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REPORT ON THE CONFERENCE

on

PREDOCTORAL EDUCATION IN THE UNITED STATES

Woods Hole Summer Studies Center
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INTRODUCTION

This informal report attempts to capture the discussion at the Conference on Predoctoral Education in the United States and to share it with a larger group than could attend the conference.

The conference met at Woods Hole on August 24-27, 1969 in an atmosphere of deep concern, if not one of crisis. The months immediately preceding it had brought disturbing reports of trends and actions affecting the stability of graduate education in this country. Reductions in the Federal support of advanced education and academic science were beginning to press hard on the universities, and the outlook for the immediate future promised little relief. Fiscal Year 1969, which had witnessed the granting of the largest number of Ph.D.'s in the nation's history, had closed amid reports from placement officers, prospective employers, and doctorate recipients themselves that jobs in some fields of specialization were becoming increasingly scarce. The development of what some viewed as an oversupply of Ph.D.'s was accompanied by complaints from certain sectors of employment that Ph.D.'s were overspecialized, overpriced, and undermotivated. Finally, student unrest and dissatisfaction with many aspects of education, the claims of militant minority groups, and distrust of the rational approach to problems, which were active on many campuses at the undergraduate level, were beginning to spill over into graduate education. The underlying problems of which these were symptoms were complex, persistent, and intertwined. The storm signals were flying.

Thirty-nine representatives of graduate education and other sectors of higher education, industry, government, private foundations, and associations were invited to the Woods Hole Summer Studies Center under the auspices of the National Academy of Sciences to consider these problems and make recommendations for needed action. By way of preparation, each participant received a source book of information about graduate education -- data and excerpts from relevant reports, compiled by Wayne C. Hall -- before the conference. They also received copies of background papers by Gustave O. Arlt and Wayne Hall, which provided helpful perspective and are included in this report. The proposed program for the conference called for discussion -- in general sessions and small-group meetings -- of about a dozen key questions concerning graduate education.

With Philip Handler, Herbert Carter, and Max Tischler serving as co-chairmen, the members of the conference had three days of lively discussion. A group of this eminence could not be expected to limit themselves to the posed questions and, as the notes in this report indicate, they did not. They were impressively responsive, however, to the concerns that brought them to Woods Hole. The notes contain a wide range of observations, comments, and evaluations that penetrate deeply into the problems of graduate education.

At the end of their deliberations, the conference group asked to be sent the notes of the meeting and to be allowed to reflect upon what had been said before taking final action on recommendations. They asked, however, that the staff attempt to summarize some of the principal suggestions for action and submit this to them for individual comment and possibly for endorsement. Both of these requests were met before the end of September, and queries, corrections, comments, and suggestions were subsequently provided by the members of the conference. Although not all had replied by the date of this report, the consensus seemed to be favorable toward implementing the outline of suggested action included in this report. Exploration of the possibilities of doing so is now going on.

The purpose of giving this report a limited distribution outside the conference group is to acquaint other interested persons with the discussion at the meeting and to encourage a wider expression of views concerning ways to strengthen graduate education in this country -- including the views of those who are not themselves members of the academic community. Comments or suggestions from readers of the report will be welcomed by the undersigned.

Financial support was made available for the conference by the Carnegie Corporation of New York and by the National Academy of Sciences. Staff support was provided by members of the staff of the Office of Scientific Personnel and the Woods Hole Summer Studies Center. Several of the organizations represented at the conference provided travel funds for their representatives. To all of these -- and especially to the participants in the conference -- are due sincerest thanks.

William C. Kelly, Director
Office of Scientific Personnel

December 1, 1969

REVIEW OF GRADUATE EDUCATION AND EFFORTS TO IMPROVE IT

Gustave O. Arlt
President, Council of Graduate Schools in the United States

In a faculty meeting a good many years ago, I saw a prominent professor rise to his feet and make the pronouncement that nothing that happened before the year 1900 had any significance for the contemporary world and should therefore be excluded from a college curriculum. If I subscribed to this gentleman's philosophy---although he later became a college president---I would find it unnecessary and even inappropriate to begin this review of the history of graduate education at its beginning. Before this informed and sophisticated audience, it may indeed be redundant but certainly neither unnecessary nor inappropriate. For the problems that vex us today, the ills of which we complain, are not the symptoms of gerontomorphosis, not the syndrome of senescence---they are congenital. They were hatched with the embryo and were born with it. They were recognized and discussed and debated a century ago, even before the formal establishment of the first graduate school. What we do here tonight and in the days to come is in the best, time-honored tradition of our antecedents. And much that we will say tomorrow and in the following days has been said by George Ticknor and Edward Everett and Daniel Coit Gilman and William Rainey Harper.

American higher education, as everyone well knows, is the offspring of the uneasy marriage of the British liberal arts college and the German university. From the former it inherited the aristocratic, Graeco-Roman classical tradition with its emphasis on formal teaching, strict preceptorship, and rote learning. Its character is well described by a Revered Thomas Bray in 1697 who wrote: "Its design seems more immediately directed to the service of the clergy, yet gentlemen, physicians, and lawyers will perceive they are not neglected in it. And indeed, those persons of quality, whose eldest sons, being commonly brought up to no employment, have a great deal of time lying upon their hands, seem to me to be as nearly concerned as any to favor it." The importation from the German university brought freedom of thought, learning, and inquiry, emancipation from formal teaching, scientific and philological approach to research, scholarly thoroughness---in short, the ingredients of professionalism. The antithetical character of the two educational philosophies and systems is at once apparent. They are, if not actually diametrically opposite, at least incompatible within a single structure. Here, long before the establishment of the first graduate school, even before the initiation of any graduate work, lie the beginnings of the never-ending controversies---learning versus teaching, research versus preservation of knowledge, professionalism versus liberal education, and, to use a horrid modern term, contemporary relevance versus academic traditionalism.

About the year 1825 George Ticknor, Edward Everett, George Bancroft, and Joseph Green Cogswell returned from Göttingen to Harvard full of enthusiastic plans for curricular reform. Their chief recommendations stressed the need

for persons with "advanced," that is, graduate, education. They provoked a great deal of animated discussion, much of it favorable to drastic reforms, liberalizing the classics-based curriculum, expanding existing universities ---but no action. Even the modest proposal to establish an advanced seminar ---then called "seminary"---at Harvard failed. The conservative forces in the New England colleges rallied in support of tradition and in 1828 the Yale faculty issued its famous apodeictic report defending the "dead languages" as the wellspring of all learning, recognizing the need for improvement in various areas but placing the greatest emphasis on "the discipline and furniture of the mind." Since Yale provided so many presidents and teachers for the new colleges in the South and West, the Yale Report was instrumental in delaying curriculum reform for at least thirty years. Of the approximately seventy-five colleges in existence before 1840, thirty-six had presidents from Yale, twenty-two from Princeton, and eight from Harvard.

It remained for Thomas Jefferson---a product of neither New England nor Germany---to effect the first significant reforms. As a member of the Board of Visitors of the College of William and Mary, he established professorships of law and police, anatomy, medicine, and chemistry, and modern foreign languages. Of equal importance were provisions abolishing Greek and Latin as entrance requirements, permitting students to elect courses, and making the time required for a degree dependent on the student's qualifications. These drastic changes put William and Mary almost a century ahead of the time and presaged the even more liberal innovations at the University of Virginia in 1825.

Jefferson envisaged Virginia as a graduate university combining training in many practical fields, including commerce, manufacturing, and diplomacy, with an intellectual orientation of university breadth and depth.

The years from 1825 to 1860 can only be characterized as a period of high aspirations and tragic failures. Harvard and Princeton had a few "resident graduates" before 1830, but President Edward Everett's efforts to launch graduate programs at Harvard in the 1840's were frustrated by the Corporation's indecision and the irreconcilable division of his faculty. Extensive plans for graduate education at New York University, Columbia, Union College, and the University of Pennsylvania failed completely. Most promising and therefore most tragic was the case of the University of Michigan. President Henry B. Tappan, a graduate of Union College and a visitor at many German universities, arrived at Ann Arbor in 1852 with grand plans for the establishment of a comprehensive graduate school. He gained the rather full support of his faculty and the half-hearted acquiescence of the Regents and by the late 1850's he had a small but flourishing graduate program under way. His efforts to reorganize the entire educational system of the State of Michigan, however, incurred the anger of politicians and the Detroit newspapers and in 1863 the Regents discharged him as being too "Eastern" and too "Prussian" for this frontier state. With his departure the promising young program collapsed.

I call the period from 1861 to 1876 the Years of Ferment. The dates are self-explanatory: 1861 marks the award of the first three Ph.D. degrees at Yale and 1876 the establishment of the first graduate school at Johns Hopkins. A good many things happened in these fifteen years that were to

have lasting effects---for good or for ill---upon graduate education. Let us examine, first of all, the document which led to the establishment of a Ph.D. program at Yale by action of the Corporation on July 24, 1860. It originated not in the general faculty of the University but in the faculty of the newly founded Sheffield Scientific School. This fact significantly emphasizes the continuing academic schism between the British classical tradition and the German ideal of scientific research. The Memorial from the Sheffield faculty proposed that "in accordance with the usage of German universities the degree of Doctor of Philosophy be conferred on those students who successfully pursued a higher course of scientific study." It added, however, that "in accordance with the practices of foreign universities, this same degree may hereafter with propriety be conferred for high attainments in Mathematics or Philology or such other branches as may be taught in the Department of Philosophy or the Arts." With this language Yale University cemented the Ph.D. into place as the capstone of American higher education, if not forever, at least for more than a century. It settled two questions---that graduate work would be validated by a degree and that this degree would be the Ph.D. in all fields.

The Memorial also established three other lasting characteristics of Ph.D. programs. It provided that "this degree be conferred on students of the Scientific School on the following conditions:

"1. That they shall have pursued their studies for the year next preceding their examination for the Degree in this Institution.

"2. That they shall have passed a satisfactory examination in all of the studies in the above-named scientific course.

"3. That they shall present a written thesis which shall be approved by the Faculty giving the results of an original chemical or physical investigation."

These requirements---residence, comprehensive examinations, and an original thesis---these three pillars of graduate study stand to this day, although they are beginning to show signs of erosion.

The battles that rocked the Yale faculty before 1861 were fought all over again in a dozen universities over the next fifteen years. Most of them established graduate programs of some sort but only three awarded earned Ph.D.'s before 1876---Pennsylvania in 1871, Harvard in 1873, and Columbia in 1875. What these pioneers chiefly lacked was an organizational pattern in which graduate education could flourish. The undergraduate colleges with their long-established tradition and conservative faculty resisted the superimposition of an amorphous body of teachers and students engaged in an enterprise that was foreign to them. It was the lack of an appropriate organization within the university, more than anything else, that retarded the more rapid acceptance of graduate work. For the many older established colleges of our own time who are moving into the graduate area, there are valuable lessons to be learned here.

Finally, in 1876 Johns Hopkins led the way to a new pattern by establishing the first strictly graduate school. The level of scholarship, the emphasis on the freedom of research and teaching, the excellence of the doctoral programs were soon copied by other universities, both older ones and those newly founded. Clark University and the University of Chicago boldly followed the example of Johns Hopkins in organizing a strictly graduate environment. Graduate work began to take root in half a dozen strong private colleges in the East and an equal number of state universities in the Mid-West and Far-West. The development was not easy. In the established institutions it took years to overcome faculty resistance to the spending of university funds on such luxuries as research libraries and laboratories. In the three new institutions, Johns Hopkins, Clark, and Chicago, the inspired vision of a strictly graduate university soon faded before the fiscal realities, and they had to add undergraduate colleges. It might be added that more recent efforts in the same direction also failed. One of the newer examples is the University of California at San Diego, which was planned as a graduate school of science and engineering, but which began to add undergraduate colleges after only two years. The one successful exception is the Rockefeller University, and it owes its success to its exceptional character and circumstances---small size, restricted field, and ample funds.

By the year 1900 the problems that had existed from the beginning and that plague us in aggravated form today had become so acute as to necessitate some kind of concerted action. The preeminence, then as now, of the natural sciences was a source of irritation to the humanists and the social scientists. They had already forgotten that the graduate school was created under pressure of the sciences, and they ignored the fact that they lived in an increasingly scientific and technological age. Then as now, the endless controversy over the relative emphasis on teaching and research divided the academic community and erupted into the Battle of the Giants---Daniel Coit Gilman, who insisted that the preparation of college teachers was the primary task of the graduate school, and William Rainey Harper, who announced that promotion would depend "more largely" on research productivity than on teaching. Then as now, the question of the university's responsibility for "service to the community" was debated and again it was Harper who said in 1895, "the most marked characteristic in the development of university life has been the adaptation of its methods and training to the practical problems of the age in which we live"---a remarkable statement, coming from a man whose doctoral dissertation was "A Comparative Study of the Prepositions in Latin, Greek, Sanskrit, and Gothic." Most ominous, however, to the hegemony of the prestige institutions was the rapid and uncontrolled rise of a large number of new competitors in the graduate area. In 1900, fourteen universities awarded 88 percent of all doctorates, but already thirty-seven others were engaged in doctoral programs, and almost 150 were actively preparing to enter the field.

To meet these emergencies, the Presidents of the Big Five---Harvard, Columbia, Johns Hopkins, Chicago, and California---invited the Presidents of the slightly Less Big Nine to join them in the establishment of The Association of American Universities. While the name of the organization probably sounded less arrogant in 1900 than it would today, it clearly gave notice that the established institutions were prepared to consolidate and defend their position of leadership. The invitation to the organizational meeting stated:

> "The deliberations of such a conference will (1) result in greater uniformity of the conditions under which students may become candidates for higher degrees in American universities, thereby solving the problem of migration; (2) raise the opinion entertained abroad of our own Doctor's degree; (3) raise the standard of our own weaker institutions."

Growing slowly from fourteen universities in 1900 to thirty-nine in 1940, deliberately maintaining its exclusiveness, representative of no constituency except its own elite membership, the Association of American Universities was the most potent guardian of the values and practices of graduate education until the Second World War. It became the natural forum for the unending debate that began a hundred years ago and continues to this day. It repeatedly rejected proposals to accredit graduate work, generally by a very narrow margin, but for many years it maintained an "approved" list of undergraduate colleges. It deliberated at great length---but never established---minimum standards for graduate schools. In 1927 and again in 1935 it proposed "comprehensive inquiries into the present state" of graduate education, but funds for the studies could not be found. In 1902 it debated whether the Master's degree should be regarded as terminal or as a prerequisite for the doctorate and in 1910 it conducted a survey of the "meaning" of the M.A. From 1925 to 1929 the Association of American Colleges conducted a careful inquiry into the training of college teachers in graduate schools and brought out a series of mild but sound recommendations. The AAC gave the report its hearty approval, but the AAU appointed a committee "to look into the matter."

A cynical appraisal that the Association of American Universities really never accomplished anything would nevertheless be unfair. It certainly protected to the best of its ability the integrity of the Ph.D. degree both by precept and example. It actively discouraged the granting of the degree honoris causa, so that by the 1930's this formerly prevalent malpractice virtually disappeared. Its member institutions maintained and improved their own standards by self-studies, limiting and even, in some cases, reducing their graduate offerings rather than sacrificing quality. When, under the pressures of World War II and its aftermaths, the Presidents of the AAU became too involved in fiscal affairs, they abdicated direct responsibility for graduate work and established the Association of Graduate Schools in the Association of American Universities. The AGS now serves a similar purpose as its parent organization. Although its forty-one members form scarcely one-fifth of the total membership of the Council of Graduate Schools, it serves as "the leaven that leaveneth the whole lump," or, to change the metaphor from St. Paul to a more elegant Shakespearian one, it "is indeed the glass wherein the noble youth do dress themselves." It is, therefore, fair to say that, while the AAU and its parthenogenetic offspring, the AGS, have been properly concerned primarily with their own affairs, they have had a broad, salutary influence on graduate education as a whole and on large numbers of graduate schools individually.

In the past decade and a half substantial efforts to improve graduate education have been made by learned societies, education associations, and individual universities. Some of these were based on comprehensive studies

and produced some sound and useful results. Others consisted of little more than tinkering with the degree structure and the minutiae of curricular requirements. It may be worthwhile to look at a few typical examples.

In 1956 the American Historical Association, through its Committee on Graduate Education, commissioned Professor John L. Snell, then of Tulane University, to conduct a study of the Education of Historians in the United States. Over a period of five years, the Committee gathered an amazing amount of statistical material on every conceivable aspect of education in history. It also collected comments and opinions from faculty and students as well as from prospective employers. All criticisms and conclusions are meticulously documented. The 244-page report, published in 1962, contains at its end a number of detailed recommendations describing minimum requirements for an acceptable graduate department of history and a step-by-step outline which a degree candidate should follow. It also gives sound advice on the training of teachers and on the fostering of good teaching habits in later life. The recommendations for minimum requirements were adopted by the AHA and are now being used as the basis for departmental self-study. However, a proposal by the Committee on Graduate Education to publish a list of "approved" departments who meet the minimum standards was quite properly rejected by the AHA membership.

A somewhat similar study of the Ph.D. in English and American Literature was undertaken in 1966 under the sponsorship of the Modern Language Association and funded by the Danforth Foundation. Professor Don Cameron Allen of Johns Hopkins, with slight assistance from an Advisory Committee, wrote the resulting 248-page book, published in 1968. Mr. Allen made extensive use of the questionnaire method, sending out a total of 3623 to persons who won Ph.D.'s in English between 1955 and 1965, and receiving 1880 usable replies. Instead of with a series of firm recommendations, he ends his book more suavely with "Forty-four Suggestions by Way of a Conclusion." He and the Advisory Committee used a unique method, however, to gain attention for and provoke discussion of these "Suggestions" by calling regional meetings (at Baltimore, Chicago, San Francisco, New Orleans, and New York) of the chairmen of all Ph.D.-granting English departments. It is too early, of course, to judge how much impact the suggestions will have on some of the sclerotic English departments, but I recommend the book as sensible and besides good reading.

In late 1968 the National Endowment for the Humanities made a grant to the Council of Graduate Schools to make recommendations for the improvement of graduate education in the humanities. A ten-member panel of prominent academicians was established who met over a period of five months and produced a collection of position papers. These were presented on May 27-28, 1969, to a fifty-member conference consisting more largely of scientists, foundation heads, business and industrial leaders than teachers of the humanities. The position papers were thoroughly discussed and revised and are now being rewritten for publication this fall.

The training of college teachers has for about five years been a joint concern of the Association of American Colleges and the Council of Graduate Schools. A Liaison Committee between the two organizations was established in 1965 under the chairmanship of President Louis W. Norris of Albion

College. The Committee produced a report entitled Preparing the College Professor for Liberal Arts Teaching. Among its several recommendations was one proposing meetings of the Liaison Committee with representatives of learned societies or dsciplinary professional associations for the purpose of developing programs for specific disciplines. The first of these meetings has now been held with representatives of the biological sciences. Its report has not yet been published.

Mention should also be made of the modest efforts of the Council of Graduate Schools to assist in the improvement of graduate education. In doing so it is only carrying out the specific charge contained in its Constitution. The Council has issued a number of brochures outlining minimum standards for the Master's degree, the Ph.D., the Doctorate in Professional Fields, and the Establishment of New Ph.D. Programs. It is always difficult, of course, to judge how much impact such publications have, but if the volume of sales is an index, it should be considerable. Over the past four years, the universities and colleges have purchased 19,000 copies of The Doctor of Philosophy Degree, 17,000 of New Doctor of Philosophy Degree Programs, 12,000 of the Doctor's Degree in Professional Fields, and 16,000 of the Master's Degree.

Innovations on the part of individual universities, numerous as they are and important as some of them may become, are perhaps best left for treatment in the discussion groups later in the week. Among these are such interesting programs as Cornell's six-year doctorate, the accelerated English Ph.D.'s at Johns Hopkins and Pennsylvania, Yale's Master of Philosophy, the Candidate's degree---or certificate---in the Big Ten and at California. Perhaps the Doctor of Arts at Pittsburgh, Carnegie-Mellon, Washington, and elsewhere are significant innovations. And there may be others that have not had the benefit of an efficient public information officer.

In the preparation of this brief paper, I have read or re-read many hundreds, perhaps thousands of pages or books, monographs, articles, and proceedings. To read this "stupendously unentertaining literature" a little at a time---fortunately the journals don't all arrive on the same day or even the same month---has a diluting, mitigating effect. To ingest it in one solid mass has an impact that I can only call depressing. It is depressing for two reasons: First, graduate education, and particularly the Ph.D. degree, has always been the target of criticism, but why must this criticism always be destructive and hardly ever constructive? Why must it always be harsh, blatant, strident? Gentle people like Charles Eliot and Abbott Lawrence Powell, even the great pacifist David Starr Jordan, become vituperative when they speak of the Ph.D. They all take it apart but they rarely put it back together. And the other cause for depression is the dreary monotony of the dialogue. Everything that is discussed in 1900 is rehashed ten, twenty, sixty years later. The tune never changes, only the language becomes less elegant.

To be sure, we have some additional problems in 1969. One of these is "relevance"---perish the word! But even that has been discussed before (cf. President Harper's remark in 1895). Another is "special treatment for

the disadvantaged." This will undoubtedly produce discussion. But basically the ills that plague us are the same that our antecedents debated. They rarely did more than complain; they occasionally proposed small repairs of the Ph.D. structure. They never remotely thought of radical reorganization to meet the needs of a society that was changing faster than they ever realized. Such reorganization will come, indeed is already upon us, in spite of anything we may do here this week. It is my hope, fatuous though it may be, that the developments in graduate education that will inevitably take place in the next decade will, to some extent, be shaped by what we do here.

PREDOCTORAL EDUCATION IN THE UNITED STATES: CURRENT PARAMETERS AND THE DATA BASE

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THE GENERAL BACKGROUND

Regardless of the criterion of measurement, graduate education in the United States has become "big business" and is destined to become even larger for at least the immediate future. The number of doctorate-granting institutions in the U.S. (producing at least one research doctorate annually) has been increasing for the past 45 years, doubling about every 20 years (30). Between FY 1950 and FY 1967, 213 institutions had granted at least one research doctorate; the number continues to increase with research doctorates granted by 227 institutions during FY 1968 (30). A more realistic yardstick, the number of institutions producing ten or more Ph.D.'s yearly, still reflects more than a threefold increase since 1930, even though 25 percent of these institutions supplied 75 percent of the doctorates produced during this period (30). The total number of institutions offering graduate programs reached about 724 in 1967 (19) and today this number exceeds 750 (37). According to the Report of the Academy For Education Development, Inc., universities everywhere in the U.S. plan a substantial expansion of graduate and professional education during the period 1966-80 (1) and only Harvard (33) is known to have recommended a cutback.

There has been a correspondingly rapid growth in the number of doctorates granted by United States universities during the past half century. The universities awarded 560 doctorates in 1920; the number grew to 3,245 in 1940; totaled 9,734 in 1960; exceeded 20,000 in 1967; and almost reached 23,000 in 1968 (30, 31).

The increase in financial support of graduate education has been equally dramatic although at best the total investment can only be indirectly estimated. Total expenditures for higher education have recently been variously quoted as ranging from $15 billion to over $17 billion annually. DuBridge (11) states that Americans are spending $15 billion a year (referring to 1967-68) on higher education. Figures published in the November 16, 1968 issue of the Saturday Review cite current expenditures and interest for 1968-69 in support of higher education at a total of $17 billion, with capital outlay running an additional $3.4 billion (32). The Carnegie Commission Report of December, 1968 (4) tagged total institutional expenditures for higher education at $17.2 billion for 1967-68 and proposed that this should rise to $41 billion by 1976-77. The Commission further subdivided the 1967-68 total into $4.7 billion (27%) from state and local sources, $9.0 billion (52%) from private sources, and $3.5 billion (21%) from the Federal Government. Chambers (7) noted that state government appropriations in support of

higher education have crossed the $5 billion mark in fiscal year 1968. Regardless of the actual magnitude of the total expenditure, a significant part of this total is in support of graduate education.

Two recent complementary publications (24a, 24b), both compiled and released by the National Science Board in 1969, project the cost of graduate education (expenditures for educational and general purposes in current dollars) in 1968 at approximately $6 billion. These reports further state that graduate education is already the most expensive form of education per student, and current projections indicate that during the early 1970's the total cost of graduate education will exceed, for the first time, the cost of the remainder of higher education. By 1980 the cost of graduate education may attain an annual rate of $20 billion, with annual expenditures for the physical plant on the order of $3 billion, both estimates taking into account characteristic factors for inflation and increased complexity of research activities (24a, 24b).

Prior to World War II, direct support of graduate students by the Federal Government was negligible. Statistics and reports published since then, however, cite tremendous increases in support, particularly during the last two decades. Although sources differ significantly, the following figures are indicative of the magnitude of the amount of financial support for professional and graduate students: in 1960, 5,500 fellows and trainees were supported by the Federal Government at a cost of $24 million; this increased to 43,296 awards at $226 million in 1968 (14). At the 8th Annual Meeting of the Council of Graduate Schools in the U.S. in December, 1968, J. Wayne Reitz reported $355 million expended in support of the National Defense Education Act, Title IV, program in the ten-year period since its initiation (29). The Comptroller General in his report to Congress in May of 1968 stated, "In fiscal year 1967 Federal agencies supported approximately 62,500 fellowship and traineeship recipients at a cost of about $422 million" (10). On the other hand, the Federal Interagency Committee on Education Report of September, 1968 (13) quotes Federal expenditures for graduate and professional student assistance at $363 million in fiscal year 1967 and estimated expenditures at more than $400 and $450 million for fiscal years 1968 and 1969, respectively. The Association of American Universities Report (2) states that during academic year 1966-67, the Federal Government provided about $441 million to graduate students, which included support of almost 17% of all full-time doctoral candidates. Of this total, $227 million was in the form of fellowships and traineeships.

It is obvious that the patterns of graduate student support and graduate education itself are rapidly undergoing change. A number of substantial reductions in congressional appropriations has led to a sharp curtailment or suspension of several of the fellowship or traineeship support programs of the Federal agencies. Notably among these are the NASA Traineeship Program (only 75 new awards in 1968, compared with 797 new awards in 1967 and 1,335 in 1966), the NDEA Title IV Fellowship Program (less than one half, 3,339 and 2,886 awarded in 1968 and 1969, of the authorized number, 7,500). Private funds, as exemplified by the Ford Foundation-Woodrow Wilson Fellowship Program and others, have also been substantially decreased. Ceilings on expenditures imposed by Congress have had a serious impact on research funding, particularly by NSF, and in turn portend to restrict severely both

predoctoral and postdoctoral support at many universities. Stabilized or decreasing appropriations by many state legislatures are also reflecting the economic mood imposed by the National Congress, with the eventual effect of reduced support for graduate students.

The picture of waning graduate student support is further complicated by the current Selective Service regulations which, unless changed, could virtually eliminate all graduate student deferments. Although the effect of the draft failed to materialize to the extent predicted for the fall of 1968, many authorities feel that the potential impact upon overall graduate enrollment has only been postponed and the real effect is yet to be manifested during the spring, summer and fall of 1969. Nevertheless, the draft did cause a substantial drop in graduate science enrollments in the fall of 1968 and caused further attrition during the school year, according to two recent surveys summarized in Science (34). Graduate enrollments in engineering also declined (16%) in the fall of 1968, with the draft cited as a major factor (12). Compensating factors, such as higher acceptance than normal by graduate schools, a higher percentage of draft-eligible males enrolling than was expected, and the low draft quotas in the fall months of 1968, lessened the severity of the overall predicted decreases. These effects are now expected to be rapidly reversed in 1969 and 1970, unless regulations are changed, by the higher draft calls and the relatively high proportion of graduate students now in the draft-eligible pool (38). Action along these lines in time to alleviate the situation for the 1969-70 graduate enrollments appears unlikely at the present time.

The above-cited examples, as well as many definitive treatises and papers written or given by knowledgeable educators during the last 15 years, establish clearly that graduate education in this country has been experiencing a period of exponential growth since 1945 (3, 5, 6, 9, 17, 18, 19, 27, 30, 31). How long this trend and the rising demand for the products of our graduate schools will continue is a matter of debate and conjecture, but most authorities agree that it will continue until at least 1975 and possibly to 1980 (1, 24b).

In this vein, the National Science Board in its recent publication (24b) takes the position that although there are those that will demand documentation that the American society will require the services of a greatly increased, highly trained population, there are really no rational bases for forecasting the national requirements in toto or for an individual field in 1980 or 1985. Further, the report (24b) states seven cogent reasons why it is untenable to predict the future requirements; in short, it is not possible to produce too many highly educated people in the United States as long as appropriate educational standards are not sacrificed. In these terms, most leaders in higher education should find little ground for disagreement with this thesis.

Nevertheless, other views in increasing numbers are being expressed by diverse segments of the population. These voices can no longer be ignored as irrelevant. They must be given serious consideration since it is quite obvious that the future support of graduate education will demand better documentation and justification. In competition with other critical national problems, new arguments for financing graduate education will have to be

marshalled and sold in the legislative halls. This may necessitate careful rethinking of the entire framework currently undergirding and controlling graduate education today, particularly the heretofore sacrosanct nature of the research-based Ph.D. that has long resisted any acceptable replacement or equivalence. It is granted that it is impossible to produce too many highly educated people, as long as these people are trained for different roles in society and are not misled in their expectations. But to assume that all of the highly specialized research-based Ph.D.'s our first-rate graduate schools are capable of producing in the future can be placed in prestigious universities or that their research expectations can be met in the future is, in the opinion of the author, highly untenable and illogical.

Many studies relating to the assessment and prediction of needs and requirements of individual fields have either been completed or are currently in progress. Representative of the various studies that have been undertaken are those that have been conducted under the auspices of the Committee on Science and Public Policy of the National Academy of Sciences. Committee reports have been issued for Chemistry in 1965 (21a), Physics in 1966 (21b), and Mathematics in 1968 (21c). Studies by the Committee on Research in Life Sciences and the Survey Committee on Behavioral and Social Sciences have been conducted and reports are scheduled to be issued in the fall of 1969.

The overall review of higher education has been the target of several national commissions, study groups, and individual authors (1, 3, 4, 5, 6, 9, 16, 17, 23, 24, 28). Of the many studies on graduate education and publications issued therefrom since 1960, perhaps no two have stimulated more discussion and debate than Bernard Berelson's "Graduate Education in the United States," in 1960 (3) and Allan Cartter's "An Assessment of Quality in Graduate Education," in 1966 (6). Both authors have questioned the validity of past suppositions made by others about trends based on insufficient or incorrect data derived from inadequate models predicting supply and demand for Ph.D.'s and the impending disastrous national shortage unless corrected (17). And both stress quality in graduate education rather than the numbers game as an important ingredient to the solution to the multitude of problems besetting graduate education of the future. Under the direction of Dr. Kenneth Roose, the American Council on Education has scheduled a follow-up survey to the "Cartter Report" as it was agreed in 1966 that the study should be repeated within five years to assess any changes occurring since 1964. The number of institutions and the number of fields to be surveyed have been expanded in the 1969 study. It is hoped that the "Second Assessment of Quality" will utilize, within the practical restraints imposed, quantitative criteria in addition to subjective ratings in determining changes in quality in graduate education. Publication of the "Second Assessment of Quality," as well as the results of other studies currently under way or recently published on other critical aspects of post baccalaureate education (1, 2, 4, 21, 22, 24, 37), should prove useful in assessing patterns, strengths and weaknesses, and in serving as an aid to individuals, institutions and agencies seriously concerned with the improvement of graduate education and the evaluation of supply and demand of its products.

THE DATA BASE

The literature pertaining to graduate education in the United States is so voluminous that any attempt to review more than selected information and statistics, arbitrarily judged to be significant to this Conference, is impossible. Therefore the presentation will be mainly restricted to summary data and reports germane to the 1960-69 period and estimates and projections for the 1970-80 decade. Only occasional reference will be made to older data for comparative purposes or for establishing statistical trends or information otherwise deemed useful to the Conference. Selected information has been summarized in a Source Book (35), and copies of other pertinent reports and studies will be made available for use as desired as a working library at the Conference.

Although both Berelson (3) and Cartter (6) have justifiably criticized conclusions made by others from insufficient or incorrect data derived from inadequate models predicting supply and demand for Ph.D.'s, the observation is also offered that apparently little of immediate or practical usefulness has been gained from the use of elaborate or sophisticated statistical and mathematical models. Because of the number and extent of the unknowns as well as the general imprecision of the various input factors, any degree of high predictive accuracy or reliability cannot and should not be expected. As a result, a simple mathematical approach based on logical trends and reasonable assumptions seems to be as useful as more sophisticated techniques. Also, although supply and demand studies and data are important and useful in providing needed background information, it must be kept in mind that other factors must also be considered and evaluated if a constructive review and assessment resulting in meaningful recommendations for the future are to be made. Finally, in commenting about the enrollment and degree production data base, given in this paper, although the sheer magnitude of the absolute numbers and increases are impressive, the relative figures and changes for the major fields have remained remarkably stable over the years, confirming the fact well known to graduate deans that graduate education changes slowly. If one ignores the temporary ripples, the ephemeral changes in popularity of selected subfields or interdisciplinary combinations and fluctuations caused by major wars and national disasters, changes in broad categories as percentage of the total are minimal, and major changes take place rarely.

Enrollments and Trends

Graphic summaries of fall graduate enrollments for master's and higher degrees, available from the Annual Surveys of the Office of Education for 1960 to 1967, and projected assumptions for 1968 through 1980 are presented in Figures 1-A to 3-A. More detailed tabular data are given in the Source Book (35). The data of Figure 1-A show that from the fall of 1960 to the fall of 1967 the total and full-time number of graduate students enrolled in all fields in the United States institutions for master's and higher degrees more than doubled. If these trends continue, the total and full-time enrollment will almost triple by the fall of 1970 compared to that of 1960. The total graduate enrollment by 1980 has been variously estimated (35); regardless of the accuracy of the various models, the total enrollment by 1980, barring a national disaster, should approach 1.4 million (varying upward or downward by 100,000). The full-time numbers should approximate at least

50% or more of this amount. For comparison, the report of the National Science Board (24a), which is believed to be conservative, estimates that the fall enrollment of graduate students will grow to 816,000 in 1970, to 1,086,000 in 1975, and reach 1,385,000 in 1980.

In the past, more graduate students have enrolled in the combined non-science fields (social sciences, arts and humanities, education and the professional fields) than in the natural sciences and engineering (EMP fields and the life sciences) (14). This trend has continued from 1960 to 1968 and is projected to continue until 1980, with graduate enrollment in the non-science fields increasing at an overall greater rate than in the engineering and natural sciences areas (35). Among the individual six broad fields, education has the highest total graduate enrollment (both actual and projected), followed by the EMP fields (Figure 1-B). The EMP fields lead in full-time graduate students throughout the 1960-80 period (Figure 1-C).

Within the EMP fields, engineering reflects both the highest number and the most rapid rate of increase of total and full-time graduate students (35). The yearly growth rate in engineering is particularly significant from 1960 through 1967; incomplete information indicates that in the fall of 1968 graduate enrollment in engineering decreased about 16 percent (12), possibly attributed to a greater impact of the draft and other factors deterring engineering students who normally would have enrolled in graduate work. The slowing down of enrollment in engineering is expected to prevail for several additional years, but it is believed that an upswing will again occur beginning in the early 1970's. Incomplete information also suggests that the physical sciences may also have experienced an enrollment decrease, rather than the increases assumed in this paper. The physical sciences (chemistry, physics and astronomy) and earth sciences have a higher relative percentage of students enrolled for full-time work than do the engineering and mathematics fields (35). Although the earth sciences represent only a small proportion (about 5%) of the EMP enrollments and the total numbers and the rate of annual increase have been modest, it is noteworthy that much of the enrollment increase since 1962 can be attributed to a rising interest in the more popular areas such as oceanography, the planetary and atmospheric sciences, and geophysics.

As might be expected, the basic biological sciences dominate the life sciences field, but the other areas of the life sciences also experienced substantial increases in both total and full-time students enrolled from 1960 to 1967 (35). The popularity of the life sciences is expected to accelerate until at least 1980. While the 1960's can be perhaps characterized as the golden decade of the EMP fields in terms of national interest and relative growth, it is predicted that the life sciences will assume this role in relative popularity and percentage growth in the 1970's.

In general, the first-year student component of the total yearly enrollments varies from 40 to 70 percent in the EMP and life sciences fields, physics and astronomy being the notable exception in having more intermediate level students since 1961 (35). The proportion of full-time students of the total enrollments has been increasing with time and this trend is expected to continue in the future.

If we ignore the catchall "all other" social sciences category, psychology, followed by the political sciences and the economic fields, has commanded the highest graduate enrollments in the social science fields (35) from 1960 to 1967. Although it is popularly believed that students are showing an increasing interest in "where the action is," the trends exibited in the social sciences during the 1960's are expected to continue during the 1970's. This prediction is not to dispute that the social sciences overall may become an increasingly popular area, but popular belief and actual enrollment seem to be poorly correlated to date.

Enrollments in the arts and humanities (including history in this category) have been relatively stable, displaying only slight percentage increases from 1960 to 1967 (35). It is expected that this trend will continue through 1980, with the highest total enrollment being in English followed by approximately equal total enrollments in history, classical and modern languages, and the fine and applied arts.

Business administration has been the largest contributor to the enrollments in the professional fields from 1960 to 1967 and is predicted to maintain this position until 1980 (35). The "all other" professional category (which includes architecture, library science and other fields) and religion and theology comprise the bulk of the graduate enrollment in the professional fields.

Other than total figures, which are large, graduate enrollments in education are difficult to fractionate into meaningful subfields because of the different methods of definition and classification used in past surveys. However, the increasing number of students initiating graduate work in education, in contrast to the relatively low percentage of full-time students and apparently high attrition rate, marks this educational component as an area of concern (35). The disproportionate number of those majoring in educational administration and supervision would suggest that our graduate schools of education may be training too many chiefs and not enough Indians.

Doctoral Production

Doctoral production by the United States universities has increased rapidly from 1958 to 1968, the years for which actual data are presently available (2-A). Various projections have been made for the future, usually to 1980, and a few of these estimates or assumptions are summarized (35). A compromise model varying by field and based on growth rates (6 to 12%) expected for the six broad fields of study has been selected for the estimates of future doctoral recipients used in this paper (Figures 2-A. 2-B). As pointed out in NAS Publication 1489 (30), the average growth rate in degrees awarded from 1958 to 1966 has been 9.3% per year, while data available since then for 1967 and 1968 show average growth rates of 13.6% and 12.5% respectively (31). Using the growth rates selected would give more than 28,000 doctoral recipients by 1970, in excess of 44,000 by 1975, and more than 71,000 by 1980. The National Science Board's (24a) projections agree closely with these figures until about 1975; but a more conservative projection thereafter by the NSF Board predicts about 48,000 doctorates by 1980.

The growth of the general fields in terms of the relative contribution of each field to the total doctorate production is depicted from 1920 to 1962 in Figure 4 in NAS Publication 1142 (20) and has been extended in Figure 2-C. It is apparent that the natural sciences and engineering have dominated to date (about 50% of the total), and although decreasing slightly in the future, are still expected to contribute about 46% of the total. Education has changed from a relatively minor position in 1920 to one of increasing relative size equaling and exceeding the life sciences in the 60's and 70's. The social sciences and arts and humanities have been nearly the same size, but the social sciences are expected to take a slight edge in the future. Relative growth in the professional fields has been static throughout.

Doctorate production in the EMP fields has increased at a slightly greater rate (nearly tripling) from 1958 to 1968 than has the number in all fields, but the rate of growth is expected to decrease in the future (Figure 2-C). Although the EMP fields exceeded the average growth rate of 9.3% during the 1960's, the individual EMP fields exhibited considerable variability, and overall the EMP fields are projected to decline slightly in the next decade (35). The spectacular rise in graduate enrollments in engineering since World War II is paralleled by a quadrupling of the doctorates granted during the 1960's and the average annual growth of engineering in this time is the highest of all fields. As a result, the doctorate recipients in engineering changed from 8% of the total to almost 14% of the total; the engineering contribution to the EMP doctorate production was even more dramatic in the 1960-68 period with an increase of 12%. The relative position of chemistry has shifted markedly since 1950 and its production of Ph.D.'s as percentage of the total is expected to continue to decline. Mathematics displayed about the average growth rate of all fields from 1958 to 1968 but the physical sciences exceeded the average slightly, being almost entirely due to the production rate in physics and astronomy. The production rate of the earth sciences, despite the current popularity of certain fields, has changed slowly, either as percent of the total or as percent of the EMP doctorates granted.

The life sciences more than doubled in the 1958-68 decade, and evidently the climacteric spurt in the growth rate beginning in 1968, spearheaded by the basic biological sciences, presages the trend for the future (35). Both the health-related and agricultural sciences apparently are destined to remain fairly static as percentage of the total Ph.D. production.

Doctorate production (actual and projected data) in the social sciences, arts and humanities, and the professional fields are given in Figure 2-B. Psychology leads these fields in number produced or as percentage of the total doctorate production (35). The individual fields in these major areas have changed very little in terms of percentage of the total doctorate recipients produced during the 1960's. Based on these trends, much the same condition, it is believed, will continue during the next decade in these areas (35).

Overall, the educational fields exhibit an increasing rate in the relative doctorates produced (Figure 2-C). However, large changes or variability within subfields, usually caused by changes in subfield definition or subfield inclusion in the surveys, bring into question the reliability of the yearly changes shown for the specialized fields of education (35).

POSTDOCTORAL AS RELATED TO PREDOCTORAL EDUCATION

The significant increase in the number of research doctorates being awarded annually (almost 23,000) in 1968, compounded by new discoveries, the rapidly expanding knowledge base and innovative changes in research methodology, techniques, and facilities, makes it reasonable to assume that the demand for the postdoctoral experience will accelerate and even become a mandatory component in several fields of higher education in the future. The Study of Postdoctoral Education in the United States (22), whose report is to be released this fall, treats both the pros and the cons for the postdoctoral experience and discusses other aspects of postdoctoral education in some detail. For a more comprehensive review the reader is referred to this report (22) and particularly to the "Conclusions and Recommendations," "Summary," and selected graphics from the Report included in the Source Book prepared for this Conference (35). Among the findings of the postdoctoral study are the extent to which postdoctoral work is thought to be obligatory from one field to another and the amount of time elapsing after the doctorate to when the postdoctorate is deemed most appropriate. This influences somewhat the length of the baccalaureate-doctorate time lapse.

Postdoctoral education and support has received recent attention by others; only a few of these studies will be briefly mentioned. R. A. Whiteker of the OSP Fellowship Office summarized the postdoctoral research fellowships and national associateships (excluded are the research associateships offered by individual academic institutions or research laboratories and the clinical postdoctoral traineeships) offered during 1966-68 in May of 1968 (39). He found that the total number of postdoctoral fellowship opportunities in various scientific areas dropped by about 7% from FY 1966 to FY 1967 and then remained approximately constant at the 1967 level during FY 1968. In certain fields postdoctoral fellowships in the 1966-68 period were substantially reduced and incomplete information indicates that the situation during 1968-69 has not improved.

Two lines of concern and inquiry converged in the Mt. Hope Conference on Postdoctoral Fellowships and Research Associateships in the Sciences and Engineering (26). One was represented by the Study of Postdoctoral Education in the United States (22) referred to in a preceding paragraph. The other derived from the responsibility of the National Research Council for the administration of a number of postdoctoral fellowship and research associateship programs and for conducting the evaluation of applications in still other nationally competitive programs. The definitive paper by Magoun (26) on the "Distribution of Postdoctorals in the United States" is particularly enlightening as to the historical perspective, development and geographical imbalance of postdoctoral education. Several shorter articles have been published; typical of these are "Fund Cuts, Draft, Put Squeeze on Postdocs," appearing in the November 18, 1968 issue of Chemical and Engineering News (8).

Suspension of the NSF Senior Postdoctoral program during FY 1969 (fortunately, it is to be activated again in FY 1970), severe reductions in the Senior Fulbright program during both 1968 and 1969 and other sources of support for postdoctorals, are causes for alarm and suggest the appropriateness of serious rethinking and perhaps reshaping of the intimate predoctoral-postdoctoral interrelationship that currently exists in American higher education.

THE FINANCING OF HIGHER EDUCATION

General Recommendations

Although the Special Report and Recommendations by the Carnegie Commission on Higher Education (4) primarily zeroes in on other facets and proposals, it does make two major recommendations of concern to graduate education. First, the Commission recommended that certain universities be selected (on the basis of program proposals submitted to national panels) to undertake specific graduate talent search and development programs, and that Federal funding be made available for such programs in the amount of $25 million in 1970-71, rising to $100 million in 1976-77. In the second recommendation, the Commission proposed a federally financed predoctoral fellowship program based on demonstrated academic ability for students in all fields of intellectual endeavor, without reference to need. Stipends of $3,000 annually were recommended for a maximum of two years to graduate students advanced to candidacy for a Ph.D. or equivalent research doctorate; the total number of such first-year fellowships was to equal three-fourths of the national total of earned doctorates in the previous year. This would amount to approximately 19,000 to 20,000 fellowships in 1970-71 if the current rate of doctorate production continues, and the estimated level of funding would be $105 million in 1970-71, rising to $165 million in 1976-77. One half of the of the fellowships to be awarded annually would be selected by national competition, the other half would be granted on the basis of allocations to the institutions for certain departments or interdepartmental major programs designated by national panels of experts. The institutions and departments would then select the recipients as is currently done for the NDEA (Title IV) Fellowships and NSF Traineeships. The Commission had also recommended that educational opportunity grants based on need should be made available to first-level graduate students for a maximum of two years during work toward a graduate degree, presumably a master's. In addition, a program of loans to assist students at all levels of undergraduate and graduate study was proposed. Cost-of-education supplements to institutions were recommended for first-level graduate and doctoral students in the amounts of $1,050 and $3,500 for 1970-71, but rising to $1,500 and $5,000 in 1976-77 respectively.

The recommendations of the Carnegie Commission (4), although deviating in emphasis and approach, in general track and expand the earlier recommendations of the Association of American Universities (2) concerning the "Federal Financing of Higher Education." The AAU Report (2), however, proposed that, taken together, the current programs contain the main features of the sort of Federal policy toward student aid judged to be necessary. Specifically, the direct support of graduate students, requiring a substantial additional investment, should consist of fellowships and traineeships accompanied by cost-of-education supplements to institutions. The exact amount needed for stipend expansion in the form of fellowships and traineeships was not indicated, but the AAU Report (2) did stress that the current institutional supplement, now set at $2,500 each, accompanying these grants was sorely inadequate. If $4,500 is the average cost to the institution to educate a graduate student (exclusive of the research support required), and if an annual cost rise of 6% is assumed to continue, the cost to the institution per student will be approximately $8,000 in 1975-76.

A report to the President entitled "Toward a Long-Range Plan for Federal Financial Support for Higher Education" (the so-called "Rivlin Report") was released by the Department of Health, Education, and Welfare in January 1969 (37). While the report did not find evidence for an imminent "crisis" in higher education finance, it did find need for increasing support of higher education from Federal resources. Among the several recommendations were those particularly directed to improving graduate education and research: (1) expansion of the NDEA graduate fellowships to support 30,000 students by 1975, especially to alleviate imbalances in the non-scientific fields and for part-time students, (2) increasing the cost-of-education allowance for Federal graduate fellowships to a level of perhaps $5,000, with periodic review of this figure if necessary to adjust upwards as the costs of graduate education rise, (3) expanded funding for existing NSF, NIH, and OE institutional grants to speed the development of new centers of excellence at the graduate level and a similar program under the National Foundation on the Arts and Humanities, and (4) supplementation of existing research programs by a program of "sustaining grants" equal to a percentage of Federal research awards received by educational institutions of higher education. Overall the estimated increase in Federal funding to FY 1976 to implement all of the programs recommended was $6.3 billion, with about $1.17 billion of this in support of the graduate programs enumerated above.

National debate is turning to formulas for institutional support to accomplish a number of desirable objectives. Although "block" grants based on some yet unknown formula system of Federal support to states, geographical regions, or institutions are perhaps inevitable and the most feasible partial solution to provide the massive assistance required by higher education in the minimum possible time, it is not yet clear how quality and the unique characteristics inherent to graduate and postdoctoral education can be maintained and fostered by the various formulas or approaches proposed to date. The National Science Board (24b) proposes six types of Federal grant programs; all but the institutional sustaining grant type would be awarded on the basis of appropriate national competition. It is believed that we need also to keep before the public and the Congress the problem of recognizing individual ability and alternative ways of further developing the capabilities and demonstrated potentialities of individuals based on past performance and merit.

Other recommendations of the National Science Board (24) concerning the financing of graduate education have been briefly reviewed in the General Background section of this paper and will not be repeated here.

Graduate Student Stipends and Support Mechanism - 1960-68

A preliminary review of available information and publications reveals no single recent comprehensive study of total support for graduate students and suggests the need for an in-depth investigation of the current situation as well as projections for the future. However, fairly recent reports bear on certain aspects of the total picture and a few of the more pertinent publications will be briefly reviewed (13, 15, 21, 22, 23, 26).

The National Center for Educational Statistics released a report in 1967 (23) describing the academic and financial status of graduate students and other parameters of graduate education in the spring of 1965. Student

characteristics and other statistics of historical interest are: the majority of graduate students were part-time, only 44% were enrolled for a full course load; men outnumbered women in the sciences and professional fields, while women predominated in education and the humanities; nearly 10% of the students were foreign graduate students; and nearly all graduate students in education have had full-time employment experience prior to entering graduate school, while a surprising three-fourths of the students in the other fields reported employment before undertaking advanced degree work. The principal sources of funds for financing graduate education were fellowships, the student's own employment, or that of the spouse. Somewhat less important sources were teaching and research assistantships, followed by gifts or loans from relatives; loans from other sources provided only 3% of the cost of graduate education. The 1965 data indicated 477,535 graduate students enrolled, and funds used to finance graduate study totaled about $1.6 billion. About 42% of the students in graduate school in the spring of 1965 held stipends in the form of scholarships, fellowships, teaching assistantships or research assistantships, with the dollar value of the stipends ranging from less than $500 to over $4,500. The average stipend was about $2,500.

Insight into the magnitude of graduate student support types, sources, and distribution for the science and engineering fields for the falls of 1965 and 1966 is provided by the National Science Foundation report of June 1968, compiled by Linnell and entitled, "Graduate Student Support and Manpower Resources in Graduate Science Education" (15). Basic data comprising this report were submitted by the science departments requesting support from the National Science Foundation's Graduate Traineeship program. The science departments responding awarded nearly 80% of all science doctorates in 1965 and nearly 92% of the science doctorates in 1966. Forty-one fields of science organized into six broad areas (life-medical, engineering, mathematical, physical, social sciences, and psychology) are represented by the data. Clinical fields were excluded.

In Linnell's report, the sources of support were grouped in seven categories: U.S. Government; institutional, State-local governments; industry; private foundations; other institutions; loans and other; and foreign. Listing by these categories, major support for full-time U.S. science graduate students in the fall of 1966 can be summarized as follows for doctoral departments and master's departments, respectively:

1. U.S. Government - 40.9% doctoral and 19.9% master's (doctoral support ranged from 48.4% in the physical sciences to 24.6% in social sciences)

2. Institutional, State-local - 35% and 46.3% (range of support among fields much less than from U.S. Government)

3. Industry - 3% and 1.9% (support was highly selective and engineering fields received largest support)

4. Private Foundations - 2.6% and 1.1% (social sciences received largest support)

5. Other Institutions - 0.65% and 0.5% (mostly faculty and staff on leave)

6. Loans and other - 18% and 30.2% (closely identified with self-support)

7. Foreign - about 0.1% for all U.S. citizens (excludes foreign students)

The types of major support, traditionally by the types of appointment, were grouped by Linnell (15) into five categories: fellowships, traineeships, research assistantships, teaching assistantships, and all other (often self-support). Summary by these categories in the fall of 1966 for doctorate-granting and master's departments indicates the following:

1. Fellowships, Traineeships, Research or Teaching Assistantships - 75.8% doctoral and 59.3% master's (variations ranged from 9/10 of physical science students to 6/10's of those in social sciences)

2. Nationally Administered Fellowships or Traineeships - 33% and 16.5%

3. Research Assistantships - 25% and 16% (ranged from 30.9% in physical sciences to 9.1% in mathematics in the doctorate departments)

4. Teaching Assistantships - 24% and 32% (largest numbers supported in physical sciences and math; least amount in engineering)

5. Other Support - 24.2% and 40.7%

Under the direction of the Associate Director (Education), the National Science Foundation has updated information and statistics for the "Support of Full-Time Graduate Students in the Sciences, Fall 1967" (25b). This report is yet to be published in 1969, but the "Summary" from the draft copy is found in the Source Book. In overall terms, fellowships-traineeships supported 31.6% of the students, research assistantships supported 22.7%, teaching assistantships 22.8%, and "other" mechanisms 22.8% among the 133,972 students studied. Non-Federal U.S. funds supported somewhat less than three-fifths of the 1967 science graduate students; fully two-fifths of the remaining students were supported by Federal funds, and a small fraction (1.6%) were supported by foreign funds. Also, at the Summer Workshop sponsored by the Council of Graduate Schools in the United States in July of 1969, Falk (25a) of the National Science Foundation presented summary information for the support of full-time graduate students in the sciences and engineering in the fall of 1968 (35).

In response to a request in 1967 from the Chairman of the Committee on Academic Science and Engineering (CASE), the Federal Interagency Committee on Education (FICE) undertook an investigation of Federal predoctoral fellowship and traineeship support in relation to full-time graduate enrollment for the academic years 1960-61 through 1968-69. The Report of the Task Force (14) emphasized the numbers of students supported rather than levels of funding, and the scope of the study was restricted to fellowships and traineeships supported by AEC, NASA, NSF, OE, and PHS. As is well known, the Federal Government provides a large portion of the total graduate student support through other means than fellowships and traineeships. Therefore, data and projections given in the FICE Task Force Report (14) represent only a portion, perhaps less than half, of all Federal support for graduate students, and even a smaller segment of support from all sources (15).

The principal findings, conclusions, and recommendations of the FICE Task Force on Fellowships and Traineeships can be summarized briefly as follows:

1. From 1960 to 1968 Federal fellowship and traineeship support grew even more rapidly than enrollment. The number of students aided increased from 5,503 in 1960 to 43,296 in 1968 (nearly 8 times) while enrollment rose from 124,689 to 334,950 (nearly tripled) during the same period.

2. However, in 1967 and 1968 Federal support for graduate fellowships and traineeships diminished as a proportion of graduate student enrollment.

3. Federal support of graduate students in the social sciences and non-science fields has increased substantially, while support in the natural sciences, mathematics and engineering has enjoyed steady growth.

4. The Task Force forecast that the nation's need for highly trained professional and scientific manpower will continue to grow. However, the proportion of students enrolled in the sciences and engineering, as well as the proportion of the support they receive, will decline.

A major contribution on graduate education were the reports referred to earlier, published by the National Science Board in 1969 (24). The reports indicate that it is clear that from 1958 to 1967 the trend is in the direction of an ever-increasing role of the Federal Government in support of higher education in the major universities; that graduate education in these universities represents about 66% of the total income for educational and general purposes. When equated in terms of Federal funding for graduate education in the sciences and engineering, the percentage becomes even greater. The Science Board Report shows that of the 124,255 full-time graduate students in science and engineering at 204 doctoral institutions in the fall of 1966, about one half of the total is supported by sources other than the Federal Government, foundations, industry, or foreign sources. About one-third of the students received support from Federal sources. The projected cost of graduate education is estimated to be slightly above $7 billion in 1969-70 (0.8% of the GNP) and escalates to over $19 billion (1.31% of the GNP) by 1979-1980.

Survey of Stipends in EMP Fields

As a corollary and supplement to the paper by Linnell and Chapin (16) on the "Trends in Doctoral Chemical Education," Paul (27), in 1967, studied the levels of stipend support for first-year graduate students in chemistry by means of a questionnaire sent to 172 departments of chemistry offering the Ph.D. degree and 70 additional departments eligible to award the M.S. degree but not the Ph.D. Paul (27) noted great diversity in the level and administration of stipends under the institution's direct control, particularly stipends for teaching assistants. Paul's study shows that about

a third of the Ph.D.-granting institutions in chemistry provide their teaching assistants net stipends of less than $2,500 per year, about a third between $2,500 and $3,000, and about a third between $3,000 and $4,000. Of the institutions awarding total stipends of less than $2,500 practically all (85%) provide no supplement to the basic 9-month stipend for the teaching assignment. Thirty-eight (63%) of the chemistry departments listed by Cartter (6) as of superior quality in terms of assessment of the effectiveness of their graduate programs returned questionnaires in Paul's survey. The top-quality (Cartter-rated) departments included a lower percentage paying stipends to teaching assistants of less than $2,500 and higher percentage paying stipends exceeding $3,000 than the Ph.D.-granting departments generally.

In regard to research assistantships, Paul found that, although many institutions do not provide this form of support to their first-year chemistry students, the level of stipends is somewhat higher than for teaching assistants -- more than half of the institutions offered 12-month stipends of $3,000 or higher. However, an appreciable number of individual departments offered identical stipends to teaching and research assistants. Paul noted that the difference in the distribution of research assistant support in the departments on Cartter's list from that in the Ph.D.-granting departments generally was insignificant, perhaps because most of this form of support is derived from similar funding through research grants.

During 1968, the Fellowship Office of NRC also compiled data on the stipend levels for graduate students holding fellowships, teaching assistantships, and research assistantships in U.S. institutions in the fields of engineering, physics, and mathematics. A summary table of the percentage distribution of institutions according to the level of stipends paid during 1966-67 for the three categories of support is found in the Source Book (35). Comparable data on the top-quality departments according to Cartter's listing based on the effectiveness of their graduate programs are also presented. The results of the Fellowship Office tabulation show that slightly more than two-thirds of the institutions provide their teaching assistants in physics stipends less than $2,500, while slightly less than one half of those in engineering and mathematics fall below $2,500. In the $2,500-$3,000 range of stipends paid teaching assistants, approximately one-fourth of the institutions in each of the three fields fell in this intermediate bracket. On the other hand, mathematics departments (27%), followed by engineering (24%), paid teaching assistants the higher stipends -- $3,000 or greater, compared to only 6% in physics.

Although the actual percentage figures varied considerably by field for research assistants who were paid less than $2,500, a pattern of distribution similar to that found for teaching assistants, but skewed toward the higher stipends, was followed by research assistants in engineering, physics, and mathematics. Conversely, stipend levels greater than $3,000 were highest in mathematics (46%) and engineering (43%) and lowest in physics (18%). About 1/5 (engineering) to 1/4 (physics and math) of the institutions fell in the intermediate stipend levels ($2,500-$3,000).

The stipend levels for fellowships were in general lower than stipends paid either teaching or research assistants; from 58% (engineering and

mathematics) to 68% (physics) of the institutions paid their fellows less than $2,500. On the other hand, the percentage of institutions paying their fellows $3,000 or more varied from a high of 29% in engineering to a low of 16% and 18% for physics and mathematics, respectively.

Comparison of the Cartter-rated departments, in terms of effectiveness of their graduate programs, to all departments indicates considerable variability as to field, type of support, and stipend level. In general, the Cartter-rated departments in engineering had a higher percentage of departments paying stipends of $3,000 or more for all types of support than did all engineering departments. Mathematics in general followed the same trend as engineering with the exception of fellowships, whereas the converse was found in physics. As noted by Paul (27) in chemistry, individual difference among institutions as to stipend levels paid in all of the EMP fields appears to be more significant than quality difference.

Standardization of Support - Studies and Needs

During 1967-68 renewed attention was focused upon the need of standardization of support of stipends and allowances for graduate education (predoctoral and postdoctoral) among the Federal agencies. Prior to this time no concerted effort has been directed toward Government-wide standardization of stipends and allowances. Perhaps the best single document summarizing the policies and procedures governing the stipends and allowances paid under certain selected Government-administered graduate fellowship and traineeship grant programs stemmed from the study conducted by the General Accounting Office (GAO) in 1967 and the report issued in 1968 (10). As noted in the Comptroller General's Report of 1968 (10), two Task Forces, one appointed in 1965 by the Secretary of HEW and the other, known as the PHS Special Task Force of 1966, arrived at diametrically opposite conclusions. The HEW Task Force was of the opinion that stipend comparability was not feasible, while the PHS Task Force concluded that stipend comparability was feasible at certain program levels.

The GAO study showed that there were varying bases, criteria, and considerable variances in amounts allowed for which there was no adequate justification from an overall Government viewpoint. Based on findings and discussions with officials of the agencies involved in the study, the Report of the Comptroller General (10) recommended, recognizing that some flexibility may be required, that it would be desirable to bring about the maximum possible Government-wide standardization of stipend, dependency, and travel allowances paid by the various agencies under fellowship and traineeship programs. The agencies concerned in the review expressed general agreement, provided certain flexibility be permitted in certain circumstances, with the findings and recommendations. Implementation apparently awaits further action by the Director, Bureau of the Budget, and/or Congress in 1969-70.

The Secretary of HEW appointed an Advisory Committee in 1967 with representatives from the constituent agencies of HEW, the academic community including students, and other associations to consider the standardization of stipends and allowances of fellowships, traineeships and training grant programs administered by HEW. To my knowledge the final report and recommendations of this committee are yet to be developed, probably in 1969.

Projections of Needs Related to Tentative Enrollments, Production, and Support

Several of the recent major reports (1, 2, 4, 24, 37) briefly reviewed in this paper adequately document, summarize, and justify the nation's needs for formulating a definitive national policy to guide future planning and financing of higher education specifically directed to the unique characteristics of graduate education in the 1970's and perhaps to the year 2000. From data and projections summarized briefly in this paper and available from other sources, it is pessimistically unlikely that sufficient funding will be provided to support the present nature and thrust of graduate education adequately in the future. One of the alternatives available is to consider modification of the existing structure and its future direction. The basic purpose of this Conference, of course, is to evaluate not only critical problems but to weigh the alternatives. History reveals that reform of hierarchical or monolithic organizations seldom comes from within the system.

The AAU Report (2) states that the instructional and professional staff in U.S. colleges and universities doubled from 1955 to 1965, going from 236,000 to 465,000. This group (2) estimates that about 250,000 additional faculty will be required by 1975 and the number of Ph.D.'s and equivalent trained manpower required in other fields will be no less than 250,000, bringing the gross requirement for additional Ph.D.'s to 500,000 by 1975. Other authorities, however, postulate that the production of research Ph.D.'s will exceed the employment opportunities by 1970; some indices indicate that this condition already exists for certain fields. It is of further interest that the AAU Committee projects that to maintain the present ratio of trained manpower to population will call for 100,000 more physicians between 1965 and 1975 and two million new elementary and secondary teachers by 1975. It was believed (2), based on present trends, that graduate enrollments will grow from 314,000 in 1960 to one million in 1975, or over an average of 45,000 yearly. The Carnegie Commission (4) predicts that the enrollment of doctoral candidates will increase at an average rate of 6.6% annually to 1975, which would also bring the total enrolled to approximately one million. The National Science Board (24) estimates graduate enrollment at 1,086,000 by the fall of 1975 and reaching 1.3 million by 1980. Other sources, including the assumptions used in the present paper, project even higher enrollments. Regardless of the actual numbers of total and full-time graduate students enrolling in the future, the potential magnitude is large and the problems faced by our graduate schools in coping with these numbers portend to be staggering.

The numbers of doctoral and master's degree recipients potentially to be produced are closely linked to enrollments, and problems of equal criticality presently exist not only while the students are in graduate school but also relate to post-graduate employment, support of research expectations, and the effects on the national economy. For the period 1958-68, the average yearly growth rate exceeded 10% overall and was higher for individual fields. Assuming that this growth rate will continue (and there is considerable doubt that it will, particularly in certain fields), projections given in this paper would derive a total of new Ph.D.'s exceeding slightly more than 150,000 from 1958 to 1968, over 250,000 by 1975, and a total of not quite 325,000 by 1980.

The AAU (2) projection calls for a need for 500,000 additional Ph.D.'s from 1968 to 1975, 250,000 for college and university faculty, and 250,000 for other fields; this would require an average yearly production of 50,000 from 1965 to 1975 to meet the need. The AAU projections admittedly may be in error or grossly overestimated, since the model or the base used for computing the estimates is unstated. However, of the estimated total graduate enrollment in 1968 (715,000), about 3% (22,834) completed research doctorates in 1968. About 7% of the full-time students in 1968 completed doctorates. Extending this percentage (3%) to 1.1 million graduate students estimated to be enrolled in 1975 and assuming that the rate of attrition is constant, only 33,000 would complete doctorates in all fields in 1975. Based on estimated full-time students enrolled in 1975, the number of doctoral recipients would be slightly greater (about 7% or about 38,000). Based on known attrition rates and using the estimated figures for first-year, intermediate-year, and terminal-year students tabulated for 1968, even fewer doctorates would be expected in 1970 and 1975 than the numbers estimated. Similar computations can be made for 1980 using the projections estimated. It is obvious, however, that even if allowances are made for considerable error in the AAU-projected 1975 needs or the estimated number completing doctorates, a severe discrepancy still exists between estimated needs and anticipated production. It is not known whether the AAU-estimated needs allow for reentrance of previously enrolled students or for migration of foreigners into the U.S. manpower pool; this of course would also affect the accuracy of the prediction. Overall, one would agree that there is little danger of producing an oversupply of highly trained (Ph.D.) people in the United States as long as high standards of education are not sacrificed (24), training for different roles in society is considered, and postdoctoral expectations are not misrepresented.

An important consideration, if the gap between estimated needs and the apparent potential supply is to be closed, is of course the amount and types of financial support to be provided, particularly by the Federal Government (the main logical source), for graduate students during the next decade. Postdoctoral employment and support of researchers also must be considered. An in-depth study of the funding requirements, field by field, to establish the realistic requirements for predoctoral support geared to potential enrollments and postdoctoral research and employment is now in order and needed. Based on the preliminary figures presented in this paper, support by the Federal Government for graduate education and research approaching at least the amounts recommended (although they differ) by the Carnegie Commission (4), the National Science Board (24), or the HEW Report (37) appear tentatively to be both required and justified if the intellectual resources and leadership of the future are not to be allowed to wither. Unless positive steps are taken now, the continued health of graduate education and the long-range economy of the United States will eventually suffer.

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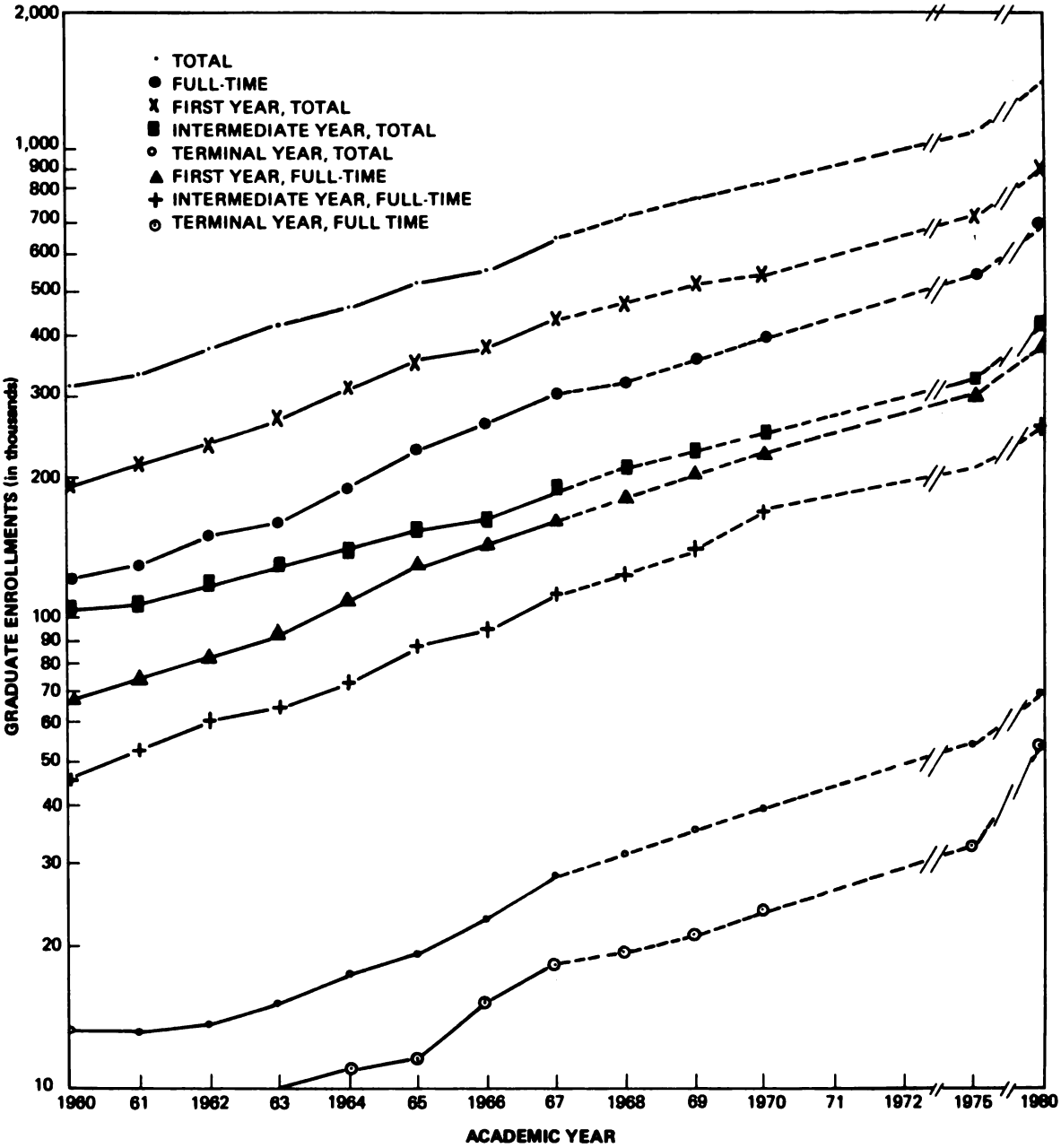


FIGURE 1-A
Graduate Enrollment in All Fields, Full-Time and Total, by Level of Study, Actual 1960–1967 and Projected 1968–1980

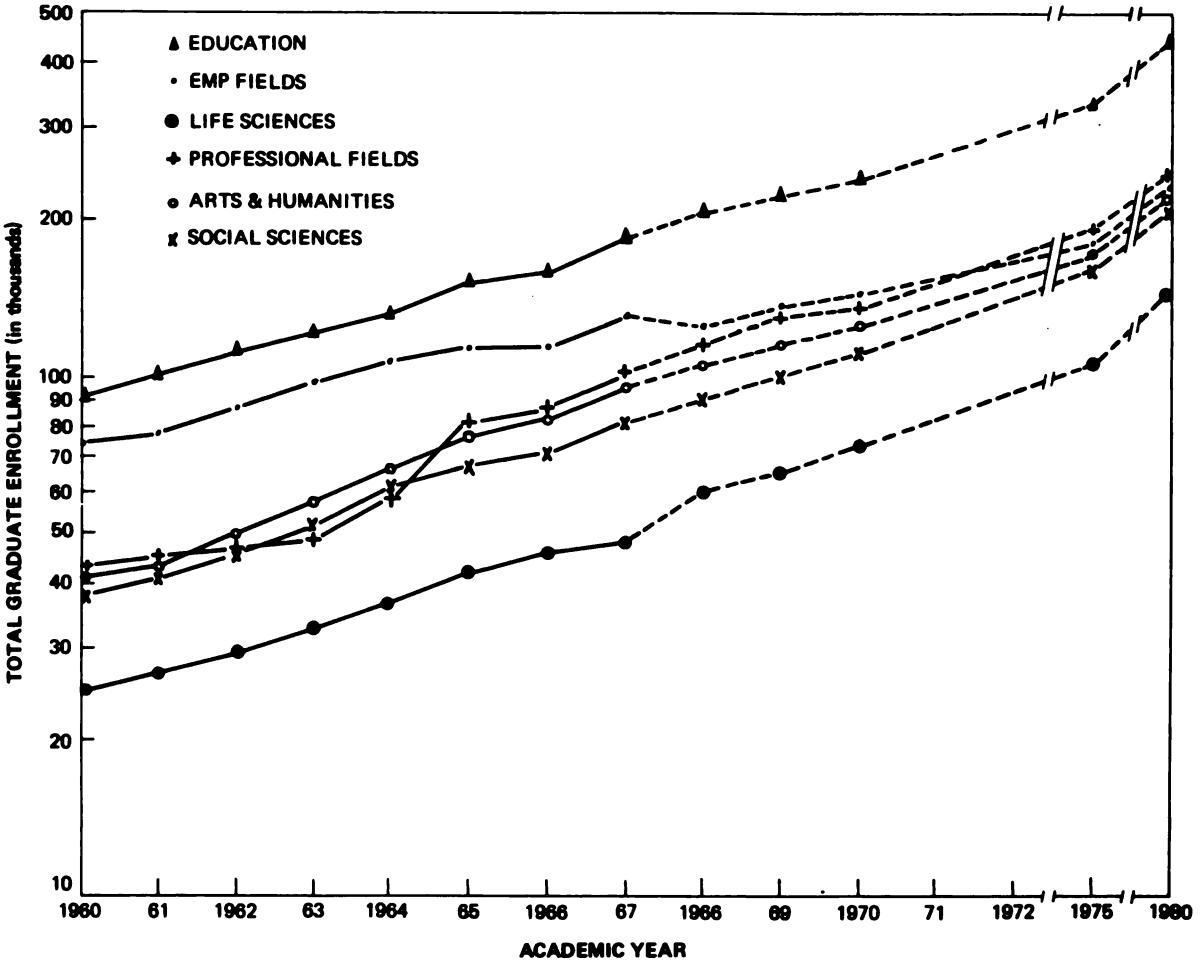


FIGURE 1-B
Total Graduate Enrollment in Six Broad Fields, Actual 1960–1967 and Projected 1968–1980

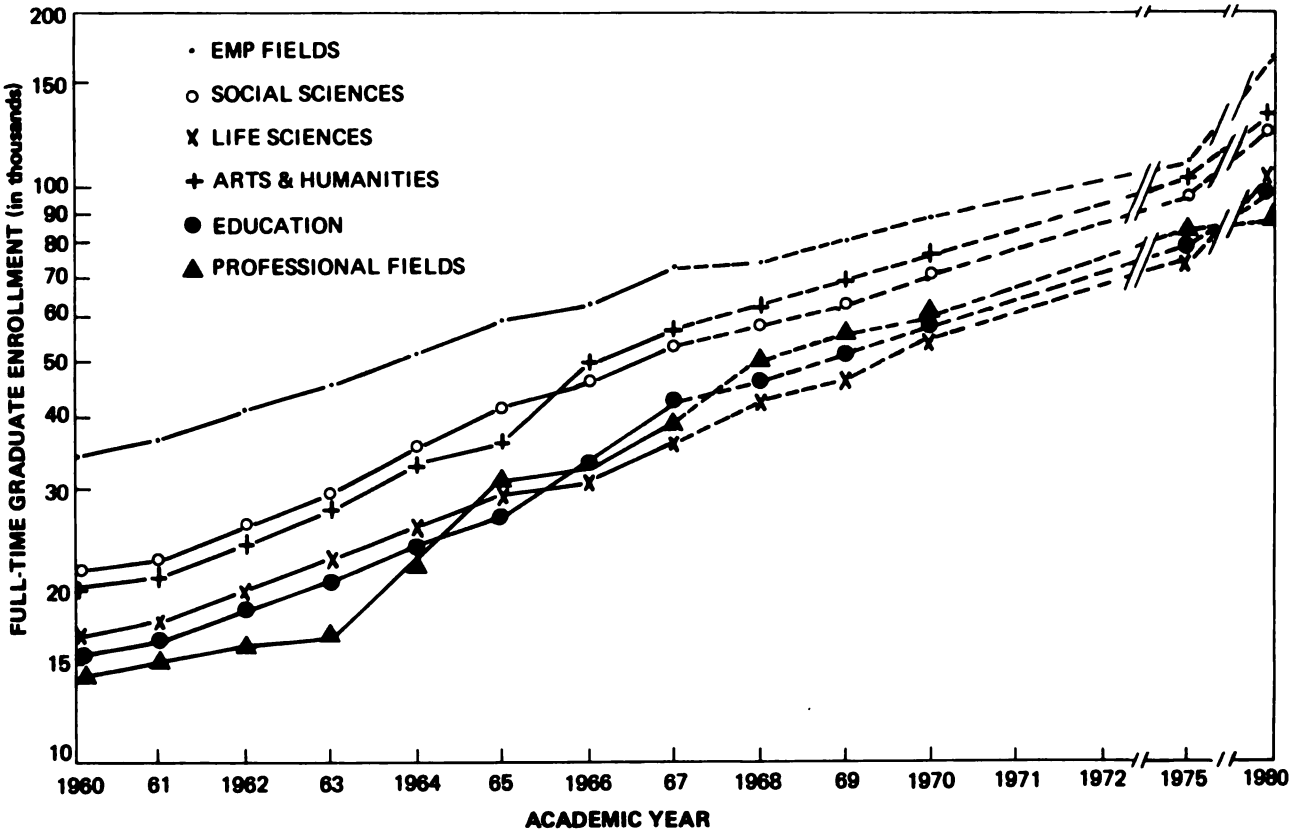


FIGURE 1-C
Full-Time Graduate Enrollment in Six Broad Fields, Actual 1960–1967 and Projected 1968–1980

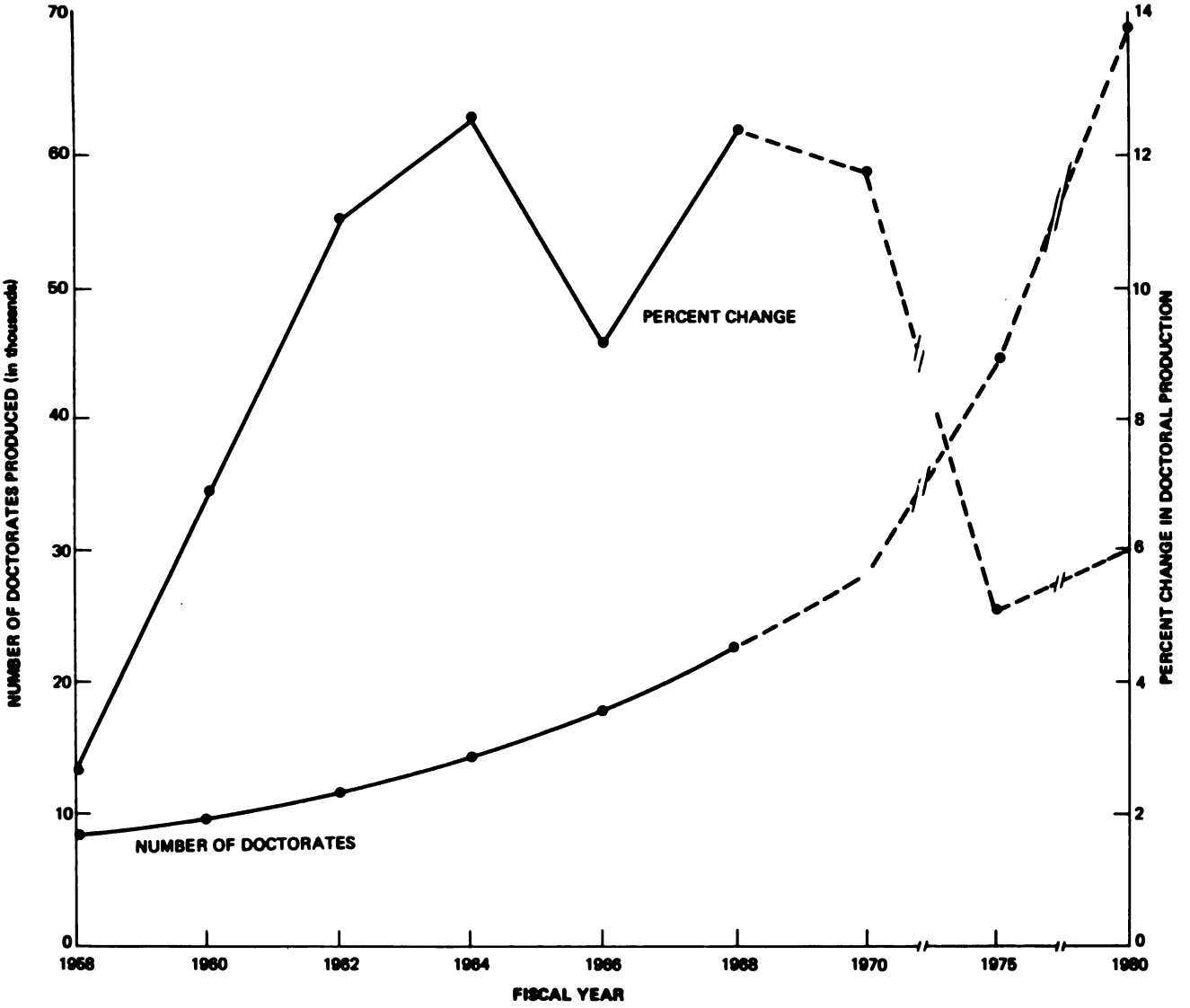


FIGURE 2-A
Number of Doctorates Produced, and Percent Change in Doctoral Production, Actual 1958–1968 and Projected 1969–1980

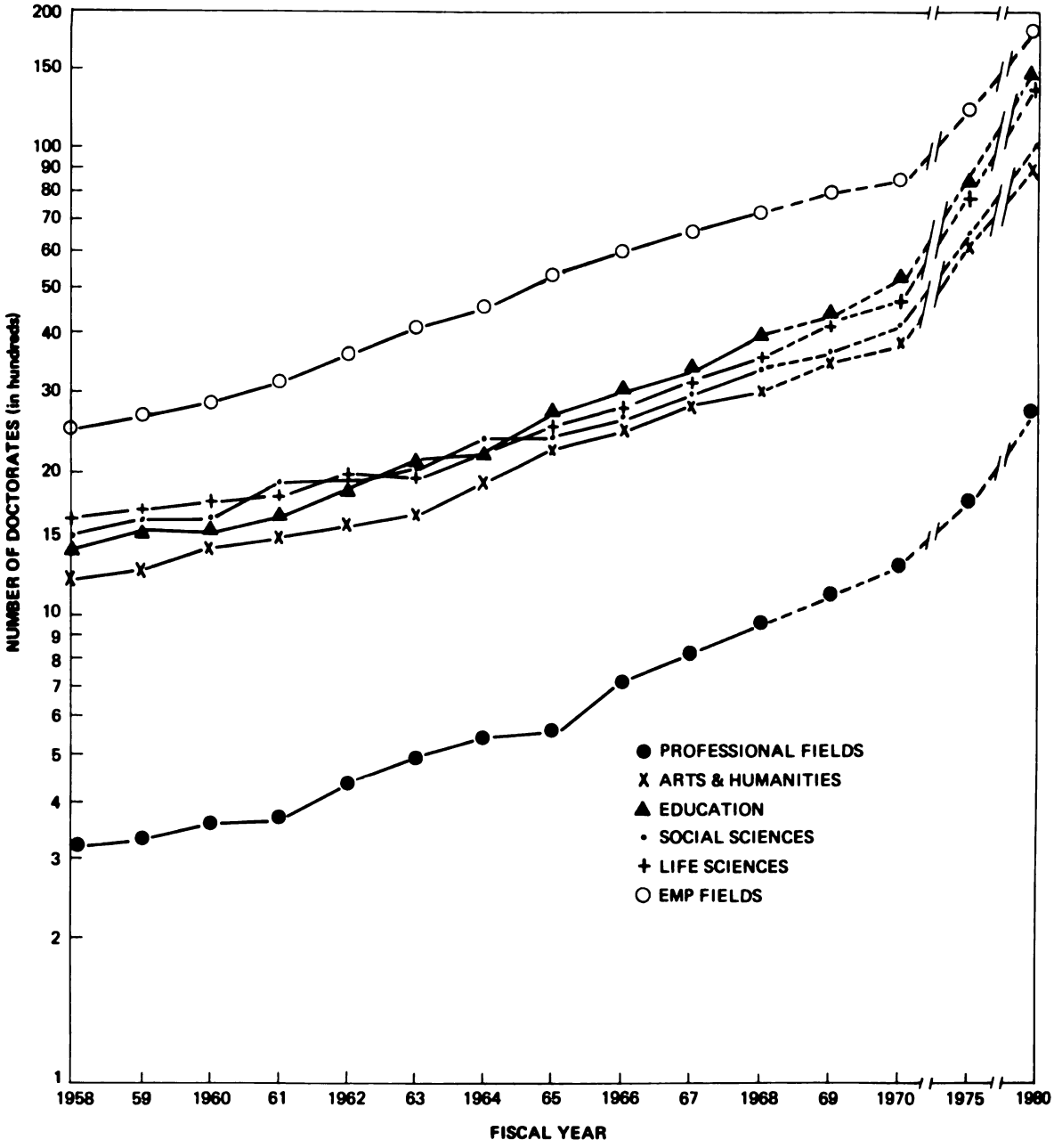


FIGURE 2-B
Doctoral Production in Six Broad Fields of Study, Actual FY 1958-1968 and Projected 1969-1980

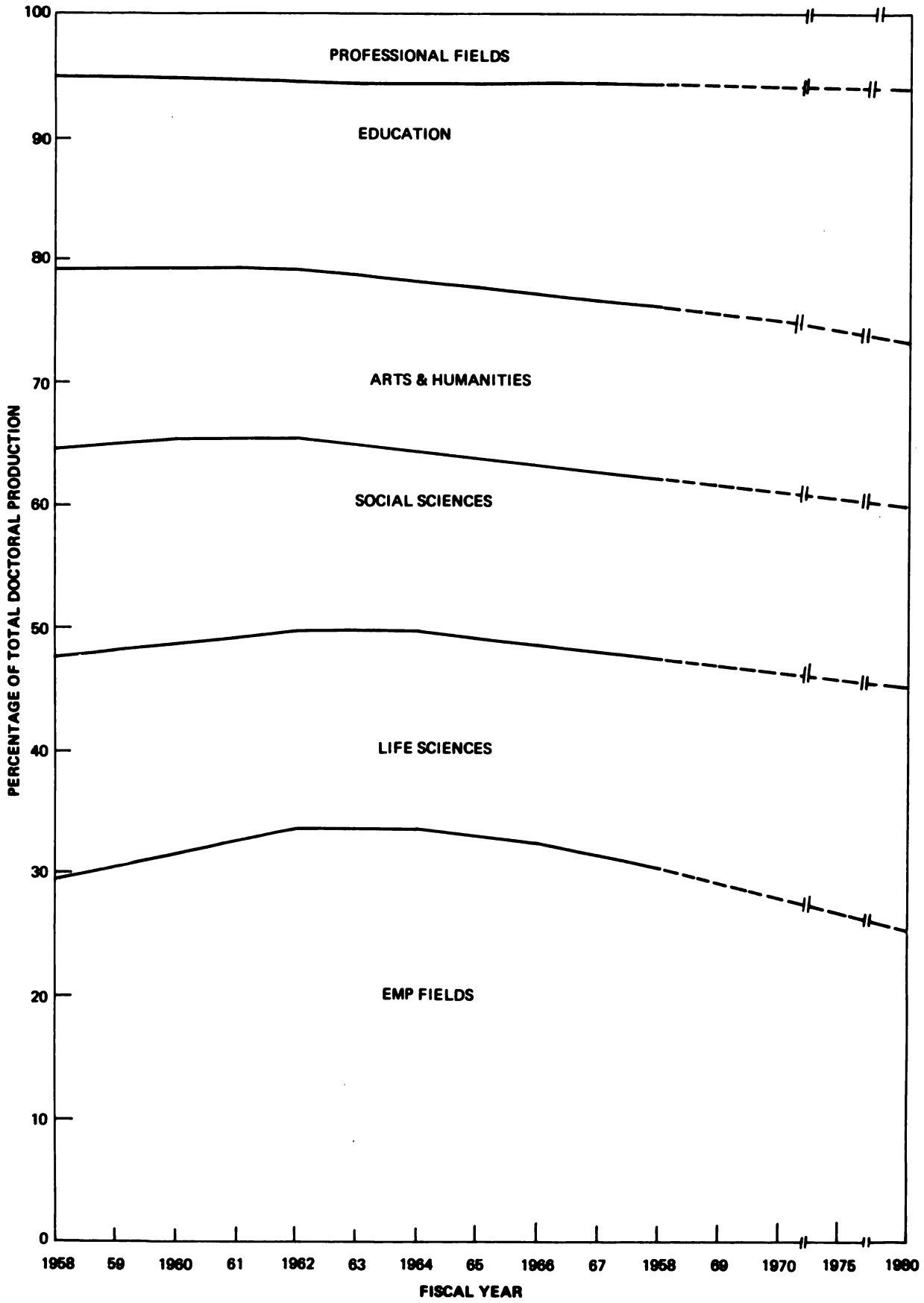


FIGURE 2-C
Proportion of Doctoral Production in Six Broad Fields, Actual 1958–1968 and Projected 1969–1980

INFORMAL NOTES ON THE

CONFERENCE ON PREDOCTORAL EDUCATION IN THE UNITED STATES

Evening Session, Sunday, August 24, 1969

Philip Handler, Chairman

Dr. Handler opened the meeting by welcoming the participants and reviewing the reasons for calling the meeting.

The conference had its origins in the concern of the Council of the National Academy of Sciences regarding graduate education in the United States. The Council asked whether the problems of graduate education had become so critical that they should be studied by the National Research Council. Further questions were whether any study should be confined to the sciences or should cover all fields in which graduate work is conducted. The conference group was convened to discuss these matters and provide advice.

Dr. Handler then reviewed some of the pressing problems of graduate education. An increasing number of people are being educated to the highest degree levels. Is this number insufficient or is it excessive? How should the proper number of Ph.D.'s be decided? Should we let the marketplace decide? Another problem is that of insistence upon an intensive research experience in preparation for the Ph.D. and upon the requirement of an original contribution to knowledge. Is this proper for everyone who goes on to the doctorate level of preparation? The third problem is that of the best preparation for teaching. Does the usual Ph.D. program provide this? The rising cost of graduate education is increasingly a cause for concern. Graduate education is already the most expensive part of higher education in this country on a per-student basis. The cost of the next doubling of costs of graduate education will be terrific. Should the nation engage in this kind of an expansion of graduate education, and is it prepared to meet these costs? Finally, although the classical disciplines have served well in the past as the basis for graduate education, present national problems do not fit into these neat pigeonholes. In what way can graduate education be reorganized, or can graduate schools be reorganized, better to meet these complex transdisciplinary problems?

Dr. Handler concluded his introduction by saying that he hoped that by Wednesday the group would have arrived at some answers. In the discussions of the next several days, they would have a chance to sharpen their thinking, to exchange ideas, and perhaps to indicate where the solutions to these important problems are likely to be found.

Gustave Arlt, the next speaker, presented some comments upon his paper "Review of Graduate Education and Efforts to Improve It" that he had prepared for the conference and that had been circulated in advance of the meeting. He remarked that it was not strictly true that the "past is prologue"; the past is always with us and is a part of the present. He made five points concerning the development of graduate education in this country. First, graduate education had its origins in the system used in German universities in the middle 1800's. The German universities provided an intensive research experience for specialists on the basis of a strong earlier academic preparation. The United States has combined the German graduate school with the British undergraduate university. We stretch out university education into the graduate period so that graduate study is really a combination of basic preparation and research experience. Secondly, the establishment of the Ph.D. as the highest degree awarded in this country has proved to be a mixed blessing. It was originally set up at Yale in the Sheffield School as the highest degree for science "and other fields". Its eventual extension, however, to other fields and the problems this extension would involve were not envisaged fully at that time. The third point is that other graduate degrees were established, but were not very successful. No other degree has approached the Ph.D. in prestige. As a result, we have tried to make the requirements for the Ph.D. degree the same in all fields. Fourth, we have oversold the degree to all varieties of employers and in so doing have reduced the value of the lower degrees and are now trying desperately to rehabilitate them. Finally, in addition to these perennial problems, we have a whole series of new problems in graduate education. They include relevance, the problems of the disadvantaged students, the soaring cost of graduate education, disorders on the campus, and even, in recent years, the problem of the draft. Dr. Arlt concluded his remarks by saying that he thought that disorders on the campus might not be as frequent next year. The situation may be coming under control. In regard to the draft, General Hershey has prepared a memorandum to draft boards asking them to defer graduate students until the end of the present academic year. If this order were signed and put into effect within the next few days, it would have an important and beneficial effect on graduate student enrollment for the coming year. Dr. Arlt urged that all possible support be given to efforts to persuade General Hershey to sign the order and put it into effect at the earliest possible date so that graduate students could make their plans accordingly.

Dr. Handler commented that, in addition to the important problems that Dr. Arlt mentioned, one must remember that there is a problem of the rapid growth of new graduate schools and new graduate programs. He cited as an example the statistic that the number of chemistry departments with Ph.D. programs had grown from 122 in 1964 to 170 now.

Wayne C. Hall, the next speaker, reviewed his paper "Predoctoral Education in the United States: Current Parameters and the Data Base". The paper contained some basic data, including a few projections of present trends. He disclaimed any accuracy for the projections, for extrapolated curves, etc. These had been made on as reasonable a basis as possible, but it was not possible to claim a high accuracy for them. Dr. Hall said that a number of additional documents containing data, recommendations, and reports of studies were available in a small reference collection that had been placed in the library in this building. Finally, he recapitulated some of the main points

in his paper by reviewing briefly the rapid growth of the numbers of graduate students enrolled and the numbers of Ph.D.'s granted during the recent past in all fields in which research doctorates were awarded. The paper also contained information about the financial support of graduate education and about the numerous constraints on support that are now appearing. He referred also to the fact that in a number of Federal programs the stipends for fellowships/apprenticeships are proving woefully inadequate. Finally, data obtained from the Council of College and University Placement Bureaus indicate that although demand in the employment market for holders of the baccalaureate was holding up very well, the number of job offers for holders of the Ph.D. had decreased by 31% and the number of offers for master's-degree recipients had decreased by 35% in the last year.

Dr. Handler questioned the applicability of the data that had been presented concerning job offers for holders of the doctorate. A more significant question would be whether there were any unemployed Ph.D.'s. Industry was probably reducing the number of offers to Ph.D.'s this year as compared with previous years. A church-related liberal-arts institution that advertised for a scientist for its faculty this year received some thirty-seven replies to its advertisement. This was a new and significant development in the employment situation of Ph.D.'s, but did not necessarily mean that Ph.D.'s were without jobs. The comment was made that a number of job offers did not go through the placement offices on many campuses. It is worthy of note, too, that job offers to recipients of the baccalaureate degree were up 11%. Is this an effect of the draft? Comments from industrial representatives indicated that some companies were inhibited from hiring Ph.D.'s by the high salary levels now prevalent. Professor Miller commented that there were not as many good offers to Ph.D.'s this year in many fields of the social sciences as in previous years.

Dean Magoun said that the emphasis on evaluating graduate education has too often centered on a supply/demand question. We tend to go around and around on these matters, without obtaining new information that allows us to break out of the circle. He recommended that we consider the quality of education and its relevance to what the person does in his career. We should study the performance of former fellowship holders and look at some of the NSF parameters for quality in graduate education. We need objective data. Dr. Arlt suggested that other criteria than those employed in the Cartter study be used for judging the output of departments. We should consider some of the more objective measures as well as the opinions that were relied upon in the Cartter study.

Mr. Kearns said that the problems facing graduate education impressed him, as a representative of industry, as being marketing problems. Graduate schools and others interested in graduate education might have something to learn from marketing people who have developed techniques for evaluating the reception being given to products. Dr. Bueche asked what would be the result if the country started afresh. Suppose that we had no system of graduate education. What kind of a system would we design to solve educational problems in this area? Dr. Arlt commented that we should ask whether we need a highest graduate degree and whether it should be the Ph.D. for everyone. We have oversold the Ph.D. Dr. Morse said that he was concerned about the rigidity of graduate programs, which provide little flexibility to meet new educational needs.

Dr. Carter said that the graduate education system impressed him with its stability. This is probably due to the kinds of satisfactions it offers to those most immediately concerned---the students and the graduate faculty. What other kinds of satisfactions could be provided to an individual, either a professor or a graduate student, that would replace the satisfactions of the Ph.D. if there were no Ph.D. programs?

Dr. Shannon commented that greater diversity is occurring in graduate programs in the biological fields. It is also worthy of note that there are longer periods of study for graduate students, even though the people who enter graduate schools are better prepared for their work as a result of undergraduate education. Dr. Shannon also remarked that the cost of research is going up so fast that we may not be able to employ as many research scientists in the future as we have in the past.

Dr. Weaver said that he had just returned from a trip to Germany during which he consulted with West German educational authorities. He said it would pay us to look again at what is happening within the German system. The Germans are now running into the problems of mass education that we have had for some time. Specialization is not going to continue to do the job for them that it has in the past. He went on to say that we need to make graduate education relevant to our students. He was not at all sure that the situation on the campuses this fall would quiet down as much as Dr. Arlt felt that it would. Students were going to zero in on the relevance of their education. The usefulness of the Ph.D. as a preparation for work in industry was being questioned. The usefulness of the Ph.D. for undergraduate teaching has also been challenged.

Dr. Fusfeld asked how the problem of graduate education differed from what it had been four years ago. He thought that there were several significant differences: first, the greater numbers of students enrolled in graduate schools and greater numbers of higher degrees granted; secondly, the lack of an infinite amount of money for graduate education; and thirdly, the more restricted number of job choices for the student.

Morning Session, Monday, August 25, 1969

Herbert Carter, Chairman

Dr. Carter opened the session with some announcements about procedures that would be followed during the rest of the conference. Working groups were being organized to consider some of the questions of graduate education that had been outlined in the program. He suggested that the members of the conference sign the sheets in the lobby to indicate the working group in which they were interested. Each working group would be asked to prepare a rough-draft statement of findings and recommendations after their discussion of the problems. Tomorrow morning, the chairman of each working group would present to the whole conference the results of their discussion, and the results would be discussed. The present session would be devoted to discussion of all the topics to be discussed later in the day by the working groups so that everyone could comment on questions of great interest to him.

Dr. Carter then opened the discussion of the questions for the morning session by stating some of his personal views about graduate education. In the first place, the input to graduate education is much more diverse than previously. In an earlier day, graduate students were highly selected and came to graduate schools with a burning interest in doing research and obtaining the necessary preparation for careers in research and university teaching. This is no longer the case. Graduate students are a more heterogeneous group now. An increasing number of chemistry graduate students, for example, are not devoted to research. Several years ago, Dr. Carter said, ten out of ninety of the chemistry graduate students at the University of Illinois wanted some alternative to the Ph.D. program in chemistry for themselves. This year, forty out of 110 wanted an alternative. A number of graduate students asked that a program or seminar in environmental problems be started to meet their interest in that field, and this was done. But the interest of increasing numbers of students in alternatives to the Ph.D. was something that gave him concern. Disturbing signs were also showing up elsewhere. For example, a recent supplement to the Harvard Crimson had to do with university research and contained a recommendation that Harvard get out of Federally sponsored research entirely. Dr. Carter was also concerned about the relentlessly rising cost of graduate education. It now costs about $10,000 per year to train a chemist, $13,000 per year for a biologist. The space problem of graduate education is becoming more serious. The University of Illinois at Urbana will have to expand its research space by 75% if present enrollment trends in graduate work continue. One also has to think about the problems of how to motivate and educate people to meet new problems. Examples of new problems would be the delivery of health care and applied problems of various kinds in the sciences. We should ask how appropriate our graduate education system is for meeting these needs. He thought that a professional degree should be considered, but should be generalized in some way. We need to sell to the public the desirability of supporting graduate education, and above all we need some alternative to the research-based Ph.D.

Inviting discussion, Dr. Carter asked whether it were true, as Dr. Cooke claimed, that we will be short of graduate students. (See paper by W.D. Cooke: "Some Questions on the Future of Graduate Education in the United States.") Surely there is a demand for graduate education, and large numbers of students are presenting themselves for graduate work. Dr. Cooke replied that although the assumption is made that there will be a huge influx of students into graduate work, he thought this assumption should be challenged. There is evidence that prospective graduate students will be in short supply in the face of growing numbers of graduate programs. The developing universities are trying to raise their status by launching graduate programs, although they put this in various pious ways. This sort of thing is occurring at each level of higher education. The two-year colleges are trying to become four-year colleges, the four-year colleges to become universities. Dr. Cooke said that what caused him great concern was that social and economic pressures for some time have forced students to go to college as undergraduates when they were not highly motivated to learn. This pressure is now developing in graduate education. Students also want different kinds of programs. In a seminar for graduate students at Cornell the students decided they wanted to discuss the effect of pesticides, the role of science in society, etc., but they were being forced into the traditional programs in graduate education. Students face a hard decision not to go to graduate school. The easy decision is to go on with

their formal education. They will receive support, and they will have four or five more years of student status without further responsibilities. Dr. Cooke suggested that the decision to go to graduate school should be made harder. He was impressed by the fact that those who pay tuition at Cornell as graduate students, about 5% of the total, are highly motivated as students.

Dr. Carter asked the opinions of others on this point. Is there in fact a floating population who should not be in graduate school at all, or is it that the people in graduate school need different kinds of programs? Dr. Sawyer asked whether the draft had not had an effect on graduate-school enrollments, keeping people in graduate school who were not highly motivated for graduate work.

Dr. Shannon commented that the data base often used in discussing graduate education---the undergraduate population---is misleading. One usually asks what percentage of the undergraduate population is now going to graduate school and compares the present percentage with that in previous years. But the present undergraduate population is a much more diverse group; more people in the age group, including the disadvantaged, are now going to college. Perhaps it is no longer valid to use the same percentages in determining what would be appropriate numbers of students going on to graduate school. The present situation gives a broad sense of unreality to the whole examination of numbers in graduate education. In the past, there was very stringent selection of graduate students. However, this was thought to be discriminating, and the country now follows a less stringent policy of selection.

Dr. Bronk commented that the kinds of education offered to graduate students were of extreme importance and should be examined closely. He was impressed, when he was at Johns Hopkins University, by the fact that many people in literature, for example, went into their field as graduate students because they were interested in literature. In their graduate programs, however, they found that they had to become very specialized and often lost their interest. They often are ineffective teachers. On the contrary, some of the better secondary schools, such as the Lawrenceville School, attract able generalists who are not so specialized that they cannot bring appreciation and enthusiasm for their subject to their students.

Dr. Miller said that the comments by Dr. Cooke and Dr. Shannon were highly valid. We have been providing special premiums to students to go into basic research fields. A prestige system has been set up that encourages them to do this, but does not pay sufficient attention to the quality of the people going into these fields or to their enthusiasm for research. Fellowships, scholarships, the draft, and other influences have moved people in this direction in the graduate schools. These pressures at the margin have moved them away from other areas where their services were needed, such as medicine, business, etc., into the more traditional scholarly fields. Graduate deans all over the country are recruiting graduate students assiduously, using these premiums and subsidies. Dr. Miller went on to comment that business, to be sure, pays for the educational product when it employs Ph.D.'s, but does not pay the full price because of these subsidies. The comment made the previous evening, that industry was now opting for baccalaureate-degree recipients because of the high salary expectations of the Ph.D.'s, was significant. He wondered what would happen if industry had to pay the full cost

of educating a person to the Ph.D. There is a problem here of the allocation of national resources. Is it more in the national interest to subsidize larger numbers of these people or to support the preparation of others in other fields? Some key questions are (1) whether this is worth the cost, and (2) if it is, whether we have triggered the system at the margin to push people in the right direction. Finally, no premium is put upon innovation in the universities. Faculties are not encouraged to develop new programs. We need new programs, not more output from the research-based ones in the arts and sciences.

Dr. Weaver said that he had a feeling we were fighting the "Chinese armies"---the faculties of U.S. universities. They are unwilling to change. They have built a protected way of life, a tidy little enclave. The reward system is based on research and publication, and the faculties want to do research. They want graduate students, lower teaching loads, and people to take over the teaching. A newly appointed young faculty person brings in all the old prejudices and wants to replicate the system in which he himself was educated. Dr. Carter commented at this point that we need the equivalent of "genetic engineering" for our educational system. Dr. Weaver went on to say that the problem of graduate education seemed to him to be soluble only in changes in faculty attitudes. We must work at the pressure points if we want change. Dr. Reitz commented, however, that one must also look at the role of the administrations in setting up such a reward system in the first place.

Dr. Page said that the data base indicates continued strong growth. We have probably oversold the Ph.D. and in the process have depreciated the master's degree. Should we not attempt to upgrade the master's degree? Dr. Cooke replied that in his opinion the fight to rehabilitate the master's degree had been irrevocably lost. He thought, however, that one could have an effect on this situation by cutting down the financial support of students. Dr. Page said that the two-year colleges and four-year liberal arts colleges are seeking Ph.D.'s for their faculties. Are Ph.D.'s really needed for this? Dr. Weaver commented that accrediting agencies demanded, or at least reinforced, this interest. Dr. Arlt said that this was no longer true; the accrediting agencies have quietly dropped the Ph.D. count as one of the criteria for accreditation.

Dr. Crawford said that he was concerned about the criticisms of the Ph.D. he was hearing without any accompanying statements about the many good things about Ph.D.-degree programs. It is not altogether a matter of prestige that people want the Ph.D. themselves and that colleges want Ph.D. holders. The teacher, even in a four-year college, needs current awareness of his subject to make it interesting, alive, and relevant. To possess this, the teacher must have had some kind of research experience---in order, for one thing, to acquire the cynical view toward the printed page. He must have had the experience of looking behind the published statement at the investigation which supported it. Publication is a process by which a man "keeps his thoughts clean", and the Ph.D. program provides this. We must keep in mind the positive features of the Ph.D. program at the same time that we try to correct its deficiencies. Dr. Morse replied that this could be an argument for research experience by graduate students and that he agreed very much with this. However, it did not mean that every graduate student needed to get the Ph.D. Dr. Crawford said that he would accept this, that one might very well diminish the size of the Ph.D. project in general and perhaps considerably for some students.

Dr. Morse said that last night the group regarded the employer as the consumer, then the student as the consumer, and now the group was talking about the faculty as the consumer in the graduate education system. He felt that we should concentrate on the student---the student should be the consumer. Under the present system, the student has no alternative to the Ph.D. He thought it was important for us also to clarify our ideas about the system we are talking about. What are the entry and exit points? Dr. Carter added that we should also find out for which jobs that society wants done the Ph.D. is not the most appropriate preparation.

Dr. Bueche said that he talked to many young Ph.D.'s, and his impression was that a goodly number of them were not excited by their graduate work. Employers generally see this. The young Ph.D.'s do not sense the significance of their work. They do not see their graduate work in the perspective of later need. Dr. Bueche said he often asks a young Ph.D. what was the significance of his Ph.D. research. Most of them, quite independently of the school where they did their work, cannot give a satisfactory answer. Whose fault is this? It is partly the fault of the student, but also of the professors. He cited the resistance to change of many academic programs. Materials science is a good example. Chemists and physicists are still stuck on this kind of a problem. Why don't they seek out new problems, more challenging ones? Students are not challenged because professors are not inspired.

Dr. Harris commented that in one of his visits to universities he talked to students about environmental problems, the problems of pollution of the atmosphere, the pesticides, drugs, etc. He found the students extremely interested. However, when he talked also to one of the professors, the professor said that he saw no reason for getting into these socially related problems because pure chemistry was exciting enough.

Dr. Bueche called attention to undergraduate education. Little has been done in innovation there. He felt that bright new ideas are just not rewarded in universities.

Dr. Cooke commented that the answer to Dr. Bueche's question about why Ph.D. research was done was "to get their Ph.D.'s". Dr. Page asked whether the people at this conference knew what they were in graduate school for when they were students. Dr. Weaver commented that we need to break the migratory laws of the system of graduate education.

Mr. Kearns returned to his suggestion of the previous evening about market analysis. He said that an affirmative approach to the problem of graduate education is needed. We should ask what are the problems and what are the needs, now and in the future. We should look into product design. In the past, we could "sell" everything produced; now we must look more closely at the product. Dr. Morse asked who is the consumer in this kind of a study---the student? Mr. Kearns said that, in his opinion, society is the consumer because society pays for graduate education.

Dr. Carter said that the group should look at the diverse needs for graduate education. Should not physics and chemistry, for example, be involved in the education of political scientists? What are the inputs needed into the creation of new institutions of society? Dr. Bronk asked what graduate

education does to encourage continued learning. He had been impressed by the paucity of individual libraries of Ph.D.'s. Dr. Morse said that we should not judge the magnitude of national problems by the numbers of Ph.D.'s in presently related fields only. We should not rely only on present building blocks.

Dr. Arnold commented on the values system involved here. Students who are approaching their Ph.D.'s want to stay profesionally alive. They see the possibility of doing this only through research and are reluctant to take jobs in colleges and small universities where research will not be possible. We should make teaching jobs more attractive as teaching by providing reasonable teaching loads, assistance, and various other forms of support. If this kind of attention and assistance were given to young Ph.D.'s, they would be willing to take teaching jobs rather than to consider only research possibilities. We might then have some alternatives to the proliferation of graduate programs.

Dr. Carter reminded the group that Harvey Brooks has suggested that a standard four-year Ph.D. program be developed. Postdoctoral work then would provide the extra time and experience in research needed by future researchers. The medical fields have done this more than the basic science fields.

Dr. Crawford commented that one could retain good faculty in the smaller places with a little help of the kind Dr. Arnold had suggested. Young people think that the only alternative to a graduate program is a 24-hour teaching load and that such teaching loads are characteristic of the undergraduate colleges. The country needs more undergraduate schools, but relatively few new graduate schools. We must think about ways of getting young Ph.D.'s into the four-year colleges which do not need many research-oriented Ph.D.'s. How can one get hard information on this---is marketing research needed? The University of Minnesota has tried this in a survey of its own Ph.D.'s to find out the extent to which they consider their graduate education relevant to what they are now doing.

Dr. Cairns said that these studies were of a "need-responsive" sort. We should find out what people think about the graduate education they themselves received. We should find out what employers think of the graduate education of their employees. Was it useful for their present work? Did the students overlap with other departments in their graduate work in order to get a broader view? The trouble is that we are dealing with a very closed system, one that is medieval in its origins. Political pressures and economic pressures, however, are less important now than they were in the days when university education was being formed. Why should the system be so isolated from the rest of society? The difficulty is that one is dealing with an isolated system that is trying to reform itself.

Dr. Weaver said that undergraduate teaching is one of the important markets for Ph.D.'s. We should educate a different kind of person than the research-oriented Ph.D. for this sector. Deep specialization is the problem here. Dr. Arnold said that his calculations showed that, if one wanted to keep teachers of undergraduates intellectually vital, it was less expensive to provide them with help than to set up new graduate programs. Dr. Harris said that need-responsive studies in this case might reveal what the

preparation should be. Dr. Cooke asked what prompted the Rockefeller Institute to become Rockefeller University. He thought that this was a question whose answer would be significant for the group. Dr. Carter said that, in his experience, one cannot dissociate research from graduate teaching.

Dr. Dickey said that the group had been taking about discontinuities between the market and graduate education and between research and teaching. We should look at the breaking down of discontinuities in many other places. For example, the discontinuity between good secondary education and undergraduate education is fast disappearing. There is now much less difference between work in the better high schools and work in undergraduate colleges than formerly. We need to hook up our examination of undergraduate and of graduate experience. Motivation for graduate study must be present from the undergraduate years. It is difficult to bring it out at the graduate education level if it does not already exist there.

Dr. Bronk returned to Dr. Cooke's question and said that of ten research institutes in this country and abroad, comparable to the Rockefeller Institute, only Rockefeller had survived because it became a university and had young people coming through. Dr. Morse said that the Woods Hole Oceanographic Institute was somewhat similar. Dr. Bronk said that they work with Harvard and MIT in their graduate programs. It is important not to become a graduate institution for prestige reasons only. Dr. Cooke said that if we cannot decouple research from graduate teaching, perhaps we can decouple graduate education from degrees.

Dr. Weiss then reported on "marketing" surveys being conducted by the Carnegie Commission. They are collecting opinions from faculty and from Ph.D.'s about the success or failure of graduate education. They are also doing some strictly demographic studies. Their investigations indicate that by the 1970's, about 50,000 people per year will want Ph.D.'s, not including the disadvantaged. If the latter are included, the number would be more like 80,000 per year. There will be, however, a leveling off of graduate enrollments in the 1980's. On the financial side, he could foresee no additional Federal funds for domestic programs in the immediate future. The assumptions underlying this forecast were that the tax bill would be passed, the welfare package passed, the Vietnam war phased out, and the uncontrollable programs such as medical insurance, interest on the debt, etc., would continue to expand. No money for domestic programs will therefore be available, and one can assume that there will be continued and even greater frustration for research-trained Ph.D.'s seeking funds to support their research.

Dr. Magoun commented that the suggestion of a marketing survey was the one positive suggestion that had emerged from this meeting so far. We very much need this kind of information. The Carnegie Commission will be able to contribute to this, but would not be able to solve the whole problem. We should consider what was done in previous surveys of graduate education. Two of the most notable were the one conducted by Berelson at the end of the 1950's and the one by Allan Cartter. These were broad surveys over the entire country, with questions designed around the foci of interest at that time. These foci have now changed, and the information should be updated. We should consider possible approaches by this technique rather than make up a number of ad hoc recommendations not based on valid and current information. He said that the

COSPUP studies had not tapped all of the possible sources of information. One should consider what the OSP Doctorate Records File could contribute. It contains information about the postdoctoral plans of new Ph.D.'s. We need to look also at the output of non-Ph.D. degree programs. Should not the collection of information be widened to include them? Also, the study of postdoctoral education in the United States contains a great deal of information relevant to graduate education. The report on that study will be published this fall. All of these should be looked at as possible models for collecting and interpreting information about graduate education.

Mr. Kearns suggested that we follow a disciplined, analytical approach to the problem rather than a strictly operations research approach. One should define the problem, look at the system, consider the need, consider the various alternatives, and prepare a set of weighted alternatives. Someone---an "astronomer royal"---should then examine the results and organize the programs for action. Dr. Kidd commented that the trouble with the Berelson and Cartter studies was that they were all internal to the system. A broader examination of graduate education is needed, not only introspective examination by graduate deans. The two-year colleges, the four-year colleges, industry, and other interested sectors should be brought into the examination. The whole range of problems should be considered.

Dr. Bueche said that in his opinion we need a whole series of coordinated studies. We should look at the whole system and ask what are the needed outputs of trained people. He suggested three studies, of which (1) and (2) would be inputs to (3): (1) a study of people needed for teaching, to be conducted by representatives of colleges and universities and government, but not only graduate deans; (2) a study of the needs of commerce and industry for highly educated people, to be headed by economists and industrial people, with some university people taking part; and (3) a consolidating study by a presidential commission, composed of top economists, government officials, university presidents, and others, to develop guidelines for Congress to use in setting support levels for graduate education and research and development. Dr. Bueche said no one has told Congress how much R&D is needed and how many Ph.D.'s are needed. He was not sure that research and development in industry would continue to increase as it had in the recent past. Perhaps a slowdown in the rate of production of Ph.D.'s is indicated, to be accompanied by a corresponding increase in the number of people holding special types of advanced degrees. Dr. Harris said that we should add a third sector to the studies Dr. Bueche suggested---the public sector of government, including local, state, and national government. Dr. Crawford said that the results sought should be not only the numbers of Ph.D.'s but also the types of preparation needed. Dr. Bueche said that he agreed with both of these suggestions.

Dr. Sibley mentioned the work of the Commission on Human Resources and Advanced Education. Their report will be published this fall. He said that he was not entirely satisfied with the results of the Commission's work, but that the organization of the Commission furnished a possible model for the mechanism being considered here.

Dr. Kidd issued a mild warning. Any effort of the kind now being discussed would not produce an authoritative, dispassionate analysis but rather a statement based on certain assumptions. It could yield a high-level,

sophisticated statement of needs and recommended action, but not a completely disinterested one. Dr. Bueche said that he agreed, but that any guidelines provided by such an activity would have to be updated from time to time as the situation changed.

Mr. Kearns at this point drew some graphs on the blackboard, illustrating his ideas about the growth of the market for any product with time and how that was related to the rate of growth. He commented that growth is needed for life in any kind of a situation and that we should not be thinking about eliminating growth completely. Dr. Cooke, however, said that growth without limitations is not necessarily good. The undergraduates at universities are saying this very loudly these days. They do not want to be forced into the growing system of the kind that they see around them. This is leading to important social problems.

Dr. Shannon then commented that it was difficult to be wholly logical. In our approach to these problems we have talked all around the various elements. The important topic, in his opinion, was the Federal intent, or the Federal perception of need. Federal policy for support of science and research has been based for over a decade on the physical defense of the country, space, and health needs. Comparable needs are now emerging that do not demand the technical content of these three. Urgent sociological problems that we now face demand a technically less sophisticated approach. For this reason, the tendency to project the last twenty years into the next twenty is invalid. One first must make some type of social model for the future and see what it would require of graduate education. He was troubled about the data base used for projections, about which he had spoken earlier. He was also troubled about the lack of consideration in our discussion of the underlying social forces.

Dr. Bueche commented that he was worried about the problem of providing the national resources needed to treat these pressing social problems. We must not forget what must be done to produce the wealth needed to solve these problems. To insure that we have these resources requires that our industrial base be competitive worldwide. Looking abroad, we see the possibility that the technological gap may be turned against the United States. We must not lose the basis for industrial production in our concern for the solution of important social problems. Both must be considered in thinking about the problems of training high-level manpower. Dr. Shannon replied that he did not mean to imply that modern technology would not be needed; rather, that the new problems would be added to the old ones.

Dr. Carter said that the comments by Shannon, Magoun, and Bueche all have the common feature of pointing to the need to describe the future needs for highly educated people and that the attention of the conference was now directed toward something that he thought was highly significant.

Dr. Fusfeld said that in thinking about Dr. Bueche's suggestion he was ready to accept the need for collecting statistical data, but that caution should be observed in doing this. He felt that a number of projections of need for scientists and engineers had seriously missed the mark. One must go beyond the numbers and look at their significance, particularly at the activities that the people who are being trained will engage in. He reported briefly on a survey of industrial utilization of physicists being conducted by the

American Institute of Physics. The AIP is trying to determine the attitudes of industry towards people with preparation in physics and to describe the ways in which these people are being utilized. One of the questions that was asked of industrial managers was whether they felt that their company faced a shortage of Ph.D.'s or already had a shortage of Ph.D.'s in physics. Most of the managers said that they had a shortage, but on the other hand they reported that none of their significant programs of research and development had been delayed as a consequence. One must therefore be ready to interpret any data that come out of needs surveys.

Dr. Bueche said that one must be careful about who supplies the data concerning need. Personnel people make their living from hiring personnel and interpret needs and supply data in a different way from others who would not have that direct interest. Dr. Kidd said that we should not lose sight of the quality and flexibility of the products of Ph.D. programs in playing the numbers game. Numbers of degrees granted alone are not sufficient.

Dr. Tischler said that the point of view presented by Dr. Shannon seemed to him extremely important. How can one convince Congress of the need to support graduate education and research and development? Does a presidential commission do any good? Dr. Shannon replied that he had little faith in the ability of presidential commissions to have a very deep effect on problems. The way in which the budgets of the National Science Foundation had been treated illustrates the problem. The justification of the NSF budgets has been based on the need for fundamental research. On the contrary, the health programs took off because of broad public appreciation of the problems in the health field. The effect of Sputnik on space programs and science education programs was also broad, and those programs received broad support. He added that there are many educational expenditures at the Federal level that go beyond the formal programs that we have been discussing here. Education/manpower expenditures external to the Office of Education for fiscal 1970 amount to 3.8 billion dollars. This is an extraordinary mixture of activities by the Office of Economic Opportunity, the Department of Defense, the Department of Labor, etc., including such things as development of "civilian skills". This mixture confuses the issue. The Federal establishment needs to express its public purpose in education and has not done this so far. It may be possible to deflect some funds from certain areas into other more productive activities. We should try to get a statement of Federal intent in this area. In the mind of Congress, there is a decoupling between science and education because the agencies have not done a good job of coupling them.

Dr. Bueche asked how we can get Congress to understand the trade-offs and settle on some of these goals. Dr. Shannon said that presidential commissions don't reach down into the structure of government and affect the allocation of resources. He suggested that a council be set up similar to the Council of Economic Advisers to cover science and education. It would comprise a small but full-time group who would bring in advisory groups of specialists as they might be needed. He said that any group that is purely advisory, separated from the capability of affecting allocation of funds, is not able to be very effective within the Federal bureaucracy. Dr. Bueche commented that the establishment of such a council might be one of the recommendations of this group. Dr. Kidd said that he thought no one mode of operation would produce the desired results. We need a plurality of effort.

Dr. Arlt said he felt very uneasy about this recommendation. Do we want the Federal government to tell graduate education what to do? Dr. Weaver replied that educational people have not been talking about these problems and there has not been an input to government circles of their views. Dr. Crawford said that what was probably needed was an advisory group that would carry on continuing studies and maintain a data base on a continuing and current basis. Dr. Bueche said that it would be necessary to develop some practical limits as to the area of concern; we were not proposing, obviously, a study of all educational problems. Dr. Shannon replied that he was not suggesting that we try to solve all educational problems. He went on to say that the Council of Economic Advisers originally did not have much influence within the Federal government, but had gained it in time. The problems that the Federal government faces required it. Something similar might happen in the near future with a science and education council if one were formed.

Dr. Carter said that the first three studies suggested by Dr. Bueche must come before any efforts of this kind, i.e., to set up a council or some continuing body, would succeed. We must define the need for trained people, and the surveys and studies would help to do that. Dr. Bueche said that he agreed. Industry has not spoken up about these needs heretofore. Why was this? Industry should take part in these discussions, because if universities alone say these things the statements seem to be examples of special pleading. He had not seen this kind of participation from industry. Presidents of industry have not said these things.

Dr. Shannon said that possibly something might come out of hearings of the Daddario Committee. Although it may not be wise to concentrate all science activities, it may be good to concentrate the policy formulation at least. Dr. Weiss said it would be very important to get Presidential sponsorship of the proposed council, and Dr. Shannon said that he agreed. The council should involve both the Executive Office and the Secretaries of the departments that would be most affected.

Dr. Bronk said that he could support the idea of involving groups external to the graduate-education community in the effort to support graduate education. He cited as an example the work of the Committee to Save Library Funds, of which he was chairman. He was able to get people from the outside to serve on the committee and to present testimony about the need to provide financial assistance to the universities. The committee was able to create a groundswell of support for these funds among people who were concerned with a reevaluation of national policy in this area. They stimulated columnists to write about the problem and people to write letters to Congressmen. As a result, they were able to get a 1.1 billion dollar restoration of funds for this purpose.

Dr. Cooke expressed some personal pessimism about the willingness of academia to support some of the things that we were talking about here. He said that the academic establishment will probably never take a stand in favor of changes in graduate education. No one there wants to make a decision. They believe in the hands-off policy in graduate education---no limitations on their freedom to conduct it as they see fit. Someone outside the graduate education community would have to make the decisions. Before anything effective could be done by the graduate education community they would have to clean their own

house first. There were many very difficult and serious problems that would have to be worked on internally.

Dr. Crawford replied that there was some truth in this. He asked whether the proposed council or some type of central focus should be set up under the Four Councils to give it the kind of broad sponsorship needed. Dr. Kidd said that such an organization or such a sponsorship would not make possible an effect on the budgetary process within the Federal establishment. Dr. Shannon said that at present there was no place for the educational community to go to in order to register their support or to have an effect on Federal policy and programs. Dr. Crawford said that the Selective Service situation provided an example. There had been no consensus expressed by the academic community on the drafting of graduate students, and only here and there had a voice been raised from the academic community about these problems. Dr. Bueche added that industry also did not protest the draft regulations.

Dr. Arnold suggested that perhaps industry did not need as many top-level people in research and development as formerly. Dr. Bueche said that we could not afford to be complacent in that respect. He cited Japanese competition, which is becoming increasingly keen. He said that a number of American companies had set up foreign manufacturing facilities in the Far East to reduce costs.

Dr. Harris said that we have been bearing down on the education community in this discussion. We also need to push industry to consider activities to develop their own staff. Dr. Carter said that there was a five-year lag in preparing Ph.D.'s. He wondered whether there had been any planning in industry for manpower requirements. Dr. Harris replied that he was aware of very little. In any case, there is a need to look at plans every three months, on a kind of a rolling basis.

Dr. Shannon asked whether any information were available about Japanese education programs for people in industrial research and development. Dr. Bueche said that what impressed him was that the Japanese had no hesitation in taking a new idea and improving it. They were quite different in this respect from Americans. He thought that the Japanese in fact were more innovation-oriented than we were. He went on to say that our best-known inventors believe that university training in this country in effect breeds innovation out of people. Dr. Cooke said that in Japan they prepare people within industry for several years before putting them into development work. Here, our practice is to shift people into sales after a few years of work in research or development and to lose the usefulness of the earlier training.

Afternoon Session, Monday, August 25, 1969

The session was devoted to meetings of small working groups. Their reports are presented below.

Morning Session, Tuesday, August 26, 1969

Max Tischler, Chairman

Dr. Tischler said that the first item of business would be the presentation of reports by the chairmen of the working groups that had met Monday afternoon. He called first on Dr. Weaver to present the report of Group 1.

- 0 -

Report of Working Group (Monday)

John C. Weaver (Chairman), Richard Armitage, Charles M. Kearns, C. V. Kidd, H. D. Rhodes, Max Tischler, T. W. Tuve, J. Weiss.

Questions: Has the surge in the number of advanced degrees granted during this decade established a sound basis for continuation in the future? Is it leading to an oversupply of people with specialized research expectations? Has it occurred at the price of a decrease in quality? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies that might require further study?

Group 1 interpreted the first question to mean: Can this growth be expected to continue? Their answer was: Probably not. The growth rate will undoubtedly slow. The consequence of continuation of the present trend (Fig. 1) would be the production of something like 700,000 Ph.D.'s per year in the year 2000 at an annual cost of over $100 billion (Fig. 2). Most of the group thought that even lesser, but still great, increases in the rate of granting of Ph.D.'s would not make sense, but a few were not so sure. Continued growth would depend on two limiting factors: (1) the finding of new areas of demand that had not yet been developed, and (2) the finding of new financial resources. Financing limitations will be an important constraint on the further growth of graduate education. Private universities are in financial trouble because the growth of philanthropy is limited; public ones are limited by the tax revolt. Both public and private institutions look to the Federal government for help, but the Federal government is cutting back its support.

The second question for the group was whether the increase in the number of advanced degrees granted was leading to an oversupply of people with specialized research expectations. Group 1 feels that at present this is a spotty picture. There is no great shortage at the moment in industry, government, or teaching. Unless large new undeveloped needs are found, there could be oversupply---in some fields before others. The group discussed at some length whether industry were satisfied with the preparation given to Ph.D.'s. Industrial people feel that many Ph.D.'s lack creativity and display rigidity of attitude, intellectual arrogance, and basic insecurity because of heavy specialization. Industry may decide to do more training of its own people if this continues to be a problem.

FIGURE 1

PhD's GRANTED IN THE U.S.

(ACTUAL THROUGH 1968)

SOURCE: NRC, Office of Scientific Personnel, Doctorate Records File.

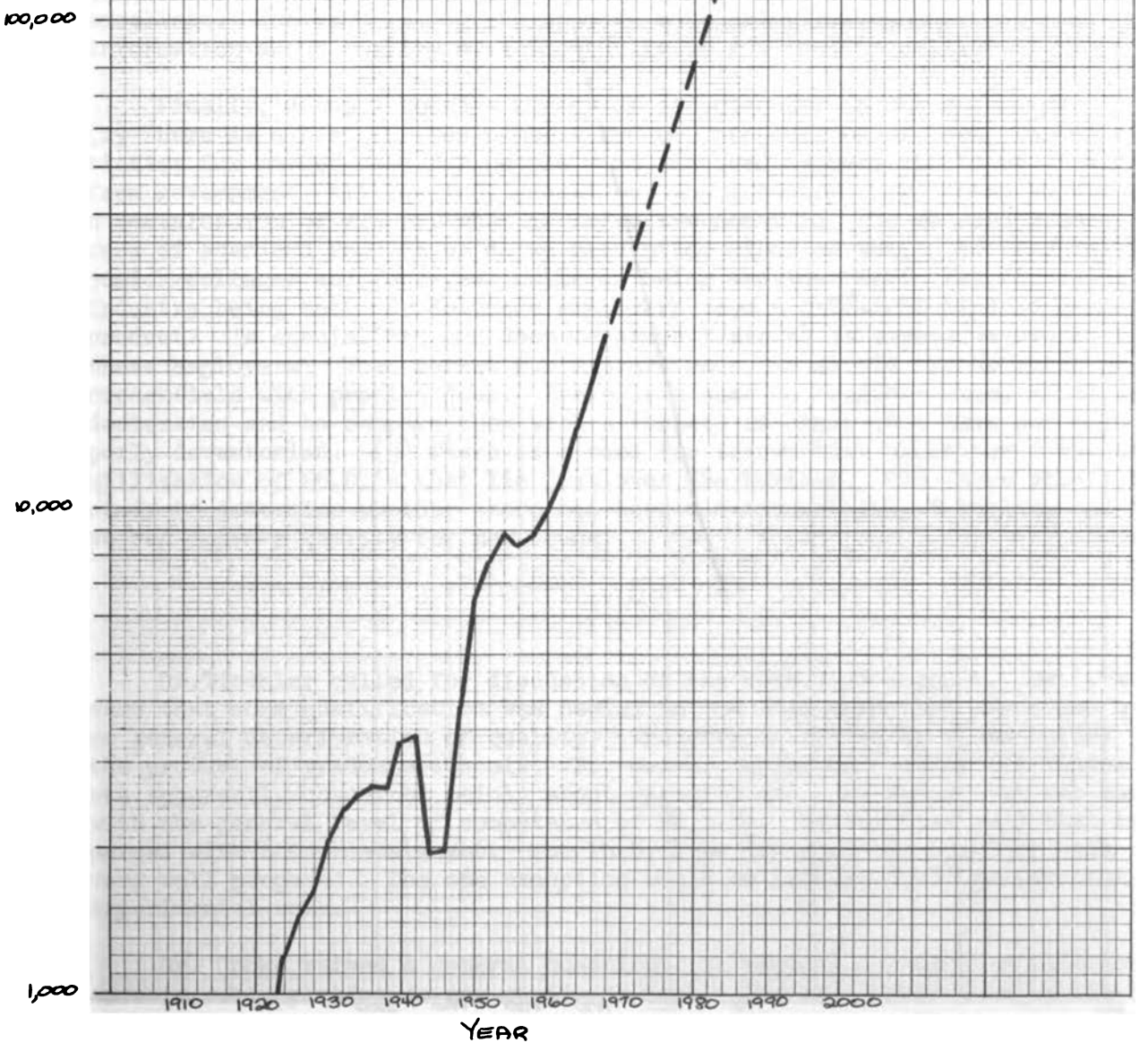
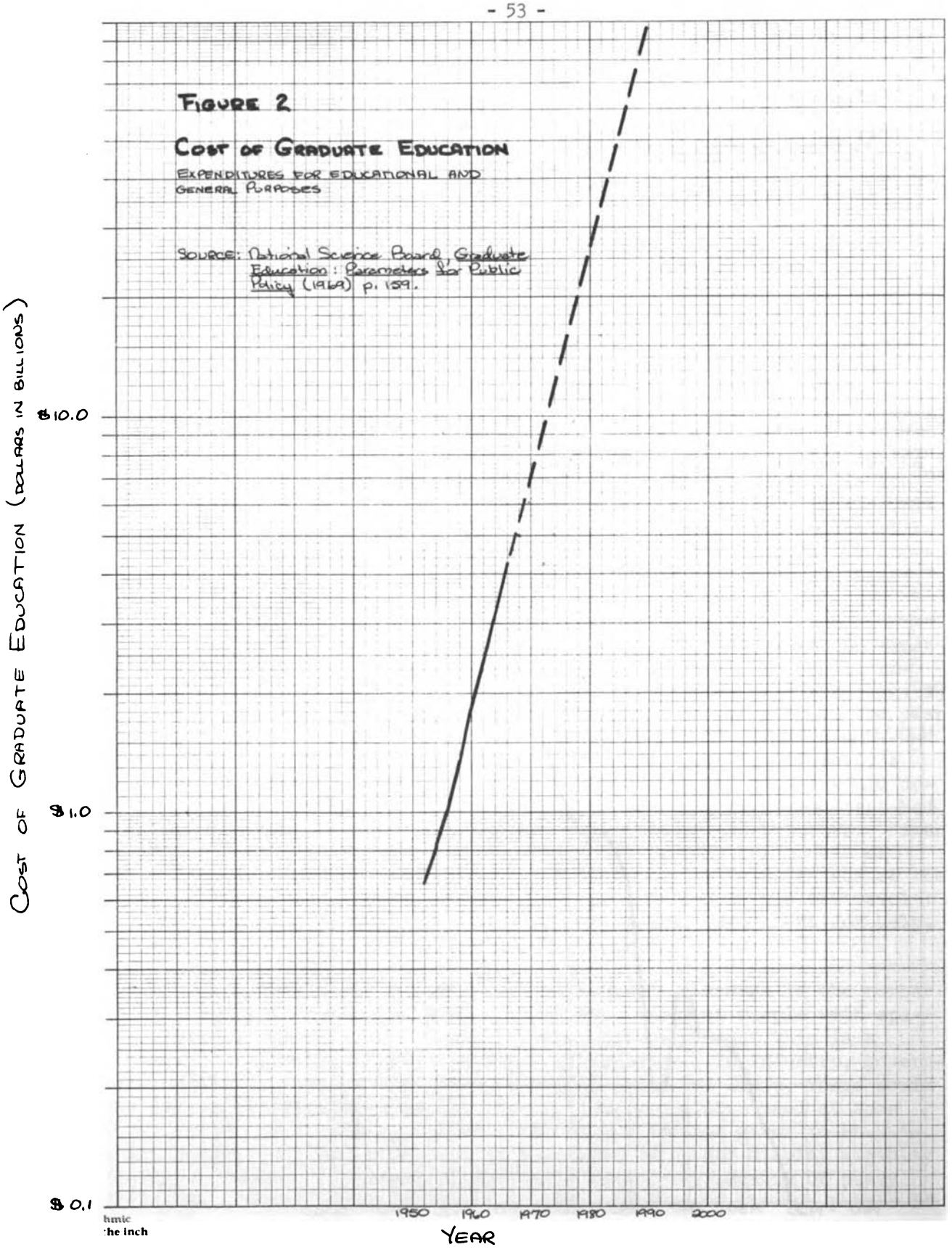


FIGURE 2

COST OF GRADUATE EDUCATION

EXPENDITURES FOR EDUCATIONAL AND GENERAL PURPOSES

SOURCE: National Science Board, Graduate Education: Parameters for Public Policy (1969) p. 159.



Concerning whether a decrease in quality has occurred, the group believes there are no solid measures for quality upon which to base an answer. The group went on the basis of hunch and opinion. They believed that probably, for the entire national scene, the graduate product is the best ever. Quality has been elevated considerably. Opportunity and access have been increased. The quality of work has been elevated especially in the middle-level institutions. The group considered what has happened to quality in the top places. The important questions are whether students are getting enough individual attention in these large institutions because of large enrollments. In the physics department of one major university, there were 260 Ph.D. candidates. Twelve professors were there to work with them, but some of these had only one or two candidates each, putting a large load on the others. In another large institution, one professor was responsible for 65 Ph.D. candidates in French literature. It seems likely that some reduction in quality is occurring in the top institutions because of crowded seminars, classrooms, and laboratories. There is danger that the major institutions will become less excellent. The country may end up with mediocrity triumphant. We need more information about quality effects, but it is not easy to collect.

Finally, Group 1 found a number of deficiencies in our knowledge. (1) There is a need for new numbers and new projections of need; better statistics for market need for people with advanced degrees should be obtained from government (all levels), education, and industry. (2) There should be a reevaluation of exactly what it is we are counting. Do we need greater numbers of standard Ph.D.'s or do we need other kinds as well? Is teaching in junior colleges and four-year colleges being provided for? Are the needs of industry being met? Or do these employers need a different kind of graduate product? Is specialized and deep research training an expensive overkill for these employers? When market surveys are made, we should try to match precise credentials with precise jobs. There is a need to consider other kinds of doctorates and to compare them with a variety of needs that have not been properly inventoried. (3) There is a need for information about new areas of utilization of Ph.D.'s that lie just over the horizon. (4) There should be a study to determine whether there has been a deterioration of quality and how we can improve quality for new needs.

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Dr. Tischler called for discussion of the report of Group 1. Dr. Crawford said that some qualification was needed in the statement that there had been no general deterioration of quality. Industry is evidently dissatisfied with the product of graduate schools. Dr. Weaver explained further that industry was apparently concerned mainly about rigidity and narrowness, but was content with the general level of competence of Ph.D.'s. Dr. Tischler said that he agreed with this restatement. The Ph.D.'s he had come into contact with were very well prepared. The one exception would be perhaps their preparation in experimental work.

Dr. Cooke raised a general question. Do reports of the kind this conference is contemplating do any good? In reply, Dr. Reitz said that in the U.S. Office of Education, in working on programs such as the NDEA, etc., the OE made great use of such reports. They keep reports and refer to them. It is true

that, at the top level of any agency, political considerations come into the picture also to determine actions. Matters such as inflation have to be considered. Secondary political considerations are important. In the Office of Education, for example, one of these decisions was that money would be put on people rather than on things and that within this decision every effort would be made to assist the disadvantaged. Recommendations on fellowships would be extremely important to the Office of Education. Dr. Kidd said that in his experience reports have a cumulative effect on the tone of discussion. Rarely is a report identifiable as the sole cause of an action, however. Good reports set a climate of opinion. They are often introduced into budget testimony. Dr. Harris said that he thought it was important that these things be put on record by means of reports because of competition with other needs when agencies make up their budgets. Dr. Stone said that in his experience reports had a cumulative effect, but seldom an immediate effect. Dr. Fontaine said that because the National Science Foundation does not have all of the advisory assistance needed and is not able to send its staff out to consult widely and frequently, reports are extremely important and are very much needed. He thought that the timing of a report was a crucial matter. For example, the Gilliland Report on the needs for Ph.D.'s in the EMP fields had a good effect because it appeared at a strategic time. Dr. Shannon said that a report was important to the extent that it answered questions in the minds of the Executive, Congress, and others. Few important actions are unrelated to these reports. However, academic reports have not been as effective as they could be. Dr. Bronk said that the establishment and growth of the Woods Hole Oceanographic Institute was an excellent example of something that originated from a report, in that case the work of a committee of the National Academy of Sciences. Another example was furnished by the work of the Committee on Atmospheric Sciences in stimulating research in its area.

Dr. Morse said that he wanted to go back to the statement by Group 1 that no recognized shortage existed. He thought that it was probably not fair to make such a statement in the absence of comprehensive and precise knowledge. In his experience, anthropology and some other fields were experiencing a short supply of Ph.D.'s. Dr. Weaver replied that he agreed that information was spotty. His group simply said that there were no very noticeable shortages. Dr. Morse said that in some fields the shortages were very noticeable---medical doctors, for example, and city planners. Dr. Arlt said that in the humanities a number of shortages exist. He referred to the report of the Committee on Graduate Education in the Humanities, which will be published about December 1st of this year.

Dr. Magoun returned to the question of what reports accomplish by pointing out that the recommendations of the Commission on Humanities in 1964 led to the National Endowment for the Arts and Humanities.

Dr. Weiss said that shortages should be compared with the willingness of society to pay for services. He pointed out that at one major university there are five historians of science looking for jobs.

Dr. Harris now presented the report of Group 2.

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Report of Working Group 2 (Monday)

Milton Harris (Chairman), Arthur Bueche, Bryce Crawford, Alden Dunham, L. H. Farinholt, Thomas Fontaine, Lawrence Hafstad, Carl Krieger, Sidney Millman, Wayne Reitz, Frederick Stone.

Questions: Do present doctoral programs in fact inculcate rigid attitudes toward research specialization? Will present degree programs satisfy the needs of industry, government at all levels, and the universities and colleges, including two-year colleges? Are the expectations of graduate students concerning their degree programs being met? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies that might require further study?

Question 1: Do present doctoral programs inculcate rigid attitudes toward research specialization?

The overall answer is yes. However, there must not be a severe overreaction to this. The present system is not all bad. We do need a broad spectrum of people. For example, the present system does well for producing university professors. It also does well for producing specialists with great depth of training (although here it was emphasized such people should have broad vision) for some very large companies (General Electric, Bell, Du Pont, etc.). For the small and intermediate companies, there is greater demand for broader and more flexible people.

Such programs do very badly from the point of view of teachers for small liberal arts colleges or junior colleges. Such programs do not do well for overall industry, especially from the point of view of their influence on motivation and attitudes of students. They do indeed tend to foster rigidity in the student.

Question 2: Will present degree programs satisfy the needs of industry, government at all levels, and the universities and colleges, including two-year colleges?

The discussion here tended to overlap with the discussion of Question 1.

We do indeed need many Ph.D.'s, but these are neither the answer to nor the fulfillment of our manifold needs. Industry, for example, can use more good bachelors and masters. A number of such people, working with good research leaders on good industrial programs, become equivalent to many Ph.D.'s. Such people have the advantage of thus being trained in applied research without developing mental barriers to this type of activity. It was suggested that industry consider doing some of this as a complementary activity to that of the university and on a basis which could conceivably lessen the great financial burdens of the university.

There was much discussion of the needs of liberal-arts and junior colleges. Their importance and needs are recognized, but we are not doing well at staffing them. We need a different or an intermediate degree with status. The Doctor of Arts degree was discussed at some length. There are a number of problems raised, especially from a status point of view in competition with the Ph.D. degree.

Running through the entire discussion was the question of motivation or attitude as we envision them. They do not seem to be widely fostered by present Ph.D. education. The graduate student, in his own mind at least, does not seem to have a choice. If he does not get a position in one of the better universities or research institutions, he feels that he is settling for something second-rate.

Question 3: Are expectations of graduate students being met?

As pointed out in Question 2, the answer is yes only if the majority get good university posts. In many instances, there is being created a mismatch between expectations and needs. As a young Ph.D., who had to take a position in a small liberal-arts college, stated, "This is a fate worse than death". Another problem discussed by Group 2 was the feeling on the part of graduate students that they would like to do more for the good of society, in a direct social-action sense, than they are given the opportunity for in their standard degree programs. They would like to do this as well as earn a living. More should be done on this point to make students happier.

Question 4: Deficiencies in our knowledge.

It was felt that we don't need too many further studies. Many of the problems and needs are recognized. Continuing reappraisal in such rapidly changing times will always be necessary. We also need better data. (There is a tendency to get glib with superficial numbers.)

Rather than more studies, we need boldness, experiments, and action on present ideas and suggestions.

It was stressed that government (State and Federal), through funding programs, could influence these trends and experiments. At the present time, most government funding perpetuates the present research-oriented Ph.D.

Faculties of many universities appear to be major barriers to such innovation. It also appears that the greatest resistance occurs in the ranks of the younger faculty people.

All agreed that "instant change" is impossible. After all, innovation is a war, which must fight many battles. Progress will be made by chipping away at the present system.

We must supply great needs in the following areas: (a) universities, colleges, etc.; (b) public service, and (c) industry. These are clearly intertwined. It must be remembered that massive support for education, as practiced in the United States, cannot be done without a thriving and productive industrial community. Similarly, a successful industrial system cannot exist without a thriving educational complex.

In the discussion of the report of Group 2, Dr. Miller first asked about the suggestion that industry might have to do its own training. What could industry do in this regard that would be better than that done by universities? Perhaps industry should take on portions of graduate education. Dr. Harris replied that they should, but industry would still be mainly dependent upon the universities. Dr. Millman said that industrial training would in any case have to be supplemental and in the nature of continuing education. Dr. Tischler said that in his company they have about 400 Ph.D.'s or M.D.'s. They want the best researchers. But they want the universities to motivate the student, to make the student realize that industrial research is honorable. Secondly, they would like their researchers to be able to switch to new fields and not be narrow and rigid. Dr. Bueche said that a number of companies already have sizable educational programs. Their programs are not as strong in continuing education, however, as they should be. Mr. Kearns said that United Aircraft Company found educational opportunities too few where its main plant was located. They gave support to Rensselaer Polytechnic Institute to establish a campus near Hartford to offer educational programs; this center has thrived.

Dr. Cooke asked whether there was too much focusing on formal education as compared to informal training. He thought that informal training could be very effective. A more serious problem is the continuing education of the non-Ph.D. He is not encouraged by the system to go on. Dr. Harris replied that it is true that there has been an overkill on prestige of Ph.D.'s. Non-Ph.D.'s can rise more readily in smaller companies. Dr. Krieger commented that this was true in his company. Dr. Millman said that there was less concern about formal qualifications in industry than in the universities. The universities insist on special qualifications much more than does industry. Dr. Bueche said that in the research division of major companies the Ph.D. is essential. It makes a difference to the employee in pay and other perquisites. In operations, however, the situation is quite the opposite. The generalist has the advantage. The Ph.D. is a specialist there and is at a disadvantage.

Dr. Miller, the chairman of Group 3, now presented their report.

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Report of Working Group 3 (Monday)

John Perry Miller (Chairman), Robert W. Cairns, Herbert Carter, W. Donald Cooke, John S. Dickey, Wayne C. Hall, Robert W. Morse, John E. Sawyer, James A. Shannon.

Questions: What effect will social, political, and economic developments, such as the draft, student unrest and dissatisfaction, protests, reaction, and the rising expectations of the disadvantaged have upon graduate education? Are imbalances developing among fields in the granting of doctoral degrees, in view of anticipated manpower needs? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies which might require further study?

The committee agreed that great changes are under way in the colleges, resulting from the general problems of student unrest and minority students, and that these forces are already hitting the graduate school and will intensify. It was our conclusion that they will generate pressures for revisions of graduate school curricula, some of which are long overdue, but some of which may need to be resisted. Much of the pressure in the past has been at the undergraduate level, but there have already been pressures for revision of graduate programs and some response. The Chairman cited the parallel revision of graduate programs in Political Science on several leading campuses.

The problem of standards for admission and performance of students from minority groups, especially black students, are already pressing in the professional schools. In the professional schools such as law and medicine, where the curricula are influenced strongly by the requirements of external professional groups or examination procedures, there is a widespread challenge to institutionalized authority, challenge in which both the minority groups and others are engaged. This challenge is especially strong from minority groups who feel urgently the need to increase the number of persons from the minority groups who have the credentials of the profession, particularly in law and medicine. It seems likely that these pressures will become stronger.

The graduate schools must take a hard look at their standards for admission and achievement and the indices that are relevant. The number of students from the minority groups graduating from the better colleges is relatively small at present, and the quality of education in the southern black colleges is frequently insufficient to enable the students to compete for admission to the better graduate and professional schools by normal standards. This problem should become less serious in two or three years in view of the great increase in enrollment in the better undergraduate colleges and the efforts of the southern black colleges.

There are several problems which need study with reference to black admissions. First is the question as to what graduate and professional programs and in what proportions the minority groups are likely to seek admission and complete the program successfully. It is possible that their contributions in the immediate future to the black community are not likely to be equal in all the professional and graduate programs. What programs do they wish to enter and are there reasons for providing special incentives to influence their choice? Second, a study, perhaps an independent audit, of the performance of minority groups in the burgeoning undergraduate programs seems appropriate. The colleges are experimenting in many ways with the admission and training of students from minority groups. They are using different criteria and doubtlessly will have varying success. The graduate schools, as well as the colleges, could learn a great deal from this experience and it is to be hoped that some independent auditing procedure may be developed to capitalize on this experience. Third, there should be careful analysis of the effectiveness of various indices or measures used by the graduate schools in making their admission decisions. Fourth, the desirability of special programs for the minority groups should be discussed, especially programs for practitioners of law and medicine.

Student unrest, which started to a large extent among the undergraduates, already plays an important role among the graduate students and has been associated on many campuses with the organization of the teaching assistants. Although unrest begins in the humanistic disciplines of history, political science and literature, it appears to be spreading to the more scientific disciplines. This unrest has led to many charges, including poor teaching, the unavailability of professors, the excessive commitment of the university to research, the irrelevance of many graduate programs, excessive specialization in graduate education, and the excessive emphasis upon the research-oriented Ph.D.

One interesting factor is what may be referred to as the inversion of the relationships between undergraduate and graduate education. Traditionally, the undergraduate experience was expected to be one of breadth, whereas graduate education, especially in the arts and sciences, was expected to lead to specialization. However, one of the charges is of an excessive amount of specialization in undergraduate programs in recent years as the result of the excessive influence of the departments and disciplines upon undergraduate curricula. We are now witnessing a request on the part of many graduate students for more breadth in their training, a request which has been echoed in part by many of the consumers of the products of our graduate schools, including college presidents and industrial employers. On the other hand, some college presidents warn that the current pressures at the undergraduate level are moving in the opposite direction, i.e. toward breadth, and we may well find that if the students have their way we will move from specialization at the undergraduate level to uncontrolled anarchy. The working group feels that this whole problem of the relationship between undergraduate and graduate education needs further study.

The working group concluded that there should be a reconsideration and reform of many graduate programs and the development of new alternatives. In coming to this conclusion, however, the group agreed that in view of the growing emotionalism among our students and their commitment to instant solutions to complex problems attention must be given to the maintenance of rigorous analysis in all programs, including the Ph.D. program.

We visualize several changes. First, many existing Ph.D. programs need to be reconsidered. There is nothing sacred about many of the current formal requirements, and a careful analysis of various programs on some campuses has indicated that the heavy hand of history is still controlling, rather than careful analysis of programs in the light of new knowledge. Such analysis, we believe, would lead to revision of existing programs in some cases to provide new programs and new alternatives within the programs. Second, it was the opinion of the group that the graduate school should provide new alternative Ph.D. programs. It seems probable that new transdisciplinary programs will be developed, in part in response to the logic of ongoing inquiry, such as the new programs in medical engineering and communication and information sciences. Other programs will be developed in response to the pressures of the community in which the universities live. One of the possibilities is problem-oriented programs involving the cooperation of several disciplines. Transdisciplinary problem-oriented studies will inevitably raise questions concerning the relation between the educational program and the relevant disciplines. Experience with area-studies programs may be relevant. A third development which we

foresee is the initiation of non-Ph.D. programs in the graduate and professional schools. The working group looks with favor upon the development of programs for college teaching, a subject which will be discussed in more detail by another working group. But more than this, we visualize some terminal masters programs to train people for various operational and semi-professional positions such as the management of urban affairs. Finally, we believe that increasing attention should be given to continuing education. If such programs are developed more effectively, many students may find it desirable not to go on to graduate school immediately upon completing their baccalaureate but may enter industry and government directly, receiving much training on the job.

By developing these various alternatives to the existing programs, we believe that our able students may be satisfied more effectively and some of the legitimate causes of unrest diminished.

The group directed its attention to the effect of the draft on graduate education. We recognize that the data on the current and prospective effects of the draft are not very adequate. The committee suggested that it would be appropriate to call to Dr. Handler's attention the fact noted by Dr. Arlt that there is a directive on General Hershey's desk providing that a student who is called up might have his effective date of reporting postponed until the end of the year. We believe that the Academy may wish to make some representation to the executive branch about this matter.

The group recognized that the draft has caused significant disruption to graduate education in the past and that this will continue for some time after the revision or ending of the draft. In the event of demobilization, we are not at all certain what the effect upon the universities and the flow of graduate students will be. We assume that many who dropped out of or were deflected from graduate school will return to graduate school. But we are not at all sure that most of those who were planning to go on to graduate school will return, in view of the widespread disenchantment with formal education on the part of many young people. Nor are we certain that they will distribute themselves among the various fields of study in the same pattern that students going on to graduate school without interruption do. Some investigation of intentions would be appropriate.

Finally, we took cognizance of the fact that in the past a large number of students remained in college and graduate school because this was an alternative to military service. We anticipate that when there is a widespread demobilization there may be a substantial dropout from undergraduate and perhaps even graduate study of students who in the absence of the draft would have dropped out earlier, either permanently or "to find themselves". The impact of such dropouts on college and graduate school enrollments for several years to come may well be very great. In short, we are not at all certain that recent trends are indicative of the steady state of flow of baccalaureates into graduate study. We recognize the need for more hard data on all of these matters and the difficulty in obtaining such data.

Unfortunately, the group did not give much attention to the question of imbalances developing between various fields of study. We are all aware of "straws in the wind" but we are not aware of much hard data on this matter.

We did, however, take cognizance of the fact that there is considerable under-utilization of resources in many graduate programs and are seriously concerned about the development of too many new schools and departments engaged in graduate education.

Finally, the group gave some attention to the question as to how to develop an overall strategy for graduate education and its implementation. We recognized that the problem has several facets. First, the development of priorities and of plans for the implementation of these priorities. Second, reform within and cooperation of the universities. Third, the coordination of the activities of the various administrative agencies. And finally the development of a commitment on the part of Congress to these priorities and plans. There was a feeling on the part of some of the group that it would be desirable to establish some executive agency, patterned perhaps on the Council of Economic Advisers, which would be responsible for looking not at just graduate education but at the full spectrum of education. This group would be responsible for reviewing the priorities and plans, advising the executive office, including the Bureau of the Budget, and communicating with the universities which are responsible for education and with the users of educated manpower. They would also serve as advisers to and prodders of the Congress and various Federal agencies.

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In the discussion of Group 3's report, Dr. Kidd first asked for more information about the recommendation that a group be formed to monitor the black experience in the colleges. Dr. Miller said that what was proposed was a look at relevant practices of undergraduate colleges, especially the admissions policies. This would have to be an auditing procedure and should be done outside the college themselves. Mr. Dunham commented that in his opinion such a step would be politically disastrous; it would be regarded as an example of the graduate schools' copping out. There is rather a need for graduate schools to do more for the disadvantaged and for minority groups. We should encourage the social commitments of undergraduate colleges and should copy this at the graduate level. It would be important in this regard to look at the practices of the graduate schools, such as those affecting fellowship and other financial aid, rather than to direct our attention only to the undergraduate colleges. Graduate schools should foster the enrollment of black students.

Dr. Crawford said that he could commend the commitment on the part of the colleges, but it seemed to him to be a fact that there had been a variety of admission practices, some of them wiser than others. He thought that graduate schools should examine the practices and see which were the wisest.

Dr. Dickey said that he had suggested this possible action. The idea was not to have the graduate schools monitor the whole response of undergraduate colleges to the problems of the disadvantaged. Rather, there should be examination of a large element of response that had not been dealt with on a fully candid and objective basis. Such actions are all right in an emergency, but cannot be lived with indefinitely if the colleges are to continue to prosper. Knowing what one is doing is not necessarily a barrier to effective response. Some colleges are at the point of disarray as a consequence of uncertainty

about these practices, and internal auditing is not likely to be sufficient. Mr. Dunham asked why not an audit of other areas of higher education; for example, college athletics. He thought that it would be better to use informal processes to audit the admissions process.

Dr. Sawyer said that he thought external audit would be valuable. It should not only be independent of the colleges and graduate schools, but include able leadership. Such men as Kenneth Clark, for example, should take a prominent part in it. A variety of programs to aid the disadvantaged and minority groups has been put into effect. Williams College has a number of these. Someone should assess the results of this activity and decide which of these are the most effective forms. There is a critical question of rational evaluation here. He suggested that a program be designed to do this with foundation support and leadership including such men as Kennneth Clark, Whitney Young, and others.

Dr. Magoun now presented the report of Group 4.

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Report of Working Group 4 (Monday)

H. W. Magoun (Chairman), Gustave Arlt, R. T. Arnold, Detlev W. Bronk, Herbert Fusfeld, W. C. Kelly, J. B. Page, E. Sibley.

Questions: What are the implications of the growth of postdoctoral education for graduate education? In which fields will this growth have a pronounced effect on the extent and character of predoctoral education? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies which might require further study?

The NAS-NRC Report on Postdoctoral Education in the U.S. has emphasized the ranging variability and complexity of postdoctoral education. In addition, it points out a number of more general features which were emphasized in the group discussion as being so highly desirable that they should become incorporated so fully into graduate education itself as to make the currently popular postdoctoral experience immediately following doctoral study redundant and unnecessary.

Among these general features of postdoctoral education at its best, emphasis should be given to:

1) Research as a way of learning, for this is the most stimulating of all ways to learn.

2) Learning for immediate use, which is the kind of learning that sticks best to the walls of the ventricles of the brain.

3) Broadening of education, through change of institutional and interpersonal associations, shift of fields, the applications of investigative techniques of one field to study of another, and other steps that break out of the rigid sub-specialization into which graduate study is sometimes channeled.

4) Close association or collaboration with an outstanding investigator as well as with the group or team of bright young people who tend to aggregate around outstanding investigators.

To a significant degree, these general features that characterize postdoctoral education are already represented prominently in graduate study in the natural sciences. To the extent that they are not fully represented in the social sciences and the humanities, the group advocated their increase in these fields as well.

Some of the more specific ways in which postdoctoral education interacts with predoctoral education are the following:

1) Postdoctoral education competes with graduate education for funds (Federal and institutional), time (on the part of the professors sponsoring postdocs), space, and equipment, to a significant extent on many campuses, but not yet to an extent that it poses a major threat to graduate education.

2) Postdoctorals on the campus, on the other hand, help to create a stimulating intellectual environment that contributes to the development of interest in research on the part of the graduate students. They may also bring new research techniques to the campus.

3) Postdoctorals work with graduate students on their research problems and in effect engage in a significant amount of teaching. Most significantly, they contribute importantly to the research programs in which they are engaged.

Ways in which postdoctoral education has <u>not</u> affected graduate education, sometimes to the surprise of observers, are these:

1) The availability of postdoctoral opportunities has, according to statistical evidence, apparently not shortened the time lapse from the baccalaureate to the Ph.D.---at least not as a result of conscious planning. The fields in which postdoctoral work is most prevalent happen also to be those in which the lapse of time is the shortest, but a causal relationship does not apparently exist between the two.

2) Postdoctoral work has not yet produced a degree, certificate, or other value symbol that is as widely recognized as is the Ph.D. Its institutional trappings are also comparatively modest as yet---no "postdoctoral dean", "program", or "registration" exist on most campuses---although changes may be expected in some of these respects in the future.

Group 4 made the following recommendations:

1) Indiscriminate use of the postdoctoral experience as a supposed cure for the ills of graduate education should not be encouraged. Postdoctoral support for "immediate postdocs" should be highly selective and limited to (a) fields in which experience in several disciplines or in a multiplicity of several techniques is needed to reach the research function, or (b) unusually able and innovative young investigators, or (c) providing access to unusual facilities or means of working with unusually creative senior professors. Postdoctoral experience should usually be given, if at all, several years after the Ph.D.

2) The growth of institutional administrative attention to postdoctoral education should be minimal and in no way interfere with the individualized character of postdoctoral work. The creation of a postdoctoral degree especially should be discouraged.

3) Research as a way of learning should be encouraged in undergraduate and graduate education. So should greater flexibility of program and freedom of the graduate student to move from institution to institution. To the extent that each of these is achieved, some of the special attractions of immediate postdoctoral study will disappear. There are some indications that the "erosion of educational discontinuities", mentioned by President Dickey, will accomplish this.

4) Follow-up studies should isolate the effect of the postdoctoral work. The data base provided by the "census" of postdoctorals, conducted by the Study of Postdoctoral Education, will allow this to be done effectively in another two or three years.

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In the discussion of Group 4's report, Dr. Weaver said that he wanted to endorse the point that postdoctoral education should not make up deficiencies in predoctoral programs. He asked what the graduate schools can do to enforce this. Dr. Magoun said that the role of the graduate dean was a critical one. Some attention should be given to strengthening the position of the graduate dean in this whole area. Dr. Weaver said that responsibility for postdoctorals should be placed within the office of the graduate dean. Dr. Cooke said that he disagreed very strongly with this point of view. He thought that postdoctoral work might very well be a remedy for unsatisfactory graduate work. He cited his own unsatisfactory experience in graduate school and the good postdoctoral experience which he had had subsequently and which helped to correct for this. Dr. Weaver replied that it was good that the postdoctoral experience was beneficial, but it was more important that the graduate program be improved to start with.

Dr. Arlt commented that humanists say that postdoctoral work in the sciences is a confession of failure of graduate education in those fields. He asked, first, whether postdoctoral work delays entrance into teaching at the graduate level and, secondly, does postdoctoral work serve solely to hold research teams together for some professors. Dr. Weaver said in answer to the

second question that this may be occurring in some cases, but is not widely prevalent. Dr. Magoun said that, in the steady state, there is probably no problem about getting people into graduate teaching after postdoctoral experience.

Dr. Kidd pointed out that 50% of the holders of postdoctoral appointments are foreign. He asked that the group consider the significance of this.

Dr. Shannon commented, first, that the postdoctoral experience is the first opportunity in a number of fields to work broadly after a rather narrow training in graduate education; and, secondly, that the postdoctoral work had special significance for post-M.D.'s because it provided an opportunity for them to acquire research experience. Dr. Magoun replied by reviewing the distribution of the postdoctorals in various fields in the percentage concentration of them. He said that, in medicine, postdoctoral work gives the basic science preparation for medical research. In his experience, post-M.D.'s had turned out to be effective researchers.

Dr. Millman remarked on the postdoctoral work in industry. Some of the larger companies have postdoctorals for a year or two to work in their laboratories. It is good to associate young scientists with eminent investigators, wherever they are, and industry is no exception to this. Dr. Bueche said that in his opinion one gets a more mature, experienced man out of postdoctoral work. It is particularly important that the opportunity exists in postdoctoral work for the man to get experience in the administration of research; he gets a kind of management experience. Dr. Hafstad commented that the industrial postdoctorals go back to the universities after their experience. Dr. Bueche said that he agreed that most of them go back to universities with good industrial experience and a knowledge of industrial practice.

Dr. Carter said that postdoctoral work should emphasize above all broad preparation at another institution and, desirably, work on another problem. Dr. Arnold said that control of postdoctorals by individual professors seemed to him to be undesirable. Awards should be made competitively to individuals rather than be made under research contracts by professors.

Dr.Tischler now turned to the questions what would be given to working groups in the afternoon and asked that the conference turn its attention to these questions so that comments and suggestions could be directed to the different working groups. He asked for comments first on Question 1, dealing with the extent of financial support of graduate education, ways in which this support should be provided, and related matters. Dr. Miller said that we were in effect providing subsidized talent because of the extensive Federal support of graduate education. A significant question was whether we were wasting resources. Should we supply subsidized talent to this extent in the future, and to what extent should it be provided? He remarked that industrial people said that when Ph.D.'s reached salary levels of $15,000 per year, industry would not use them so extensively. The true cost in fact is greater than this.

Dr. Kidd said that in terms of national policy, as the Bureau of the Budget points out, one should determine the proper level of research support rather than agree to provide support to every Ph.D. Dr. Morse said that this was a significant point. The economics of funding graduate education will

shape graduate education in the future. The question should be turned around and asked in this form: If present trends in funding continue, what will be the effect on graduate education? He went on to say that in regard to providing funds, it was more important to provide continuous support than to provide occasional injections of support.

Dr. Shannon asked whether support should be provided through institutions or through students. Dr. Bueche replied that if manpower is the requirement, funds should be applied through people; if research and development, then through institutions. Dr. Weaver demurred at this, saying that one would have to support institutions to keep them alive, regardless of whether the requirement was manpower or research and development.

Dr. Morse said that the emphasis on students probably comes from the fact that unit costs have gone up. Some new incentive to the production of students should be given. Dr. Crawford pointed out that in considering financial support of graduate education we must note that costs vary by degree program and field. Dr. Bueche said that the cost per service unit in various sectors of the economy has gone down in the past. Education, on the contrary, has increased its cost per unit and he thought that this should be looked at very closely. Dr. Page said that the states seem to him to be at the limit of their ability to support students. Dr. Miller said that the cost-of-education grants should be reexamined. Perhaps they should vary by field of work, as Dr. Crawford pointed out. As to educational productivity, he could think of a lot of under-utilized departments in this country. Asian studies seemed to him to be an example; there are some universities where such special areas have very few students. Furthermore, the need for new departments should be examined very closely before they are set up.

Dr. Crawford referred to Questions 2 and 3 and said that it was his interpretation that Question 2, which had been given to his group, dealt with existing degree programs, and Question 3 referred to new degree programs. Turning to Question 2 for the afternoon working groups, Dr. Sawyer said that a great wave was now rolling in on the social sciences and the humanities. Students were going to push for change in the form of large clustering of subjects and of focus on national problems. They were seeking a psychedelic, instantly meaningful experience, to use some current slogans. There was danger, as a result of this, that a great wave of mush would roll in on the graduate schools. There was a need to maintain the integrity of the Ph.D. as an element of stability in the whole situation. No special comments were provided on Question 3. On Question 4 for the afternoon, Dr. Miller said that he wanted to support the earlier recommendation that the office of the graduate dean within universities be strengthened to cope with the new problems in this area. Dr. Carter added the final comment that some further activity in the form of studies and other associated activity seemed indicated to him. The question that the group still had to deal with was in what direction these activities should move.

Afternoon Session, Tuesday, August 26, 1969

Philip Handler, Chairman

Dr. Handler said that it might be advantageous to reverse the order of presentation of reports, leaving the topic of finances to the last, and called first for the report of Group 4 dealing with quality in graduate education and programs for the disadvantaged. Dr. Morse, the chairman of Group 4, presented their report.

Report of Working Group 4 (Tuesday)

Robert W. Morse (Chairman), Detlev W. Bronk, A. M. Bueche, H. E. Carter, Allan Cartter, W. C. Kelly, C. V. Kidd, H. W. Magoun, Wayne Reitz.

Questions: How can quality in graduate education be maintained or strengthened, considering the growth in the numbers of graduate institutions? How can workable programs be devised for the disadvantaged graduate student without jeopardizing standards? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies that might require further study?

Group 4 discussed at some length the concept of quality in graduate education. The group felt that this should be looked at, using every possible objective measure of quality. Graduate-student input and institutional input both should be examined. One should look at institutional quality and the quality of the whole system as well. The group agreed with the report of one of the earlier working groups that there has been a growth in the number of high-quality institutions. The chief factor has been the increase in the quality of incoming students. The group recommended that the graduate dean be given whatever additional authority could be delegated without major reorganization of the university structure.

Group 4 felt that accreditation does not now exist for graduate education in the non-professional areas in any real sense. In discussing the desirability of accreditation, the feeling of the group was negative at first, but then the consensus swung to support for some form of accreditation. The compelling reason was the implication of lack of accreditation for financial support. Without control of the numbers of graduate institutions, it seemed to group 4 that there would be an undue proliferation of graduate programs. Any system of accreditation should provide for control of new programs rather than for enforcement of standards at the local level.

The second topic for the group dealt with the development of workable programs of graduate education for the disadvantaged. Group 4 asked first how we could get better information about incoming students and how we could increase the numbers of black students entering the graduate schools. There is no strong evidence that remedial or special programs are indispensable. The group felt that much more could be done within present standards with different styles of funding of graduate education and different modes of supporting graduate students. The present competitive support seems to be biased against disadvantaged students. The group looked with interest at the Graduate Opportunity Fellowship Program conducted by the University of California. Under that program, a significantly large number of black students were admitted within the usual standards of graduate admission and given support. Many more fellowships of that kind could be used. Group 4 had the general feeling that ways to increase rapidly the number of disadvantaged students in graduate school was the most important topic before us. They felt that a rational, coherent study of these problems should be recommended by this conference.

The majority of the group felt, however, that they would not recommend a broad, undifferentiated study of graduate education. Any further effort should be focused on a finite set of questions, such as the question dealing with disadvantaged students.

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In the discussion of Group 4's report, Dr. Allan Cartter said that he agreed fully that the area of black student admissions and support, and access to professions and jobs is of first importance.

Dr. Arnold asked whether the programs for the disadvantaged would be special ones and limited pehaps to fields of the social sciences. Dr. Morse replied that no special programs were contemplated, but special encouragement should be given. Dr. Bueche said that perhaps one should make this matter really one of concern with the "disadvantaged" rather than with any specific minority group and that it should be put on an income basis so that all falling below a certain income level could be considered. The black students would be included, but the effort would not be limited to them. Dr. Weiss said that the Carnegie Commission has looked into this problem. Initially, their plans were for special programs to be developed for black students but later, as they looked further at the problems, the black members of the Commission wanted to get away from a specifically black orientation in any study programs that would be developed.

Dr. Allan Cartter said that it was important to look at the undergraduate situation now. Formerly, colleges made scholarship awards to undergraduates on the basis of ability, starting at the top and working down. Now, he said, they do it from both the top and the bottom so that a reasonably large number of disadvantaged students would be included. He thought that this practice would hit the graduate level fairly soon.

Dr. Weaver said that in our concern for the disadvantaged we should not give up our concern for excellence. Dr. Morse replied that we were quite flexible now in our standards if one considered the range of institutions and programs; the range of standards represented is quite wide.

Dr. Handler said that he was somewhat skeptical about our ability to compromise standards at the lower levels without compromising them at the graduate level. Dr. Arlt said that he agreed. Dr. Morse commented that it was much more difficult to provide remedial education to the undergraduate than to handle the problem at the graduate level. Dr. Bueche said that the new programs for the economically deprived are having an effect on the quality of industrial products. A number of industrial companies have initiated special programs to employ members of disadvantaged groups and are now finding that this turns out to have its own cost associated with it in the form of lowered quality of work, etc. Something similar to this, he said, may happen in graduate work. Dr. Weaver commented that this sort of thing had happened in the case of foreign students; standards were somewhat relaxed for them, and this has had an effect on standards elsewhere in the graduate area. Dr. Miller commented that graduate schools may in fact have a more flexible standard than undergraduate institutions.

Dr. Handler asked who was going to hire the "inadequate" Ph.D. Dr. Miller replied that industry and other employers have hired over a wide range of quality in the past. Dr. Morse commented that these questions illustrated the problem and measured the quality of the system. He thought that, in particular, medical schools would need to increase their enrollment of black students. Dr. Arlt said that time would be needed to allow undergraduates to complete their undergraduate programs and enter the professional schools. One cannot do this on a short-time basis.

Dr. Handler now asked Dr. Rhodes to present the report of Group 3.

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Report of Working Group 3 (Tuesday)

Herbert D. Rhodes (Chairman), Richard Armitage, Alden Dunham, Thomas D. Fontaine, Milton Harris, John Perry Miller, J. B. Page, John E. Sawyer, Elbridge Sibley, Trygve Tuve.

Questions: What types, patterns, and mixtures of graduate programs and degrees will be needed for the future, considering the role of the traditional research-based Ph.D.; master's and intermediate degrees; programs with a professional, rather than a scholarly orientation, at both the doctorate level and lower levels; and specialty and interdisciplinary doctorates? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies that might require further study?

In considering the general question of what types, patterns, and mixtures of graduate programs and degrees will be needed for the future with particular consideration for the role of the traditional research-based Ph.D. degree, the panel spent most of its time discussing problems and prospects of the training and education of college and university teachers for undergraduate, and particularly lower division, service. There was general agreement that such teachers should have an appreciation of research and should have had some limited research experience; but it was the panel's feeling that the intense specialization and deep research emphasis of many Ph.D. programs is very likely unnecessary for the teacher who will not be a producing scholar and may lead to a certain degree of frustration in some cases. In any event, it certainly leads to an unnecessary attenuation of the program for such persons who could very likely use some of the research time to much better advantage.

The panel recalled briefly that the Harris Committee (Group 2 - Monday) had previously concluded that the research-orientated Ph.D. program does not do a good job in preparing teachers for undergraduates and that the Miller Committee (Group 3 - Monday) had also concluded that certain new non-Ph.D. programs are needed for the training of college teachers, particularly in a number of trans-disciplinary areas of fairly recent origin such as urban planning. This committee pointed out that colleges and universities must be responsive to the communities in which they find themselves.

Dean Miller reviewed briefly the Master of Philosophy program recently introduced at Yale. This program seems to be progressing smoothly, but it is still too early to attempt any sound evaluation. Admission to the Master of Philosophy program demands the same intellectual capacity and academic background as admission to the Ph.D. degree in the same field. It is Yale's hope that a number of women might be enticed into the field of college teaching by this means, particularly women who might be able to complete the Master of Philosophy program in the relatively short time available to them but who would not be able to complete the longer Ph.D. program. The panel appreciated the value of the M. Phil. program at Yale, but agreed that it shows little promise of producing the great number of college teachers necessary.

There was some discussion of the Candidate in Philosophy degree or certificate, sponsored by a number of institutions and vigorously proposed and supported by Dean Spurr of Michigan. This degree or certificate is awarded to Ph.D. students when they have passed their preliminary (or general or qualifying) examinations and have therefore completed all of the requirements for Doctor of Philosophy with the exception of the dissertation and its final defense. About half of the CIC have agreed to award such certificates or degrees while half have declined to do so. Here again, this program could hardly be effective in increasing the number of qualified undergraduate teachers available since it merely marks a particular degree of advancement toward the Ph.D. It is probably of value in establishing officially the status of the ABD, but can hardly increase the supply of teachers by attracting more students into the field.

It was agreed that there appears to be a great deal of confused thinking regarding the preparation of college teachers at a level below that of the present Ph.D. degree. There was general agreement that we should develop an important, significant alternative to the Doctor of Philosophy, and the Doctor of Arts degree (as presently offered by Carnegie-Mellon, Pittsburgh, and Washington) seems attractive. This program is now offered through the College of Education but is under the control of specific subject-matter departments. About 75% of the work is taken in the subject-matter department and the program here is generally broader than that required for the Ph.D. degree. A rigorous and detailed qualification in subject matter is required, and it is common to include supporting work in related areas. The remaining 25% of the program is in Education and is directed toward philosophy of education, methodology, the use of visual aids, and a supervised teaching internship.

There was general agreement that programs of this nature should be offered by a number of state universities and the leading institutions among the 279 members of the American Association of State Colleges and Universities. It was also agreed that it is vitally important that these institutions be willing to employ and promote holders of the Doctor of Arts degree. Mr. Dunham reported that the Carnegie Corporation is seriously considering the possibility of investing several million dollars in five or six leading institutions of the AASCU in order to assist in the establishment of such programs. The panel endorsed this proposal heartily and urged Mr. Dunham to report this endorsement to the Carnegie Corporation.

There was rather general agreement that the Ph.D. program as presently constituted is usually satisfactory as preparation for the professional practitioner outside of higher education. This agreement was within the context of recognizing that the requirements for the Ph.D. degree are now in a considerable state of flux and that many departments no longer require foreign language proficiency and certain others of the traditional features. In view of the fact that the Ph.D. has been established in such professional fields as Business Administration, Public Administration, and the like, the panel expressed no feeling that the research-oriented Ph.D. should be substantially changed for persons not intending to enter the field of higher education. The main problem with the Ph.D. product in chemistry and certain other fields appears to be one of attitude and lack of appreciation of the importance and interest of industrial employment.

With respect to preparation of teachers for community colleges, it was pointed out that strong programs for the Master of Arts and the Master of Science degrees remain very important and should be encouraged. Presidents of these institutions continue to seek well-prepared persons with the master's degree in preference to many persons with doctorates. The Master of Arts in College Teaching (developed by the University of Tennessee and now also offered by Appalachian State College in Boone, South Carolina) appears to be a very good program for the preparation of community college teachers. The panel urges that good master's programs be encouraged and that institutions undertake a strengthening of master's work. There seems to be no need for new degrees at the master's level, although a considerable need is developing for new fields of study within the currently established degree programs. For example, there appears to be a great and growing need for MS work in the allied medical professions to prepare teachers for Junior College work who will in turn administer programs in medical technology, physical therapy, dental hygiene, etc.

With respect to deficiencies, there was general agreement that our most glaring need is the need for sound cost data. Although gross averages are readily available, careful analysis of costs on a field-by-field basis have not been carried out. This panel urges that detailed cost studies be undertaken.

A second specific study recommended by this panel involves a careful evaluation of needs in specialty fields -- that is, probable needs in the near future on a field-by-field basis rather than in the broad terms in which apparent need predictions are presently couched.

Finally, the panel concluded that it is not wise to recommend at this time a broad, searching study of the prospects and needs of graduate education. There have been a number of very good studies carried out within recent years, and this panel urges that the Academy sponsor a study of studies to the end that a small group may thoroughly evaluate all substantial studies of recent date and undertake to synthesize a coordinated, comparative report emphasizing the consistencies and common conclusions and pointing out clearly the inconsistencies and disagreements among them. It is this panel's feeling that recommendations for further study can be more intelligently made following a thorough review of the studies already published.

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Dr. Handler then called for discussion of this report. Dr. Bueche asked whether there had been any discussion of the practice of law schools in changing bachelor-of-laws degrees to doctor-of-laws degrees for some nominal fee. The answer was that the topic had not been discussed. Dr. Carter asked whether there had been any discussion of the non-teaching, professional Ph.D. in chemistry, physics, etc. Dr. Rhodes said that that topic had been left primarily to Group 2 - Tuesday. Dr. Harris said that he thought any study of needs should be in new fields, not yet in existence, but on the horizon.

Dr. Allan Cartter commented that his studies indicated there would be a good supply of Ph.D.'s for teaching in colleges in the near future. He thought that changes in graduate education were called for, not because of anticipated future shortages of Ph.D's, but for other reasons.

Dr. Handler asked how the problem should be approached. Should one analyze need and then produce trained people to meet the need, or does the existence of trained people create a demand? Dr. Rhodes said that one could staff the junior colleges with Ph.D's possibly, but if so, they would be maltrained and frustrated people. It would be better to have Doctors of Arts do this teaching. Dr. Allan Cartter restated his conviction that there would be a more than adequate supply of teachers. Dr. Tischler brought to the attention of the group the article in Science by Martino (Joseph P. Martino, Science, August 22, 1969, pp. 769-772) which considers the numbers of teachers who will be needed in the steady state situation we are likely to have in the funding of graduate education and research in the near future. Dr. Carter said that we may need a study of desirable student/staff ratios. Dr. Allan Cartter referred the group to the useful report on the study of cost of graduate education carried out by Irene Butter at the University of Michigan.

Dr. Handler then asked Dr. Crawford to present the report of Working Group 2.

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Report of Working Group 2 (Tuesday)

Bryce Crawford, Jr. (Chairman), Richard T. Arnold, John S. Dickey, L. H. Farinholt, L. R. Hafstad, Max Tischler. J. Weiss.

Questions: If the present trend of increase in the number of advanced degrees granted harbors dangers, what changes in the characteristics of degree programs, selectivity in graduate admission, or requirements for degrees are indicated? What changes will the growth of postdoctoral education institute in the graduate education of future leaders in research? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies that might require further study?

I. The "degree requirements" vary so much in detail from school to school and field to field that the group found it necessary to consider broad requirements. So specific recommendations are not here.

II. One area of admissions needs major change: we need to admit students for their benefit, not recruit teaching assistants, nor helping hands for faculty, nor bodies for bounty. Two major causes:

(A) Large schools needing to recruit teacher assistants. The way to relieve this pressure is to promote and extend research and experimentation into more effective large-class teaching without so many graduate student assistants. There are various means which tend this way: use of machine-graded exams, use of full-time semi-professional teaching associates in laboratory instruction, etc. More need be and can be done, and this effort would, if somewhat indirectly, improve graduate education.

(B) "Aspiring" schools seeking to develop a graduate program. Here one relief could come if faculties and schools could learn that a graduate program is not necessary to have a good undergraduate institution. In particular, good faculty can be recruited and maintained as live scholars provided (1) that they have resources to carry out some research with their own hands or with some superior senior students; (2) that their teaching assignments provide them with time for reading and study and research; and (3) that their teaching effort be supported by assisting professional personnel so that their time and effort not be drained in housekeeping chores.

III. The present Ph.D. is characterized by specialization for research: and for some "product uses" it is just right, and no major changes are needed. The preparation for university teaching, and for some careers in industrial research, is well given by the classical Ph.D., with its thesis demand of "an original contribution to knowledge". But we discern two other "product uses" which would be better served by doctoral-degree programs of different shape.

One of these is a practicing professional career in mathematics or engineering or economics in which specialization is not needed so much as an ability to range over, or draw upon, a number of the sub-fields of the professional discipline, to become a "general practitioner" of his profession. For this we feel the need of a label which implies both high mastery and professional orientation. We suggest Doctor of Mathematics, or Doctor of Economics, etc. And the program should cover the professional sub-fields without so much specialization as the Ph.D. The program should command prestige and be respected in the institution, as the M.D. program and its teachers command respect in universities with medical schools. We noted the parallel "double track" of Ph.D. and D. Eng. at Dartmouth. Such a D.Chem., coming out, would be better prepared for professional practice, and he would have "self-selected" this choice. He would not expect a research specialist's career, nor be frustrated by not entering on one.

A somewhat different need for a broader, unspecialized, not research-oriented, program we discern in college teacher preparation and in students' needs and desires to pursue problem-oriented studies. This involves so broad a cluster of disciplines that, rather than characterize it by "Doctor of Social Sciences" or by "Doctor of Urban Planning", we suggest the Doctor of Arts as a better label.

It is important that these new doctorates should first be introduced into the graduate programs of the more prestigious institutions in parallel with the conventional Ph.D. programs which already exist in these institutions. The new degree programs should not be started in the emerging universities until they have become well established in at least some of the major institutions.

IV. The group also discussed some of the undesirable effects of outside forces on graduate education and ways which might relieve them. One is an effect perhaps visible in terms of postdoctorals, when in a university a professor builds a large research group of the "institute" type. This produces gross imbalance as between the research and teaching components, introducing real distortion of the university. A possible relief would be the removal of research institutes, which may well be justified units for desirable purposes, from the university -- as is done in the USSR and in some continental countries. Postdocs could, of course, be present both in such separated institutes and in universities, in appropriate numbers and with appropriate status in each place.

Another outside force which can tend to distort is, of course, the "Federal intent" and placement of Federal dollar support. One can note large activity in high-energy physics, for example, or oceanography; and can ask without denigration of these specific fields whether imbalances have not been produced in some universities. Perhaps the only way to relieve this type of distortion is to provide in the Federal government a "power center" devoted to education -- perhaps a Secretary of Education who might protect the educational enterprise from distorting programs designed for the purpose of other government agencies. The group discussed, without coming to a recommendation, whether we and the country were ready for such a step.

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Opening the discussion of Group 2's report, Dr. Handler asked whether the Doctors of Arts and the other new doctorate recipients would be eligible for faculty appointments in the same way that Ph.D.'s have been. Dr. Crawford said that he thought they would be. Dr. Handler further commented that this proposal would, in effect, reverse the history of medical education. Before the Flexner Report, medical schools were trade schools. As a result of the Flexner Report, they became truly professional schools. Dr. Crawford said he thought that some changes of the kind proposed would not necessarily be bad in that sense. Dr. Harris commented that reversing one's ground occasionally is not unusual in this country.

Dr. Carter said that the specialist-degree programs would have to be separate tracks, but would have to have their own integrity and high intellectual standards. Dr. Handler asked whether the specialist in chemistry, for example, the Doctor in Chemistry, would know less about chemistry than the Ph.D. in that field. Dr. Crawford said he might know more; the programs would be oriented toward the practitioner's problems. Dr. Kidd commented that an M.D. is a professional degree, not a research degree. Dr. Handler replied that they are not ordinarily appointed to faculties.

Dr. Fusfeld asked what was the rationale for these specialist programs. What would they do? Are the programs designed to relieve frustration? Dr. Crawford replied that they are not just for that, but to allow a self-selection so that the person feels that he has some choice and is not limited just to the Ph.D. itself. Dr. Carter said that he started thinking about these possibilities seriously when one of his Ph.D. candidates in chemistry took a master's degree in business administration on the side. This man did not want to do research all his life and thought that he would get some additional preparation that would help him in an administrative career eventually. Dr. Fusfeld commented that this seemed to him to make sense and would provide the preparation that would serve as a rationale for the specialist degree. Dr. Carter commented that this makes sense from the cost standpoint also. Dr. Fusfeld said that in planning such new degree programs, one should stress the upgrading and financial arguments for it. Dr. Harris remarked that there was a mismatch between needs and aspirations and preparation in a fairly sizable area of graduate education.

Dr. Bueche asked what studies would be needed to determine whether these new degree programs should be put into effect or further encouraged. He thought that studies of manpower needs and types of manpower should be a preliminary to this. In other words, we need very much the three studies discussed earlier at this meeting. Dr. Crawford said that he agreed. Dr. Bueche commented further that what we need to do is to find out a need and then make an invention to fit it. Dr. Hafstad said that high energy physics furnishes an example of the problem of poor adaptation of Ph.D. holders. People who have worked in that field have concentrated so heavily in it that they cannot be converted very well into industrial physicists. Dr. Rhodes asked why the transdisciplinary degree was recommended. Was not such a degree covered by other programs? Dr. Crawford conceded that this was possible.

Dr. Shannon then presented the report of Group 1.

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Report of Working Group 1 (Tuesday)

James A. Shannon (Chairman), W. Donald Cooke, Herbert Fusfeld, Wayne C. Hall, C. M. Kearns, Carl H. Krieger, Sidney Millman, Frederick L. Stone, John C. Weaver.

Questions: If the present trend of increase in the number of advanced degrees is sound, where will funds come from to sustain continued growth of graduate education and to support research by Ph.D. recipients in the future? By what mechanisms should such funds be injected into the educational system? How can the productivity of graduate education be increased? Where are there deficiencies in our knowledge and understanding of these problems, deficiencies that might require further study?

As to the first of these questions, Group 1 believes that, in general, the data base for projections is not sound. The past decade has had characteristics of growth that tend to tip the projection upward. A projection based on the numbers of baccalaureates awarded is not sound because of the different composition nowadays of the undergraduate population. It contains relatively fewer people who are qualified and interested in going on to research careers than was formerly true.

If suitable standards can be set, all who can pass the standards should be educated to that level. This has been the assumption of the past. The trouble is that standards shift with time, and it is questionable whether the conventional standards can continue to serve this role. During the next five to ten years, it may well be that available funds will form a more realistic criterion. Reports in press now, if properly handled, could make available sizable new sources of funds. However, three to five years will be required to get this going. At least three years will be needed for changes within the Federal establishment.

Most of the discussion, but not all, by Group 1 was limited to Ph.D. programs in the natural sciences. One member of Group 1 pointed out that a new source of financial support that could be tapped with good effect in graduate education was industry. An industrial company might be willing to pay, for example, $1,000 per year per Ph.D. on its staff for a period of five years. A company employing fifty Ph.D.'s hired within the past five years would thus pay $50,000 per year to the doctoral institutions of these Ph.D.'s. Corporations, which now pay taxes and provide basic support to education, might be willing to make this additional contribution. It would have the further good effect of biasing universities somewhat toward the user requirements here.

Other new sources of support do not seem to be in sight for the next three to five years.

Group 1 believes that funds may become available for areas where critical needs are perceived by the Federal Government. These needs will have to be identified. However, while we are waiting for the play of the market to settle this, some important programs may be dismantled. Other means for assessing these critical needs should be resorted to.

As to the support of research by new Ph.D.'s. it is clear that the curves of the numbers of Ph.D.'s and the support for research are diverging, with the numbers of Ph.D.'s increasing rapidly and support at least levelling off or even declining. Industrial support of research fluctuates with the economy. There has been a predicted downward trend in support of research by the two largest Federal supporters, the NIH and the DoD. The reductions in NIH support will be out of proportion to the dollar-figure reductions because of the increasing costs of research. The National Science Foundation will not be able to pick up the slack. The effect of inflation and the cost of research increases will double the annual research cost per scientist in the next ten years. The result will be either less support per scientist or fewer scientists supported.

In summary, funds are not in sight to support either graduate education or research by Ph.D.'s fully to the extent required by present growth rates of enrollments and degrees granted.

As to the mode of providing funds, part will be provided by institutional grants, and part by the method of use -- the project system. Perhaps a 50/50 division will eventuate. At present, about 1.7 billion dollars has been provided for academic research. When one examines the purposes for which these funds are distributed, any major change in the method of distribution would probably be unacceptable to universities. However, the matter should be explored. NIH, for example, has in its budget 150 million dollars for new medical schools. Perhaps this should be used to meet other program costs, thus deferring these capital expenditures while the present emergency exists. Budgets of other agencies contain funds related to education, but for which the purpose is not completely specified. For example, the DoD budget contains 625 million dollars for the development of civil skills, presumably in servicemen returning to civilian occupations. Agencies might well become adept at looking at budgets to see where items of this kind existed and could perhaps be used.

Concerning productivity of graduate education, Group 1 finds the various methods of studying this highly controversial. On the other hand, the study of the cost of graduate education would be highly desirable.

As to new studies that would be needed, Group 1 recommends cost studies which they regard as almost mandatory. They also recommend studies of a few areas of current utilization of Ph.D.'s. In such a study, the utilization of Ph.D's in chemistry, physics, etc., would be examined to see how their educational preparation was used. In general, the Chairman of Group 1 is somewhat discouraged about the usefulness of manpower studies, but believes that a follow-up on utilization might be desirable. A surprisingly large percentage of Ph.D's might be found not to be utilizing their education very well.

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In the discussion, Dr. Hafstad and Dr. Bueche both commented that industry was already providing support to universities on the basis of the number of employees who received their degrees from those institutions. Some incremental plan should be considered. Dr. Kidd asked how the decline in Federal support now occurring and in prospect jibes with the predicted surplus of college teachers with the Ph.D. Dr. Allan Cartter, to whom this question was directed, said that it was true that the estimates of a comfortable supply of Ph.D. teachers probably did not extend validly beyond the next five years. After that, the Federal cutbacks that we are now seeing would begin to have an effect. Dr. Bueche commented that the study of costs was important, but should be broadened. He recommended that a look be taken at accounting procedures, in general, in universities. He noted that one man-year of research in a university seemed to cost between $40,000 and $70,000 per year.

Summing up the discussion of the reports of working groups this afternoon, Dr. Handler said that five specific studies seemed to have been strongly recommended: (1) the disadvantaged, (2) the costs of graduate education, (3) the needs for manpower in various fields, (4) a "study of studies", and (5) the utilization of recent Ph.D's. Dr. Weaver pointed out that there were other recommendations made earlier in the day as a result of discussions in working groups yesterday, and he suggested that these recommendations be considered also. There were added then to the list of five, two other suggested areas of study: (6) modes of support of graduate education, and (7) evaluation of quality: (a) of graduates, (b) of postdoctorals.

Morning Session, Wednesday, August 27, 1969

Herbert Carter and Philip Handler, Co-chairmen

Dr. Carter served as Chairman for the first part of this session. He opened the session by suggesting that there be a general review of what had been discussed previously and then some group discussion of possible courses of action. The session was to conclude at noon.

Dr. Crawford said that before the end of the morning it would be desirable to ask Dr. Arlt to report on the proposed CGS study of costs of graduate education. Dr. Bronk proposed that the study of manpower needs and the study of utilization of recent Ph.D's be combined. Dr. Shannon said that the reviews of the Fiscal 1971 budget were now going on in the various agencies. He thought it would be desirable for several members of the National Academy of Sciences to discuss with the Bureau of the Budget the critical situation of graduate education. The Bureau of the Budget evidently believes that the present trends in graduate education will lead to an oversupply of Ph.D's. This matter needs early attention from outside the government because the budget will be settled during the month of September.

Dr. Kidd said that deep cuts in research and development funds in the budget of the Department of Defense were being planned on the basis that this load would be picked up by other agencies. This assumption of the budget load by other agencies will not be done automatically, however, and should be given attention. Dr. Carter said that the conference probably should recommend to Dr. Handler that the attention of the National Science Board be drawn to this. Dr. Shannon suggested that the report by Ivan Bennett, dealing with the support of academic science, should be used in this effort. Dr. Fusfeld asked what it was that the conference was recommending -- a preservation of the status quo? Dr. Morse said that it would be important to consider the time delays in education in looking at the effect of budget cuts on graduate education.

At this point Dr. Handler joined the meeting, and Dr. Carter asked him to take over the duties of the Chairman.

Dr. Shannon said that in his opinion the cumulative budget cuts affecting academic science would be extraordinary over the next year or so. Dr. Carter asked whether copies of the report by Ivan Bennett should be sent to the presidents and academic deans of universities with the suggestion that they get in touch with their Congressional delegations. Dr. Handler said that this would be advisable. The Academy might ask the Council of Graduate Schools to distribute the report to the graduate deans. Dr. Arlt said that the CGS would be willing to do this. Dr. Reitz asked whether consideration should be limited to science. Dr. Arlt commented that the DoD cuts would hit the social sciences very hard also. It was agreed that Dr. Kelly would ask Dr. Bennett for freedom to distribute copies of his report to the members of the conference group and to the graduate deans.

Mr. Kearns asked for the floor and made a series of recommendations for possible courses of action from his vantage point in industry. He said that he had heard three things principally during the meeting:

1) A perspective had been given on graduate education and efforts to improve it.

2) The implications of graduate education for the disadvantaged had been explored in part.

3) The imminent problem of overproduction, quality deficiency, and inadequate financial support of educated postgraduates, including Ph.Ds, had been highlighted.

With regard to the last point, Mr. Kearns said he was impressed with the analogy to a classical business problem and suggested that a program of thought and action might be developed based on this similarity. This could begin with a study of the market which seemed to have three principal segments: government, academic, and industry. Each of these was a consumer and might be expected to share the costs. The costs and prices vs. the needs for different levels of training should be developed, both for society as we now knew it and for the future society as we might best envision it. Consideration should be given to modifications in educational programs to reduce cost, improve quality, and meet defined needs. In this latter regard, the public will to extend the educational horizon of greater numbers of people, through dispersed facilities, seemed to require many scholarly talents not necessarily based on the research experience.

As an implementation to these thoughts, Mr. Kearns suggested that an overall survey be made of the needs for and sources of support for a healthily growing output of graduate-educated men and women. Alternative courses of action should be illuminated. An executive function should be established to choose a course of action and to act upon it. Here it was essential to have prestige and the will to carry on a continuing program to influence all of the "customer" components. The tactical, strategic, and continuing nature of the subject should be recognized and, if this approach proved effective, it should be carried on as a national activity in the future.

In reply, Dr. Handler said that this was the other side of the question. Yesterday, recommendations had been made that the separate pieces should be taken up, but that a broad study was not needed. Dr. Crawford said that that was not what his group had recommended. Dr. Rhodes said that the recommendations of his group also would not be inconsistent with what Mr. Kearns had proposed.

Dr. Bronk commented that from 1945 on, with the first Rockefeller Foundation predoctoral fellowships, financial support for graduate education had grown steadily. The question now is why so much money and effort has become necessary to support graduate education. Industrial, government, and legislative people find it difficult to understand this rapid growth of the costs of graduate education.

Dr. Bueche said that each of the specific points of study should have some overall strategic framework into which they fitted, and the whole effort should be supervised by some executive function. There was the problem of getting hard data, and the study should be constantly kept under supervision with this in mind. Dr. Handler commented on this point that not all of the seven recommended studies seemed to him equally doable.

Dr. Morse asked what would be the limits of the activity? What was "graduate education"? Did it include medical education too? If so, this would be too large an undertaking. It would result in a huge study taking a considerable amount of time at the end of which the situation would have changed completely. The package was too large. Such a study might be feasible if limited to Ph.D. programs. Dr. Fusfeld said that the time scale of study and action would be too long unless the study were limited. It would be desirable to look at the problem as a whole, but then to limit the study to a feasible part.

Dr. Arnold said that some parts of graduate education need not be included because they got separate support. Dr. Morse commented that it would be important to look at the interactions of the various budgets on campus and to study the flow of funds across boundaries within the university. Dr. Miller said that, in his opinion, there would eventually be an attack on fund allocation within universities by student activists. The question of relevance of various expenditures for education would come into question. Some areas of graduate education would undoubtedly be hurt.

Dr. Bronk commented that in an earlier day the National Academy of Sciences believed that money should go to students, primarily through fellowships. Now effort is being concentrated on the universities. At the earlier stage it was hoped to work on the graduate faculties in various ways. Now we are talking about trying to get around the faculties.

Dr. Shannon said that science had carried a significant share of university costs. University funds could be used for other areas because of the availability of federal funds in the support of science. Now with the reduction of federal funds and the coming of new demands universities had become unstable enterprises. This was an argument for looking at the whole system.

Dr. Allan Cartter said that Mr. Kearns' suggestion that a look be taken at demands on graduate schools in the 1970's made a great deal of sense to him. This was not a global proposal in reality.

Dr. Handler than asked who should do this. The National Academy of Sciences covers the EMP fields, life sciences, and the social sciences. Dr. Crawford suggested that cooperation of the Social Science Research Council and the American Council of Learned Societies be sought in this. It would also be desirable to include the employers of the recipients of graduate degrees, especially representatives of industry.

Dr. Bueche suggested that we look also for alternatives to sponsorship by the National Research Council, the American Council of Learned Societies,

and the Social Science Research Council. He thought it would be very important for others to be brought in also to increase the credibility of any results. The others should serve as executive sponsors as well as participants in the conducting of the study.

Dr. Kidd asked whether the Carnegie Commission could take on this work. The answer from the group seemed to be that it could not because the Commission had not concentrated especially on graduate education. Dr. Kidd then proposed that a group somewhat like the Carnegie Commission be set up for the area of graduate education. Mr. Kearns said that the activity should have an executive function associated with it. Dr. Handler said that he agreed, but that the organization should avoid the accusation of special pleading. Dr. Bueche said it would be important in this regard to have people from other sectors on the board. Dr. Crawford said that this could be arranged so that the board would be widely representative. Dr. Bueche asked whether it would be desirable to have the Department of Defense and the Department of Commerce represented. Dr. Crawford said that he thought that it would be. Dr. Miller suggested that the three Research Councils, covering the various disciplinary fields, get together and agree on a group which would then be independent. He said that in his experience organizations that were broad and that could be trusted were rare. Dr. Crawford said that it would be important to have the correct representation from the faculties of graduate schools on the board. They constituted a group that would have to be moved if reform of graduate education were to take place. Dr. Bueche asked about having a special research organization, such as the Rand Corporation or Arthur D. Little take on the study. Mr. Kearns said that some caution should be observed in taking that route.

Dr.Tischler said that, in his opinion, the National Academy of Sciences was the right organization to undertake this activity. It has high prestige and widely recognized integrity. The organization of the board or committee could easily be taken care of. The Academy could get good people to serve on the board and could get other organizations to cooperate. Dr. Miller said that, in general, he agreed but some care should be taken because the National Academy of Sciences represented science to the world and an approach solely from the direction of science would be opposed by the universities. We must bring in the other Councils if results are to be accepted. An ad hoc group would carry more weight. Dr. Bronk pointed out that the Conference Board of Associated Research Councils had been created just for this purpose and might serve as the sponsor for the board or committee being planned. Dr. Handler said that this was so and that in the Senior Fulbright Program, a Conference Board activity, the National Academy of Sciences acted as the executive agency under the sponsorship of the Conference Board.

Dr. Shannon suggested that the National Academy of Sciences might carry out the "study of studies" at an early date and come up with suggestions for areas in which further action was needed. Dr. Handler thought that the National Research Council, the American Council of Learned Societies, and the Social Science Research Council might be able to do that with their own funds. This would get things started. It would then be necessary to turn

to the Federal Government and to foundations for further support. Dr. Bueche suggested that help be sought from industry also. It would be desirable for all of the customers and supporters of graduate education to be parties to the act. Dr. Kidd pointed out that statistical facts were needed less than a philosophy and a coherent plan of action.

At this point, Dr. Arlt reported on the planned study of unit costs of graduate education which had been planned jointly by the Council of Graduate Schools and the National Association of College and University Business Officers. He said that that study would undoubtedly be carried out regardless of any special action taken here. The CGS-NACUBO study was designed to answer the frequent question about what graduate education costs per unit. The CGS has set up a committee under the chairmanship of Dean Joseph McCarthy of the University of Washington to supervise this study. The National Science Foundation was interested in the study and agreed to set aside some funds in Fiscal 1969 to carry out the preliminary steps of developing a vocabulary of terms and investigating the feasibility of a major study, but it was not possible to complete the plans in time to utilize those funds. The Western Interstate Commission on Higher Education (WICHE) is also carrying out a large-scale study of costs using methods of systems analysis with the support of the Office of Education. NIH has been talking about making a study of the costs of graduate education but hasn't decided yet what they want. The Council of Graduate Schools is prepared to go ahead with their study. They have plans drawn up in a preliminary way, but have not been able to obtain funds yet. The CGS would like to have the moral support of this conference. They are seeking financial aid from the National Science Foundation, U.S. Office of Education, and the National Foundation for the Arts and Humanities.

Dr. Reitz asked what the difference was between the WICHE and the CGS projects. The answer was that WICHE would use just the thirteen Western States as its sample, plus Michigan and New York, rather than a more widely representative sample from the whole United States. The WICHE project also is aimed at getting a clearer understanding of management information systems.

Dr. Fusfeld asked how many universities had reliable information about costs. Dr. Morse replied that there was no uniform base throughout the country upon which such information was being compiled. The information available at present was therefore not very useful. There is a difference between wanting information for management purposes and wanting it for national statistical purposes. Dr. Arlt said that the CGS plan was to get the definitions clear first so that the terms would be understood and then to go on from there. The project, as planned, would take two years, and they expected to have the statistical work carried out by some research organization.

Dr. Allan Cartter commented that it would be difficult to get a good outfit to do this statistical work. He said that he would like to see the National Academy of Sciences get involved in this with the CGS and WICHE. Dr. Herbert Carter pointed to the many complexities in dealing with the cost of education. There are differing products, and there are changing products. He thought it better to direct the whole effort toward a continuing and increasingly sophisticated system rather than to do it for one or two years

only. Dr. Kidd said that both things would be needed -- long-range results such as the results that Dr. Carter is referring to and immediate short-range results that could have an early effect upon the course of planning. Dr. Bueche said that the discussion reminded him of the axiom in business: "Never let the planners run the business." Dr. Allan Cartter said that he thought that a continuing effort would be needed.

Dr. Handler said that actually the U.S. Office of Education should do this, but he was rather dubious whether they could with their present load of work. He said that he had become discouraged in the recent past about getting information from the Office of Education. They have run into a number of statistical difficulties in handling data.

Dr. Morse pointed to the urgency of getting something started. He said that there was a crisis already looming before the universities. In two years, he thought, the crunch would come. No answers were available. He asked what had prompted this meeting. Was it a sense of crisis or a continuing concern? Dr. Handler replied that he thought it was a sense of crisis.

Dr. Herbert Carter said that the proper organization should declare an intent and commitment to work on these problems. The effort needs continuing stability and a firm base from which recommendations can be made. Dr. Handler said that what would be needed in the very near future was a "quick and dirty" study of costs which could be refined later. At the moment it would be helpful to know what the cost was per Ph.D. within a probable error of two thousand dollars. Rough results now would be quite useful. Dr. Carter said that the State of Illinois was already asking for this kind of information from the universities there. The plan was to budget for education within the State by program. Dr. Fusfeld said that if a crisis existed, you should say you need certain things answered on a specified timetable. Then you should analyze the need, treating each piece separately. Then get the job done.

Dr. Handler said that eighteen months to three years was the range of probable completion time for the studies proposed. He thought that project 5 on utilization was related to project 3 on costs and would be doable in a relatively short time. Mr. Kearns commented that if the study of utilization showed that many Ph.D. organic chemists were now in sales, a real problem would be indicated. Dr. Bueche said that project 5 indeed bears on that problem. Dr. Herbert Carter said that any study of utilization should ask for a description of the function served by the Ph.D. and its relation to his educational preparation. A match between the two would have a lot to do with whether the man was happy in his job. Dr. Bueche said that in his experience the man who was completely happy was probably not very good in his job. Dr. Handler commented that project 7 on the evaluation of quality seemed to him to be rather soft and hard to deal with. Dr. Fusfeld said that it was certainly long-range. Dr. Handler suggested that perhaps Dr. Allan Cartter might take this on. Dr. Cartter said that he might be interested in this possibility.

Dr. Arnold reminded the group that many States were carrying on studies of graduate and other higher education and that the kinds of results they were coming up with might be used or compiled as an aid in the study of graduate education being discussed here. Dr. Handler asked whether it would not be a good idea to do all of this nationally and help the States with their task. Dr. Arnold said that he thought it would be. Dr. Allan Cartter suggested that it would also be desirable to combine efforts by fields rather than to have each field study its own problems in isolation of those in other areas.

Dr. Morse said that he thought that eighteen months to complete a project would be too long to have much effect on education. Mr. Kearns replied that the activity might be phased in such a way as to permit the read-out of some results at the end of a shorter period of time, but the work would then continue in order to obtain more refined results. Dr. Handler said that the central questions seemed to him to be project 2 on costs and project 3 on the needs for manpower in various fields.

Mr. Kearns referred to the paper by Martino in Science. The approach followed there impressed him as being quite good. It illustrated the fact that there was a lot of background material all ready and waiting to be assimilated to a study of the kind that we were talking about. Dr. Kidd pointed out that the Carnegie Commission has gotten out an early interim report based on its preliminary findings to meet the crisis which seemed to be developing in higher education. Dr. Bueche said that one could search for the range within which the answers would fall rather than trying to be too precise. It would be possible to get bands within which the answer would lie with an uncertainty of perhaps $\pm$ 20%. Dr. Allan Cartter said that if this kind of information were wanted he could provide it quite soon.

Dr. Bueche said that it would be possible to make steady-state predictions of industrial need for graduates of graduate schools, but of course anything that changed the economic assumptions would invalidate those predictions. Dr. Reitz said that an important reason why we needed information about the cost of graduate education was to advise institutions now contemplating new graduate programs. If the true costs of high-quality graduate education were known to these institutions, there might be some reconsideration of plans to launch new graduate programs.

Dr. Crawford asked whether it would not be the sense of this discussion that there should be a council or commission formed with broad representation to meet monthly to get going on this and to start the various studies discussed. The council could project its image rather promptly to Washington and graduate schools. Dr. Fusfeld said that it would be desirable to ask a few people at the National Academy of Sciences to plan this. Dr. Morse said that the dynamics of change in universities were not always apparent, but were operating. Steps are being taken by universities right now, and they invalidate projections that were provided only six months ago. Universities are cutting back and are not initiating new graduate programs. Things are going on that are not public knowledge. All of this is going to have a bad effect when young Ph.D's cannot get jobs that they want. Dr. Crawford said

that there was probably much truth in this but that it was worth noting that some institutions were starting new graduate programs - Dartmouth, for example.

Dr. Handler then began to bring the meeting to an end by saying that the staff would send some notes about the meeting and a prospectus for further action to the members of the conference. He asked the participants to correct the notes, revise the prospectus, and return the emended documents to him with further suggestions and comments. It seemed to be the consensus that some further action was needed, but the form it should take might better be decided after the participants had thought about what had been said here.

Dr. Fusfeld asked whether an advisory group would be formed. Dr. Handler said that plans for such a group would probably be included in the prospectus. It was not possible under the rules of the National Academy of Sciences to pay members of such an advisory group. However, special organizations could be hired to do the statistical work if that were necessary.

Dr. Kidd asked about plans for looking at the special problems of the disadvantaged. Dr. Handler replied that he thought that was an important problem, but a problem apart from the central ones being discussed here. He thought that it should be handled separately because it seemed to him to be outside the terms of reference of the group.

Dr. Shannon asked what the Office of Education could be expected to do in collecting information about the disadvantaged so that it would not be necessary to set up a crash program every few years. The Office of Education has several programs for the disadvantaged, the Office of Economic Opportunity has several, the Department of Labor has more, the Department of Defense has others, and so on. He asked whether the Office of Education was prepared to analyze the effect of these programs on the problems of the disadvantaged . He referred to the history of the Office of Education and the steady growth in its responsibilities for education starting in the early years of the Office with the problems of primary and secondary education, then going on, with the coming of the NDEA, to graduate education and other areas. He asked further what they were prepared to do in regard to the problems discussed here by collecting and analyzing information about graduate education. Dr. Reitz replied that the problems were well recognized within the Office of Education and that there had been real difficulties in collecting needed information and reporting it out promptly. He said that the National Center for Educational Statistics was improving in its performance. In the not too distant future the Center would probably be able to provide information within many categories on a prompt basis. However, the Center still has to solve a number of problems before it reaches that stage. Dr. Crawford said that within the community of graduate schools there had been a great deal of dissatisfaction expressed about the statistical reports of the Office of Education because the right questions had not been asked and there had been further difficulties in getting reliable data reported out promptly.

At this point, it was agreed that further consideration of the problems would take place when the notes of the meeting had been circulated and the prospectus for action made available, and after the participants had had a chance to reflect on the discussion of the last three days. Dr. Handler thanked the members of the group for their participation and adjourned the meeting.

September 17, 1969

AN OUTLINE

OF SUGGESTED ACTION

2. Costs of Graduate Education. It was suggested that this study of unit costs should be designed to meet both immediate and acute needs and long-term needs for information.

3. Manpower Needs. A survey to gather factual information and statistics from the principal employers of recipients of advanced degrees. To be based on realistic assessment of employer interest in specific types of academic preparation and not just on extrapolation of past or present trends in traditional programs.

4. Study of Existing Studies and Reports. A critical review and evaluation of information available from studies and reports recently completed or in progress.

5. Utilization Study of Recent Ph.D.'s. Follow-up on graduates of five years ago (education vs employment).

6. Modes and Magnitude of Support. A long-term study to determine levels and styles of support to meet national objectives in graduate education. The study of costs would probably have to be completed first to provide a sound base for this phase.

7. Evaluation of Quality - a) Graduate, b) Postdoctoral. This might be combined with the study of utilization and should consider inputs of American Council on Education and Carnegie studies now under way. (Some skepticism was expressed regarding this study. It was questioned whether meaningful results could be obtained. However, possibilities of obtaining objective information should be explored.)

Proposed Approach

The proposed steps in implementation of these findings were the following:

1. A phased, strategic, continuing program of study, consultation, and action concerning predoctoral education in the United States should be planned and conducted by a National Board on Graduate Education. The Board would be named by the Conference Board of Associated Research Councils (ACE, ACLS, NRC, SSRC), but would otherwise be autonomous, representing and reporting to the various interest groups (students, faculties, and administrations of graduate and other higher education; industry; disadvantaged groups; foundations and associations; government in several branches and levels; and the public). About forty persons would serve on the Board on the basis of a rotating membership.

   a) The Board would meet quarterly to establish general policy, identify problems, review the reports of studies, and plan the implementation of recommendations.

PROGRAM

PROGRAM

CONFERENCE ON PREDOCTORAL EDUCATION IN THE UNITED STATES

Session I, 8:00 p.m., Sunday, August 24. Chairman: Philip Handler

A. Background for the Conference:

1. Introduction - Philip Handler

2. Review of graduate education, historical benchmarks, and efforts to instigate change - Gustave O. Arlt

3. Remarks on the information base - Wayne C. Hall

Session II, 8:30 a.m.-12:30 p.m., Monday, August 25. Chairman: Herbert Carter

A. General discussion. Assessment of the present situation and trends and of their implications for the future:

1. Has the surge in the number of advanced degrees granted during this decade established a sound basis for continuation in the future? Is it leading to an oversupply of people with specialized research expectations? Has it occurred at the price of a decrease in quality.

2. Do present doctoral programs in fact inculcate rigid attitudes toward research specialization? Will present degree programs satisfy the needs of industry, government at all levels, and the universities and colleges, including two-year colleges? Are the expectations of graduate students concerning their degree programs being met?

3. What effect will social, political, and economic developments, such as the draft, student unrest and dissatisfaction, protests, reaction, and the rising expectations of the disadvantaged have upon graduate education? Are imbalances developing among fields in the granting of doctoral degrees, in view of anticipated manpower needs?

4. What are the implications of the growth of postdoctoral education for graduate education? In which fields will this growth have a pronounced effect on the extent and character of predoctoral education?

5. Where are there deficiencies in our knowledge and understanding of the foregoing problems (Questions 1-4), deficiencies which might require further study?

Session III, 2:00-6:00 p.m., Monday, August 25.

A. Meetings of four working groups, one to consider each of questions 1-4. Each group would consider question 5 in connection with its topic.

Session IV, 8:30 a.m.-12:30 p.m., Tuesday, August 26. Chairman: Max A. Tischler

A. Summaries of discussion in the working groups on Monday afternoon, 15-minute reports by their chairmen.

B. General discussion of possible measures to sustain graduate education and make it more responsive to anticipated national needs in the future:

1. If the present trend of increase in the number of advanced degrees is sound, where will funds come from to sustain continued growth of graduate education and to support research by Ph.D. recipients in the future? By what mechanisms should such funds be injected into the educational system? How can the productivity of graduate education be increased?

2. If the present trend harbors dangers, what changes in the characteristics of degree programs, selectivity in graduate admission, or requirements for degrees are indicated? What changes will the growth of postdoctoral education institute in the graduate education of future leaders in research?

3. What types, patterns, and mixtures of graduate programs and degrees will be needed for the future, considering the role of the traditional research-based Ph.D.; master's and intermediate degrees; programs with a professional, rather than a scholarly orientation, at both the doctorate level and lower levels; and specialty and interdisciplinary doctorates?

4. How can quality in graduate education be maintained or strengthened, considering the growth in the numbers of graduate students and of graduate institutions? How can workable programs be devised for the disadvantaged graduate student without jeopardizing standards?

5. Where are there deficiencies in our knowledge and understanding of the foregoing (Questions 1-4), deficiencies which might require further study?

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