromagnet. When this magnet's field is released, the dipoles move back towards the direction of the earth's field. The frequency of precession is dependent only on the value of the earth's field and the gyromagnetic ratio of hydrogen. Since this gyromagnetic ratio is accurately known from other sources, a simple determination of the precession frequency may be used to calculate the total intensity of the earth's field. The frequency is measured electronically by means of gated counters and the result plotted on a continuously operating strip-chart recorder. Thus a continuous record of the total intensity and its variations is made available. The instrument indicates about twenty-four gammas per cycle of precession frequency; consequently, it is not too easy to make this determination with accuracy.

The second type of magnetometer that has recently come into use at Weston is known as the rubidium vapor magnetometer. An optical pumping technique is used to raise atoms of rubidium-85 gas to an excited state, from which some fall back to an upper ground state resulting from Zeeman splitting. As more atoms are trapped in this upper ground state, the gas cell becomes transparent and the light used for pumping falls on a photo-cell, whence it is amplified and fed back as a magnetic field to depopulate the upper ground state and fill the lower, at which time the whole process repeats. The frequency with which the process repeats depends on the amount of Zeeman splitting and thus on the earth's magnetic field. The feedback frequency is measured by means of a counter or frequency meter, and the result is plotted on a strip-chart recorder. The rubidium vapor magnetometer produces a frequency of 4.66 . . . cycles per gamma. This instrument is easier to use than the proton precession unit, and it is more accurate as well.

The values obtained from the records described above are reduced with the aid of an analog-to-digital converter, and the results are printed in the form of average hourly values of the four components. These results are of value in the study of the ionosphere and its interaction with the magnetic field of the earth, as well as in investigations of the propagation of electromagnetic radiation around the earth. Correlations are found with ionospheric disturbances, solar flares, sun spots, auroras, and other electromagnetic phenomena. Information concerning these various phenomena is available to the observatory through regular bulletins and special warnings sent by teletype from the United States Central Radio Propagation Laboratories at Ft. Belvoir, Virginia. Findings of Weston Observatory are made available to other laboratories in a quarterly bulletin.

Rocket-borne magnetometer investigations. Since the field of the earth is not confined to the earth's surface, it is reasonable and scientifically valuable to examine the field above the earth with magnetometers mounted in rockets. At Weston, nose cones containing magnetometers and other similar devices, such as ionized-particle counters, have been prepared for launching by the United States Air Force at Ft. Churchill, Canada (through the aurora) and Eglin Air Force Base on the gulf coast of Florida (perpendicular to the field of the earth). A nose cone containing a rubidium vapor magnetometer is under preparation at this writing for launching in February 1962 from Eglin Air Force Base. The ground support trailer for this flight is also being prepared at Weston. This trailer will contain two high-speed tape recorders for recording the data radioed back from the rocket, along with equipment to test and check out the rocket instrumentation before flight and to monitor the various data signals sent back during flight.

Other areas of geomagnetic research. The Weston Observatory's new program in geomagnetism has up to the present had as its main preoccupation the two projects just described: rocket-borne magnetometer investigations of upper atmospheric magnetism, and observatory investigation of the local geomagnetic field. But a broader scope is foreseen for the future, stemming from research efforts that are being directed even now toward the design, development, and testing of new techniques in geomagnetism.

WESTON COLLEGE

WHO WILL TEACH COLLEGE MATHEMATICS?

JAMES F. SMITH, S.J.

Almost from the moment it was proposed in January of last year—and perhaps before—the suggested Doctor of Arts degree in mathematics has been under fire. Yet the motivating problem remains: how are American colleges and universities to staff their mathematics departments with qualified teachers, trained at the doctorate level? Where are such teachers to be found?

The problem is certainly not easy of solution. It becomes much more acute, however, for those institutions—almost every American Jesuit college and university among them—not offering a doctoral program in mathematics. And, of course, it is the liberal arts college with no graduate mathematics students at all that is in the direst straits. Most mathematicians with the Ph.D. degree take jobs with industry or government; it is only natural that of those who make the financial sacrifice that teaching entails, many will want to seek the recompense of working in the area of their specific interest with students who fully appreciate and respond to them—and this means graduate students, doctoral candidates for the most part.

Assuming, then, on the part of Jesuit colleges a particularly keen sensitivity to the mathematics personnel problem, I will aim in these pages to present a report and a synthesis of ideas recently expressed on this basic topic by mathematicians active in college and university teaching. The problem of recruiting prospective mathematics professors will lead naturally, I believe, to the more general question of suitable ways of arousing interest among college students in the study of mathematics on the graduate level. The means to be suggested is an honors research program in college, a program widely looked upon today as a sufficient—and almost necessary—condition for a rich harvest of graduate students in mathematics.

Nature and purpose of the Doctor of Arts degree. An article by Professor Edwin Moise, of Harvard University, thoroughly explaining the proposed Doctor of Arts degree, appeared last year in the American Mathematical Society *Notices* and was subsequently reprinted in this BULLETIN (vol. 38, no. 3, September 1961, pp. 58–63). It will suffice to recall here that the purpose of instituting such a degree is, in general, to provide highly trained teachers of college mathematics, and, more specifically, to accomplish this goal by offering training up to the doctorate level for "non-creative" mathematicians. The degree program itself would differ from the present Ph.D. requirements only in the nature of the doctoral dissertation. Instead of a "creative" thesis embodying proofs of results not formerly extant in the mathematical literature, the dissertation for the Doctor of Arts degree would be a scholarly work which, according to Professor Moise (p. 62), "could be historical, critical or philosophical in nature. Here the idea of historical dissertation is intended by all means to include studies of recent mathematical developments. Whatever the thesis topic may be, the course-work should be adequate to enable the student to read current research literature."

Reaction to the degree. The very next issue of the AMS *Notices* (June 1961) following upon Professor Moise's original article, included in its correspondence section a letter from Professor Melvin Henriksen, of Purdue University, voicing strong objections to the Doctor of Arts degree. Referring to the suggested program as "fraught with danger," Professor Henriksen disputes some of the underlying premises that led to the proposal's adoption by the Council of the AMS and the Board of Governors of the Mathematical Association of America. He questions whether it is after all a lack of creative ability that is the real bottleneck in the production of mathematicians with the Ph.D. degree. Rather, Professor Henriksen conjectures, there are more ("ten times as many") students who have failed to attain this degree because of their inability to pass courses or preliminary examinations than there are among those who, having fulfilled these requirements, have been unable to write a dissertation. Financial difficulties, too, are named by Professor Henriksen as a possible obstacle to the qualified graduate student, though he admits that in this respect the present state of affairs is a great improvement over that of former years. In any event, his letter states, it is fair to ask for factual verification of the assumptions in these areas that have gone towards furthering the cause of the Doctor of Arts proposal. And fair it is, though on the other hand many would doubtless accept the judgment, presumably founded on experience, of those officials of the mathematical organizations whose evaluation of matters Professor Henriksen questions.

Objections to the degree itself. Two further objections raised by Professor Henriksen may be treated rather quickly. One of these consists in the danger that the quality of the proposed type of doctoral dissertation will rapidly deteriorate. This objection was dealt with by Professor Moise in his article: he admits (p. 62) that this will in fact happen, just as it has happened with every kind of degree, including the present Ph.D. It is inevitable, he says, that the quality demanded for degrees will vary from one institution to another; hence, there is no point in citing this as an objection. Another difficulty offered by Professor Henriksen is the possibility that a worthwhile dissertation of the proposed type might be more difficult to produce than a thesis of the present "creative" sort. He alleges as his reason that at present almost all critical, historical, and philosophical articles are written by mathematicians who have had the Ph.D. for some time. But even granting that this last situation is a fact, it is hard to see how it leads to the conclusion he draws.

Problem situation forseen. It would seem that the weightiest difficulty anticipated by Professor Henriksen is simply the state of affairs that would result from the existence of two types of doctorates in mathematics. What would be the social consequences of such a situation? Would those holding the Doctor of Arts degree be regarded as second-class citizens within the mathematical community, or even within the academic portion of this group? What would be their standing in the college or university, particularly as regards rank, administrative posts, and positions of authority over others? One might even question, adds this critic, whether there is not danger of hostility between the two classes of mathematics teachers, each holding the title of "Doctor."

We may even go a step beyond Professor Henriksen's forebodings. Does it not seem strange that in the whole of the academic spectrum there should be exactly one field in which faculty members may hold either of two distinct doctor's degrees? Or, to take the viewpoint of a university conferring these degrees, would it not be odd if the institution were to offer two specifically different doctorates within one field—and this in no other department of the entire graduate school? Such a state of affairs would constitute a serious difficulty in the view of any academic administrator.

The conclusion that Professor Henriksen would apparently like to draw from the "social consequences" of the Doctor of Arts proposal, along with his other objections, is that the *status quo* should be maintained and the suggested doctorate program scrapped. But is not this procedure, in its own way, unrealistic? One has only to read Professor Moise's presentation of the Doctor of Arts proposal to see that the problem of providing well-trained college mathematics faculties is becoming more and more acute. The inability of colleges to compete financially with industry, along with the relative scarcity of doctorates awarded in mathematics (as opposed, for example, to the natural sciences, where a similar problem of competition with industry exists) makes it imperative that the talents of capable "non-creative" mathematicians be enlisted and developed. These people, by supposition, are able to learn advanced mathematics; presumably they would do as well in college teaching as our present Ph.D. mathematicians, whose ability to make up and prove a set of conjectures (or at least to prove them) is the one distinguishing essential in their background. What can be done? It would be a shame to waste all this undeveloped talent, yet the consequences of a double doctorate seem to be prohibitive. Is there no way to have our cake and eat it, too?

A possible solution. According to some remarks made by Professor Kenneth O. May, of Carleton College, there is a way. Writing in *Undergraduate Research in Mathematics,* a report of an NSF conference held at Carleton, June 19–23, 1961 (hereafter referred to as the *Carleton Report*), he says (pp. 77–78):

> In mathematics we use "research" in an extraordinarily narrow and non-operational fashion. It is supposed to refer to results that have not been discovered before and which are non-trivial (i.e. of interest to the speaker). Leaving aside the lack of invariance under individual caprice and fashion, this conception means that we cannot tell whether a person is doing research by examining what he is doing! For example, since Newton and Leibnitz invented calculus at approximately the same time, it is not clear which one of them was doing research and which merely expository work! And of course the greatest mathematical work of all time, Euclid's *Elements,* was mostly not research at all, "merely" exposition of known results! Moreover, the unfortunate use of "research" is coupled with an equally confusing use of "exposition." Every paper that is worth anything should be expository, but by opposing exposition and research, and by limiting the latter to previously known results, we encourage the habit of really separating the two activities—of including little research in so-called expository papers and little exposition in so-called research papers.
>
> These difficulties would be overcome if we used these terms in the way that the rest of the scholarly community does. We should think of research as a kind of activity leading to many kinds of results, and of exposition as a means of communicating such results. With this understanding mathematical research includes library work, study and discussion, as well as cogitation and calculation. The results may be new twigs in the jungle of mathematics, new seeds, new branches, or whole plants. They may also be works of scholarship about this jungle: explicatory, critical, analytical, or historical studies, guidebooks, reference books, text books, and so on. We stand in need of results of these latter kinds as much as of the former, and there is no reason to assign them a lower status or to refuse to describe as research the scholarly work leading to them. There *is* a legitimate distinction between results *in* mathematics and results *about* mathematics. But we need both, research is required for both, and invidious distinctions between them reflect little more than ignorance and snobbery. Mathematics is growing chaotically. Continual analysis and reorganization are quite essential for progress even though they lead to new results about rather than in the subject.

Professor May calls his paper "Heretical Thoughts on Undergraduate Research." Whether or not his views on research are indeed heretical, it will be up to the guardians of mathematical orthodoxy to judge. They are, in any event, the key to the dilemma of the Doctor of Arts. If mathematicians broaden their notion of research and abandon their singular narrowness of view in its regard, they need only continue to award the Ph.D. degree as in the past, but now in accord with a revised outlook on research. The result, seemingly, would exploit the abilities of the "non-creative" mathematicians while avoiding the incongruities inevitably resulting from two separate doctorates. And, as Professor May points out, those who would look upon such a widening of the scope of mathematical research as a degrading innovation should rather regard it as a tardy recognition of necessary diversity in scholarly endeavor. Such recognition, instead of demanding that universities make a basic and necessarily clumsy accommodation to the existing peculiarities of mathematics, would bring this field into closer similarity to other academic disciplines. Mathematics, and mathematics teaching in particular, could then enjoy the best of both worlds—the world of the present Ph.D. and that represented by the Doctor of Arts proposal.

A final problem and a suggested remedy. One problem remains. It may be stated in terms of Professor Henriksen's conclusion to his criticisms of the Doctor of Arts program: "There are a lot of talented young Americans with creative talent. They should be found and trained." An assertion such as this solves nothing, of course, nor would anyone be concerned to deny it. But it does serve to point out that even if some provision is made for the advanced training of capable "non-creative" mathematicians—as I believe it should be—the aim of attracting more and more "creative" mathematicians into the field is not to be neglected. Yet how is this goal to be attained?

An answer was suggested at the Carleton College conference mentioned earlier. Among the seventy-five participants, representing seventy colleges and the NSF, it was generally agreed that undergraduate research has a large role to play here. Though perhaps not all would be willing to widen the concept of "research" to the extent advocated by Professor May in his paper quoted above, still there was agreement that the purpose, and therefore the nature, of undergraduate research is different from what is at present classed as research activity on the part of professional mathematicians. No one would expect undergraduates, apart from occasional exceptions, to make "contributions" to mathematics in the sense borne exclusively up to now by the results of doctoral and post-doctoral research activity. Rather, what is envisioned is the better training of college students and the stimulation of their potential interest in mathematics as a field for further study.

What, then, is this "research" that college students might be expected to carry on? After participating in the Carleton conference, I would say that the essential elements in all the use made there of this word and similar expressions are summed up by describing it as productive study requiring a certain amount of insight (that is, not merely hack work), carried out independently of presentation by a teacher. This description would place in the category of "research" or "activity of research type" any assignments, even fully specified ones, requiring some thought and perhaps some extra reading on the student's part. In particular, it would include the use of the "Moore method" of teaching, named for Professor R. L. Moore, whose "success in attracting students to a mathematical career," according to Professor R. L. Wilder, "has been phenomenal" (*Carleton Report*, p. 17). A teaching technique which consists substantially in requiring students to develop the consequences of suitable axiom-systems presented to them, the Moore method is fully discussed and illustrated by Professor Wilder in *The Axiomatic Method,* edited by L. Henkin, P. Suppes, and A. Tarski (Amsterdam, 1959).

A higher level of undergraduate research. A second and higher level of attainment in college research activity is reached when the student is stimulated to exercise initiative in posing questions of interest to himself. This does not mean that the student need make up problems out of whole cloth; he may be interested in one or more that his teacher has mentioned in class, or that he has found in a book or competitive examination. It is not essential, either, that the student elect to engage in such a project rather than do no research activity at all. What is important here is that the student be allowed to choose, under guidance, some area of investigation that interests him and that he will want to pursue to his own satisfaction. Hence the value of those frameworks for undergraduate research that give scope to such initiative: extra-credit activity, dissertations, term papers, seminars, and, in general, assignments allowing the final choice of topic, within specified limits, to come from the student himself.

Undergraduate research as leading to permanent interest. If within these last few paragraphs I have succeeded in capturing the essentials of undergraduate research as conducive to permanent mathematical interest, it will be obvious that college research in mathematics is not the bugbear it has generally been thought to be. Indeed, it is something that every up-to-date and enthusiastic teacher, even if not actively publishing, encourages quite naturally. This view was taken by Professor William E. Hartnett, of Holy Cross, who stated at Carleton a basic aim of the Holy Cross course: "We attempt to provide a standard program sufficiently challenging and penetrating so that the good student begins to ask interesting questions in his first year" (*Carleton Report,* p. 83).

But beyond demonstrating the feasibility of college research activity, a look at the nature of undergraduate research should almost suffice of itself to show its effectiveness in attracting talented students into the field of mathematics. The increased emphasis in recent years on *understanding* mathematics at all levels, as opposed to the mere acquisition of technical facility, has itself done much to arouse interest in advanced mathematics. It may, in fact, be just this turn of events that has given rise to a sizable class of students with an interest in understanding, relating, and expounding higher mathematics—students so numerous as to warrant a special doctoral program for their development. It would seem, then, that activity of research type at all levels would have a corresponding effect in attracting future mathematicians, including—perhaps especially—those with "creative" talent. And there are indications that this is so. Time after time, the participants at the Carleton conference reported instances in which sudents who a short while ago were engaged in undergraduate research are now working with apparent success for their Ph.D. in mathematics. It is not likely that a causal connection is completely lacking.

Conclusion. The purpose of this paper has been to report current suggestions for supplying the lack of highly trained college mathematics teachers. There are two main approaches to the problem. The first seeks to enlist the abilities of "non-creative" mathematicians by providing some sort of doctoral program, however it is to be designated, suitable for their needs and inclinations. The second attempts to respond directly to the more general problem of attracting capable students to the study of advanced mathematics, thus indirectly adding to the number of available teachers in the field. It is here that undergraduate research is thought to be a most important means towards attaining the end in view. A number of Jesuit colleges and universities have introduced such programs already; those interested in obtaining information on the subject will find a wealth of useful facts and ideas in the Carleton report, *Undergraduate Research in Mathematics,* edited by Kenneth O. May and Seymour Schuster, available from the Department of Mathematics, Carleton College, Northfield, Minnesota. Besides the proceedings of the conference, this report contains descriptions of some successful undergraduate research programs, data on NSF grants offered for this activity, devices for stimulating undergraduate research, case histories, some suitable topics, and a bibliography.

Finally, in any discussion of the need of attracting Jesuit graduates to the study of advanced mathematics, it is profitable in our day to recall with appropriate reaction a sentence once penned by a mathematician commending to a friend his Jesuit college program of three decades before: "I must grant this honor to my teachers and state that there is no place in the world where in my judgment [the course] is better taught." His name is signed to the letter: René Descartes.

WOODSTOCK COLLEGE

POLICY IN ADVANCED PLACEMENT: A SAMPLE-SURVEY

FRANCIS A. GREENE, S.J.

In view of the growing importance of advanced placement, a survey of essential policy in Jesuit colleges and universities should be of some interest to readers of the BULLETIN.

A brief questionnaire was sent to the science and mathematics departments of the twelve Jesuit colleges and universities represented in the Eastern States Division of the American Association of Jesuit Scientists. From the forty-eight questionnaires sent out, thirty-two replies were obtained, of which twenty-eight indicated some established policy. In the covering letter it was stated that failure to reply would be interpreted as disclaiming any policy, but in the recapitulation given below those departments that did not reply will simply be omitted.

Five departments indicated that they have sole or final responsibility in selecting students for advanced placement in the department, while the others make the selection in collaboration with the dean of freshmen. Ten said the sole norm for advanced placement is the College Entrance Examination Board (CEEB) examination, while the others use a different examination or additional norms. All departments using the CEEB examination in any way accept a score of three or higher, and one department (mathematics, Boston College) indicated that a score of two would be acceptable if other factors warranted it. All but five departments stated that a student granted advanced placement would start in freshman year the courses assigned to sophomore year in those departments. Twelve departments have advanced placement students from the class that entered in 1961. Twenty-one give information concerning advanced placement in their catalogs or at least in information sent to applicants.

A recapitulation of answers received is given below. The data for Boston College, biology department, as an example, should be read as follows: the norms used in judging a candidate for advanced placement in the department are the results of the CEEB advanced placement examination (in which a minimum of three must be obtained), along with other norms, namely, the recommendation of the dean and a special examination given by the department. A student who has been granted advanced placement does not take sophomore courses during his freshman year; he must attend freshman lab, but he is not held accountable for its requirements. There are no students from the 1961 entering class taking advanced placement in the biology department.

Biology

Boston College. CEEB with recommendation of dean and department examination. Students must attend freshman lab, but not held accountable. None this year.

Canisius College. CEEB alone. Sophomore course in first year. None this year.

Fairfield University. CEEB with total scholastic profile. Sophomore course, or special freshman course, in first year. Two this year.

Georgetown University. Department examination. Sophomore course or freshman honors program in first year. None this year.

Le Moyne College. CEEB with interview by department chairman. Student starts sophomore course, or second half of freshman course. None this year.

Loyola College. No advanced placement given.

Scranton University. No advanced placement given.

Chemistry

Canisius College. CEEB alone. Sophomore course in first year. None this year.

Fairfield University. ACS examination. Sophomore course in first year (usually). None this year.

Fordham University. No policy at present; advanced placement expected to begin in 1962–63.

Georgetown University. CEEB with recommendations. Sophomore course in first year. Six this year.

Holy Cross College. CEEB with investigation of high school performance (lab work, textbook). Sophomore course in first year. Two this year.

St. Joseph's College. CEEB with recommendations. Sophomore course, or special course, in first year. Two this year.

Le Moyne College. CEEB alone. Sophomore course in first year. None this year.

Scranton University. ACS examination. Student starts second semester of freshman year. Ten this year.

Wheeling College. College's own entrance examinations with recommendations of high school. Sophomore course in first year (if schedule can be arranged). None this year.

Physics

Canisius College. No advanced placement in general, since physics course begins in second year. (Only a very rare student could move into intermediate level courses in second year.)

Fordham University. CEEB with departmental recommendation. Sophomore course in first year. None this year.

Georgetown University. CEEB, sometimes with total record. Sophomore course, or freshman honors program, in first year. None this year.

St. Joseph's College. CEEB alone. Sophomore course in first year. None this year.

Le Moyne College. CEEB alone. Sophomore course in first year if qualified in mathematics also; or student takes special freshman course. None this year.

St. Peter's College. No policy.

Scranton University. No advanced placement, since physics course begins in second year.

Mathematics

Boston College. CEEB with recommendation of Office of Special Programs. Students take special course in first year, or sophomore course in some cases. Seven this year.

Canisius College. CEEB alone, in general; however, advanced placement may also be granted on the basis of courses completed and high school performance, plus achievement test score. Sophomore course in first year. One this year.

Fordham University. CEEB; special recommendations also considered. Sophomore course in first year. One this year.

Georgetown University. CEEB alone. Sophomore course in first year, or special freshman course. Six this year.

Holy Cross College. CEEB, with consideration of the amount of calculus taken in high school. Student sometimes takes freshman course and skips sophomore. Three this year.

St. Joseph's College. CEEB alone. Sophomore course in first year. Five this year.

Le Moyne College. CEEB alone. None this year.

St. Peter's College. CEEB with personal interview. Sophomore course in first year. One this year.

Scranton University. CEEB with recommendations. Student could start in second semester of sophomore year or beyond. None this year.

WOODSTOCK COLLEGE

REPORTS OF SCIENTIFIC ACTIVITY

High Schools

Boston College High School. The chemistry department has obtained a new Beckman pH meter for studies in equilibrium and hydrolysis. The same department plans to install a custom-built fume hood that can be used for lecture-demonstrations in front of the class. Capable of being raised or lowered by a pulley, this hood will allow demonstration experiments with the halogens and with volatile sulfur and nitrogen compounds to be carried out more safely.

Canisius High School. Canisius is one of seven private Catholic high schools in Buffalo jointly sponsoring the Bishop Burke Science Seminar. This seminar, now in its third year, is designed to stimulate interest in science among the better high school students in the Buffalo area. These students have an average IQ of about 135 and are about equally divided between boys and girls. Two-hour meetings are held each Tuesday evening. College professors, research scientists, medical doctors, and representatives from industry have all been most generous in freely donating their time to give the lectures.

Under the present arrangement, one lecturer gives a series of four to six weekly talks, based, if possible, on a book which the students may follow as a text. Fr. Frederick J. Reisert, S.J. will present a series of six lectures on modern physics, based on Max Born's *Restless Universe.*

Science Honors Program. Students in the first of the three-year science honors program have been using as a text *The World of Atoms* by J. J. G. McCue and K. W. Sherk. The book was written for a one-year course in physical science at the college level, but both students and teachers have found it most suitable for the present course. The authors, in introducing the student to chemistry and physics, have skillfully interwoven the experimental, logical and historical elements responsible for the development of these sciences.

In the final year of the science honors program laboratory work includes quantitative studies with alternating current (AC) circuits and vacuum tubes. For the AC circuit experiments vacuum-tube voltmeters are used to measure the effect of varying inductances and capacitances in the circuit. As part of the vacuum tube experiments characteristic curves are found for the diode and triode, as well as the amplification factor, the transconductance and the dynamic plate resistance.

Loyola High School. Students are currently working on projects for a science fair run by three members of the lay faculty, Messrs. Anderson, Muscari and Urbancic. One blind student is engaged on a physics project.

Fr. Francis J. Nash, S.J. conducts a physics seminar for five senior honor students, substituting the seminar for a final year of Latin. Having already completed a year of the PSSC course, they are using as a text Modern University Physics by Richards, Sears, Wehr and Zemansky. Concurrently they are taking calculus and chemistry.

Colleges and Universities

Boston College. Recently in Washington Fr. James W. Skehan, S.J., chairman of the department of geology, served as chairman of an NSF panel evaluating proposals for grants in support of undergraduate research. He has also been elected secretary-treasurer of the Boston Geological Society.

Geology. According to the latest available data, the department of geology with forty-six geology majors ranks as the second largest department east of the Mississippi, and the largest of the seven geology departments in Catholic universities in this country. Two of the more outstanding graduates, Peter J. Gielisse and Thomas J. Rockett, who received their M.S. degrees in 1958 and 1959 respectively, have recently received their Ph.D. degrees in geology at Ohio State University. The former is engaged in research at the Cambridge Research Laboratories of the United States Air Force and lectures in the Boston College geology department. The latter has been awarded an NSF postdoctoral fellowship for Harvard University during 1962–63. He was cited in *Geotimes*, the official journal of the American Geological Institute, as one of the most promising young geologists.

Continuing research in the Wachusett-Marlboro Tunnel by Fr. Skehan and his students suggests that the volcanic flows and other volcanics were derived from a series of volcanoes stretching from Hingham and Westwood through Weston and Wakefield to Salem and Newburyport. Evidence for such a suggestion has been investigated in the Salem-Newburyport and southeastern New Hampshire areas. Fr. Skehan and faculty members from Harvard have visited areas in eastern Connecticut where the strata are considered to have been formed contemporaneously with those of the tunnel.

The department of geology was the recipient of a gift of $1000 from the Educational Aid Division of the Gulf Oil Company. The money was used in the purchase of microscopes.

Georgetown University. The staffs of both the observatory and the physics department have been bolstered by new members in the past year.

Observatory. Fr. Martin F. McCarthy, S.J. (*N.E.*), on leave from the Vatican Observatory, has been actively engaged in various projects at the Georgetown Observatory, from which he received his doctorate in 1951. He has assisted Fr. Francis J. Heyden, S.J., director of the observatory, in giving lectures, has helped in the translation of a Russian monograph concerning the moon, and has organized a series of monthly lectures for the Astronomical Colloquium. The latter has been sponsored by Georgetown over a period of years for astronomers in the Washington area. Fr. McCarthy's experience in initiating studies in photoelectric photometry at the Vatican Observatory has been most helpful in setting up a similar program at Georgetown. A photoelectric photometer has been mounted on the twelve-inch refracting telescope for four-color photometry of stars in selected regions of the sky.

Fr. Richard Ingram, S.J. (*Ireland*), who received his doctorate in mathematics at Johns Hopkins University, has been teaching the graduate course in celestial mechanics, in addition to lecturing in the mathematics department.

Fr. Richard Miller, S.J. (*N.Y-Phil.*) taught the first semester of the graduate course in practical astronomy. Fr. Miller received his doctorate in physics from Fordham University and will be conducting solar research at the Manila Observatory on his return to the Philippines.

Other new staff members are Dr. Sidney Reed of the Office of Naval Research (ONR), who is teaching astrophysics, and Dr. Wilson of the National Astronautics and Space Administration (NASA), who is teaching the second semester of the practical astronomy course.

Current research by the faculty and graduate students includes such topics as the determination of satellite orbits, the composition of the Martian atmosphere, the solar spectrum in the near infrared, stellar motions, and comparative spectrophotometry of the moon's surface.

Mr. Gennatt is investigating a new method for determining satellite orbits. Most present methods use four or five pictures per pass to determine the orbit. This investigation, however, employs a theodolite with 35 mm. motion picture film on which up to 200 pictures per pass of the Echo I satellite have been recorded. Altitude, azimuth and time are automatically recorded on each frame of the film. Corrections to the altitude and azimuth will be made by observations of standard stars. From the time rate of change of altitude and azimuth the orbital elements can be determined.

Mr. Brian O'Leary is conducting experiments on a simulated Martian atmosphere. Spectroscopic studies of the Martian atmosphere by Dr. C. C. Kiess of the observatory staff have shown that the absorption in the ultraviolet region is quite similar to that expected from a mixture of nitrogen tetroxide and nitrogen dioxide (N_2O_4 and NO_2). With the help of the chemistry department Mr. O'Leary is preparing samples of such a mixture at various temperatures and pressures, and passing sunlight through each sample. Spectra of this light as a function of temperature and pressure should prove of interest in the analysis of the observed spectra of Mars.

Mr. Varkey Kallarakal is studying the faint lines in the near infrared region of the solar spectrum (7000 to 8000 Å). In order to separate faint terrestial atmospheric lines from true solar lines, photometric tracings have been made of plates taken near the horizon. These tracings will be compared with observations made near the meridian at Jungfrau, Switzerland. Those lines which are enhanced on the plates taken near the horizon are due to the earth's atmosphere. From the data of this study it is hoped that new energy levels may be determined for water vapor in the earth's atmosphere.

Dr. Vera Cooper Rubin and her graduate class in stellar dynamics are conducting an interesting investigation in stellar motions. The group is attempting to see if there is any correlation between the radial velocities of early-type stars and the motions of hydrogen clouds near the plane of the galaxy. The former velocities are determined by optical methods (Doppler shifts) and the latter by the methods of radio astronomy. It has been known for a long time that these early-type stars are closely associated with the hydrogen gas in the galactic plane, having presumably contracted out of this interstellar material. Since they are young stars one would expect them still to have a dynamical association with the interstellar hydrogen from which they were born.

Mr. George Coyne, S.J. (*Md.*) is continuing work in comparative spectrophotometry of the lunar surface. Within the past few years Soviet and French astronomers have debated whether there exist color contrasts on the lunar surface and if so whether they are observable. Publications in recent Russian journals indicate that there definitely are color contrasts. Mr. Coyne is taking spectra of individual regions on the lunar surface with the 15,000 lines-per-inch Gale grating. Measurements will be made on these plates to determine the spectral distribution of energy for the various regions. Very strict controls must be placed on the photographic procedures so that the photometry may be exact enough to reveal small differences in the spectral distribution of intensity for various regions. Data from this investigation should help astronomers in determining the chemical constitution of the lunar surface.

Physics. Dr. Edward M. Corson has been appointed professor of physics. Besides serving with the Manhattan Project, Dr. Corson was a member of the Princeton Institute for Advanced Study, a Fulbright Exchange Professor at the University of Edinburgh, senior scientist at the New York

University Institute of Mathematical Sciences, and professor of mathematical physics at the University of Delaware.

Coming to Georgetown as assistant professor of physics is Dr. Misri L. Vatsia, formerly chairman of the department of physics at the Inter-American University in Puerto Rico.

Four physics majors are among last year's graduating class pursuing further studies: Louis Clavelli (NSF fellow at the University of Chicago), John Corbin (teaching assistant at the University of Maryland), Klaus Fritsch (research assistant at MIT), and William Gregory (university fellow at Purdue University).

Holy Cross College. The chemistry and mathematics departments have each announced the publication of a book by a staff member.

Chemistry. Dr. Andrew Van Hook, professor of chemistry, is the author of *Crystallization: Theory and Practice,* ACS Monograph No. 152 (Reinhold, 1961). The publisher describes the work:

> The beauty of crystals has always fascinated man. While their perfection and form are completely described and catalogued, it is only during recent years that any great attention has been given to the theoretical and practical aspects of crystallization. This thoroughgoing reference work emphasizes the recent theories of crystal growth. It discusses the principal processes, presents representative data on nucleation and growth, and describes the primary industries employing this unit operation. The author presents the basic ideas important for an effective appreciation of the subject matter, and includes an historical sketch of crystallization. Recent advances are well covered, and the leading references on each topic are listed.
>
> Research workers, chemical engineers, and solid state scientists—in fact, everyone interested in this rapidly developing field—will find this volume an indispensable reference source.

Now in his sixteenth year of teaching physical chemistry at Holy Cross, Dr. Van Hook has been working for a number of years on this monograph commissioned by the ACS. He has long been interested in sugar crystallization and has published widely in that field. The present work is more extensive, covering the whole field of crystallization.

The most recent survey of graduates who majored in chemistry during the years 1956 to 1960, inclusive, shows that there were twenty-one who received the Ph.D. degree and fifteen the M.S. degree. Details on these graduates are available from Fr. Bernard A. Fiekers, S.J., chairman of the chemistry department.

Mathematics. Dr. V. O. McBrien has recently published a mathematics text for students in the behavioral and biological sciences: *Introductory Analysis,* (Appleton-Century-Crofts, 1961).

Holy Cross is one of eighteen colleges and universities in the country sponsoring an NSF Undergraduate Research Participation Program in mathematics. Students in the program are investigating topological methods used in algebraic geometry.

The mathematics department is conducting its fourth consecutive NSF-sponsored In-Service Institute for secondary school teachers. The institute, held on Saturday mornings, introduces about sixty teachers to the background and content of the experimental SMSG texts.

St. Joseph's College. The physics department recently tabulated the results of a questionnaire sent to alumni who had graduated as physics majors in the years 1952 to 1961, inclusive. Based on a sixty-five per cent response, the following information was obtained: three doctorates and eleven master's degrees have been awarded; eighty-six alumni are presently pursuing further studies, of whom nineteen are full-time students and fourteen are candidates for the Ph.D. degree.

F. W. Carroll, '54, (Ph.D., Purdue University, 1959) is now assistant professor of mathematics at Ohio State University. He had been an NSF fellow and a Fulbright scholar. J. P. Martin, '54, (Ph.D., University of Pittsburgh, 1959) is now with the Research Institute for Advanced Study (RIAS) in Baltimore, after spending two years at the Brookhaven National Laboratories. J. P. Waldron, '55, (Ph.D., University of Notre Dame, 1961) is now a member of the faculty at St. Joseph's.

Among the candidiates for the Ph.D. three alumni are NSF fellows: I. G. McWilliams (MIT); J. C. McGroddy (University of Maryland); and T. V. Hynes (St. Louis University).

The part-time students are working towards degrees at such local schools as the University of Pennsylvania, Drexel Institute of Technology, Villanova University and Temple University, as well as at Brooklyn Polytechnic Institute, the University of Wisconsin, Penn State University and Marquette University. The tendency of many alumni to work during and after their studies at such companies as Philco, RCA, and other electronics firms reflects the interest developed during the five-year physics-electronics cooperative program that St. Joseph's conducts with these companies.

More information on this questionnaire and the alumni involved can be obtained from Fr. John S. O'Conor, S.J., chairman of the department of physics at St. Joseph's.

St. Peter's College. A subcritical reactor is currently in operation at St. Peter's. The reactor is located in a new nuclear physics laboratory which has been equipped at a total cost of $35,000. College funds were matched by grants from the AEC and local industry. The reactor will be used primarily as a teaching device and has been designed so that it cannot go critical at any time.

It contains two and one-half tons of natural uranium that has been loaned to St. Peter's by the AEC, and an eighty-gram plutonium-beryllium neutron source that triggers and sustains the chain reaction. The fissionable material is immersed in five hundred gallons of de-ionized water which acts as a moderator to slow down the neutrons so that they may be absorbed by the uranium nuclei.

The reactor is quite flexible allowing for different configurations of the uranium rods in the grids or lattices so that the reactions and neutron fluxes can be measured under a wide variety of groupings and spacings.

The new laboratory also has a neutron howitzer which, when not used for experimental work by the undergraduates, will serve as a safe storage place for the neutron source. The laboratory is equipped with all the instrumentation necessary for a complete course in nuclear and reactor physics. Adequate precautions for the protection of personnel have been taken. These include alarms for excessive radiation and dosimeters and badges that will be used by all personnel permitted in the area.

Professor Cornelius Galvin, chairman of the physics department, designed the laboratory and will be in charge of its operation. He is a graduate of the National University of Ireland and the Imperial College of Science and Technology, London University.

Wheeling College. For the second year the chemistry department is providing two special educational programs for the Ohio Valley area: the "Wheeling College Science Workshop" and "Chemistry for Industry." Both programs are free and open to all interested persons.

The first program, a series of science teachers' workshops, is supported by an NSF grant. It is an outgrowth of a series of science conferences for teachers begun by the chemistry department in 1956 and continued through the spring of 1960. The workshops, planned specifically for high school teachers, are held on the second Saturday of each month and run from 10:00 A.M. to 3:00 P.M., excluding a lunch hour. Each topic is reviewed briefly and then brought up to date with the latest developments.

The chairmen and their topics for this year's series include:

Dr. Henry S. Frank, chairman of the chemistry department, University of Pittsburgh, (*Solutions*).

Dr. Robert L. Grob, associate professor of chemistry, Wheeling College, (*Oxidation-Reduction*).

Dr. Laurence E. Strong, chairman of the chemistry department, Earlham College, (*Equilibrium*).

Dr. Leallyn Clapp, professor of chemistry, Brown University, (*Acids-Bases-Salts*).

Dr. John A. Timm, chairman of the division of science and director of the school of science, Simmons College, (*Electrochemistry*).

Dr. Frederick D. Rossini, dean of the college of science and associate dean of the graduate school, University of Notre Dame, (*Energy and chemical change*).

Dr. John F. Baxter, head of the division of general chemistry, University of Florida, (*Complex ions*).

The second program, "Chemistry for Industry," was a series of bimonthly lectures for chemists and engineers of the area, and it ran from October 18 to December 13. Its purpose was to provide an opportunity for this group to express their professional interests and to add to their professional knowledge. Five local industries, in cooperation with the chemistry department at Wheeling College, sponsored the program.

Scholasticates

Weston College. Mr. Donald Plocke, S.J. addressed the Mendel Club and Biology Graduate Colloquium of Boston College on "Alkaline phosphatase of *E. coli*; a zinc metalloenzyme," the subject of his doctoral dissertation submitted to the department of biology at MIT this past June. A brief description of the work follows:

> Spectrochemical data demonstrated the purified bacterial enzyme contained about two gram atoms of zinc per mole of enzyme. The zinc content rises in parallel with specific activity during purification of the enzyme, while the sum of all other metals falls to a relatively low value in the purified product. Inhibition of enzymatic activity by metal-binding agents indicated a functional role for zinc; this was confirmed by the preparation of a zinc-free apoenzyme which was devoid of activity, but in which activity could be immediately restored to the initial level on addition of stoichiometric amounts of zinc ions. The apoenzyme was shown to have high affinity and specificity for zinc ions; the implications of this were discussed.

Symposium on problems of life. At the semi-annual philosophical disputations in November the second-year philosophers conducted a symposium on "Problems of life" under the direction of Fr. Daniel Shine, S.J. The main purpose of the symposium was to present a few of the findings of modern biology and to show that they raise some difficulties for the philosophical explanation of life. The three-man panel of speakers stressed that the philosopher cannot simply assert that the discoveries of science do not contradict his *philosophia perennis*. Rather, he must enter into dialogue with the scientist, find out just what the scientist has learned by his investigations, and then carefully think his philosophical theories through once again in the light of the new discoveries.

Mr. R. Paul Carroll, S.J. spoke on "Deoxyribonucleic acid and life." His paper included: (1) a brief historical sketch of the developments in genetics leading to the discovery of deoxyribonucleic acid (DNA); (2) a technical description of the DNA molecule itself, including the current theoretical conceptions of DNA functioning as the master plan and director of cell operations; and (3) a review of the part played by DNA in our understanding of evolution and of the nature of life.

Mr. Kevin G. O'Connell, S.J. followed with a discussion of "Viruses and life." In his talk, he described briefly the various types of viruses and gave a more detailed description of the bacteriophage virus of the strain T2, including an account of its manner of invading a bacterial cell, its process of replication, and the phenomenon on transduction. Mr. O'Connell also called attention to some of the more obvious problems that the virus raises for traditional scholastic theories on the origin and nature of life.

Mr. André B. Charbonneau, S.J. considered the "Possibility of the synthesis of a living being from non-living matter." He sketched briefly various modern scholastic theories that have attempted to take into account the discoveries of science in this area.

Science Colloquium. Fr. Daniel Linehan, S.J., director of the Weston Observatory, inaugurated the Science Colloquium lectures for 1961–62 with an illustrated talk on the UNESCO mission to Southeast Asia. The mission conducted a survey of seismology and volcanology in the Philippines, New Zealand, Australia, India, Indonesia, Thailand, Burma, Laos, Hong Kong and Japan. Fr. Linehan, along with two other United States delegates, were members of an international team in charge of the survey.

Professor James A. Fay, of the department of mechanical engineering at MIT, discussed the second law of thermodynamics at the next meeting of the colloquium. The historical and scientific aspects of the law were first presented, and then the implications of the law for life processes, information theory and modern cosmological theories were discussed.

Fr. William A. Wallace, O.P., professor of philosophy at the Dominican scholasticate in Dover, Massachusetts, delivered a lecture on "Natural philosophy and the physical sciences" at the third meeting of the colloquium. He stressed the complementary roles of these disciplines and the mutual problems that bind them together. The philosophy of nature is not dependent on positive science for its initial formulation and its basic laws. Yet, it cannot get beyond vague generalities without an explicit use of scientific knowledge. Science, in its turn, has generated philosophical problems which cannot be solved within the framework of science. Such problems of current concern as the nature of scientific explanation and of physical laws, causality, and induction are now generally recognized as metascientific. In lieu of a developed synthesis integrating these disciplines, the most fruitful approach to unification is "bridge-building." Problems of mutual concern are now strands linking these fields. A careful study of such problems could expand this middle ground until it joined both disciplines.

This talk was generally well received, especially because of Fr. Wallace's extensive knowledge of both current thought and traditional philosophy. A few, however, had some reservations concerning the Arisotelian idea of science that was reflected, though never stressed.

(For an excellent discussion of the historical antecedents of the present-day problem of relating science with philosophy (and theology), see: Edward MacKinnon, S.J., "Motion, Mechanics and Theology," *Thought* 36 (Autumn, 1961), 344–70. Fr. MacKinnon is in his fourth year of theology at Weston.)

Graduate Studies and Research

Fordham University. Fr. Richard T. Cronin, S.J. (*Upper Can.*) is doing research in population genetics with drosophila from Texas, Bermuda and Mexico. His dissertation, "A biometric comparison of an insular population with a continental population of *Drosophila melanogaster* with special reference to apterygousness," may be summarized as follows:

> Since Darwin's time it has been known that an apterous or reduced wing length condition in an island population is advantageous under the competition of natural selection. This fact was established experimentally by P. l'Héritier *et al.* in 1937 by artificially mixing populations of normal and vestigial-winged *Drosophila melanogaster* under laboratory conditions.
>
> The purpose of the present investigation is to take a new approach to the problem and compare two natural populations, one of which is insular and the other continental, but from the same approximate latitude. McGann in 1959, working with insular and continental populations demonstrated a difference in wing length between them, but did not take into account the effect of latitude. This effect may not be negligible, as shown by the studies of Prevosti in 1955, working with continental populations of *Drosophila pseudoobscura* native to different latitudes.
>
> Preliminary investigations in the present study have shown a significant difference in wing length between the selected populations. It is desired first to establish such a difference definitely, and then to investigate the degree of selection pressure upon the apterygous character by making population "hybrids" between these stocks. The expected heterosis should appear with much greater emphasis for this character than for some indifferent character, such as tibia length.

Mr. Ramon Salomone, S.J. (*N.Y.*), working in organic chemistry at Fordham, is investigating the mechanism for the toxicity of the insecticide prolan. An abstract of his dissertation, "Synthesis and metabolic studies of isotopically-labeled prolan derivatives," is given below:

> It has been shown at Fordham that ortho-chloro-DDT [2-(p-chlorophenyl)-2-(2′,4′-dichlorophenyl)-1,1,1-tricholorethane] is markedly more toxic to both susceptible and resistant strains of *Musca domestica*. Also, in a series of ortho-halogenated DDT derivatives [2-(p-chlorophenyl)-2-(2′-X,-4′-chlorophenyl)-1,1,1-trichloroethane, where X = halogen], the following relative toxicities towards

resistant strains of *Musca domestica* were observed: F < Cl < Br > I, with ortho-bromo-DDT being by far the most toxic. The increased toxicity was attributed to the steric inhibition of some detoxification mechanism operative at the tertiary carbon by the bulky ortho-halogen substituents.

Similar studies were then undertaken on a related insecticide, Prolan, [1,1-bis-(p-chlorophenyl)-2-nitropropane], to see if the same differences in toxicity were apparent. A series of seven Prolan analogs, varying in the relative positions of one or more Cl atom on each ring, was prepared and tested for relative toxicity.

To test the tertiary C—H bond as a possible site for detoxification, the 1-deuterium substituted Prolan, [1,1-bis-(p-chlorophenyl)-1-d-2-nitropropane], was also prepared. A positive isotope effect in the form of increased toxicity would support the view that some detoxification mechanism is initiated at the tertiary carbon.

Prolan analogs individually labeled with carbon-14 at the 1, 2 and 3 positions of the propane part of the molecule are now being synthesized in order better to trace and characterize the metabolites of the detoxification of the insecticide in *Musca domestica*. The actual testing of the various insecticides against the insects is being carried out at the Communicable Disease Center, Technical Development Laboratories, Savannah, Georgia, a branch of the United States Department of Health, Education and Welfare.

University of Pennsylvania. Mr. Roger C. Phillips, S.J. (*N.E.*), seeking a doctorate in physical biochemistry, has begun research on his dissertation, "The free energy of hydrolysis of adenosine triphosphate (ATP)." The aims of the research may be described as follows:

> The free energy of hydrolysis of ATP is to a large extent due to the differences in the ionization of the ATP and its hydrolysis products. A quantitative, theoretical treatment of this effect requires a knowledge of the K_a, $\Delta F°$, $\Delta H°$, and $\Delta S°$ for each of the ionizations involved. These quantities are being determined by potentiometric titrations of ATP, ADP, AMP (the di- and monophosphate analogs of ATP), and the phosphorus acids at different ionic strengths and temperatures.

Weston Observatory. Last August two familiar seismometers were retired from service at the observatory to make room for new instruments. For years these old-timers, the Wiechert and the Bosch-Omori seismometers, served as low magnification visible recording seismographs, and as demonstration units for visitors.

The new instruments are a consequence of Weston's being selected by the United States Coast and Geodetic Survey as one of the stations in their world-wide seismic system. This system, a portion of the Vela-Uniform program, is designed to provide uniform seismic data from uniform instrumentation in over 130 seismic stations throughout the world. Each station is to be equipped with three Sprengnether long-period seismometers and three Benioff-Geotech short-period seismometers together with recording equipment and power console. The power console is to contain a radio receiver, crystal clock, electrical calibration module, batteries to operate the system and a battery charger.

Installation by government personnel was completed at Weston in mid-November, and full-scale operation resumed by the observatory. At present the Weston Observatory processes four sets of seismic records each day for permanent reference. The Coast and Geodetic Survey instruments produce two sets of three records each, so that one set indicates short-period vibrations of the earth (0.1 sec. to 10 sec.), while the other indicates long-period oscillations (10 sec. to 200 sec.). More rapid disturbances, and some of the intermediate period, detected by a Benioff-Henson system, are recorded as two other sets of seismograms. Fr. Francis Donohoe, S.J. directs the recording operations at the observatory.

In an attempt to learn about the seismic activity blanketed by seismic background noise, Mr. David Clarke, S.J. (*Ore.*) and Mr. Joseph Pomeroy, S.J. (*N.E.*) are investigating seismic noise filtering techniques. Currently, a long-period seismometer signal is being amplified by a Hewlett Packard 425 DC microvoltmeter, filtered through a Krohn-Hite 330-A ultralow frequency band-pass filter, and the signal written out by means of an Esterline-Angers recorder. The period range used at this time is ten to fifty seconds. Surface waves from earth shocks show up well on this experimental system, even in the presence of heavy microseismic background. This is one of several projects in seismic system design currently being investigated at the Weston Observatory under the direction of Fr. Daniel Linehan, S.J.

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