

INTERDISCIPLINARITY AND THE UNIVERSITY: THE DREAM AND THE REALITY

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ABSTRACT

In proposing interdisciplinary programs to deal with the problems caused by specialization, it is important to understand the development of the modern university between the middle of the nineteenth century and the present. The current organization of knowledge is the result of several changes in the university. These include increasing secularization and diversification of the curriculum and the rise of the contemporary discipline as a new social institution. A variety of existing programs, including those at Pennsylvania State University, demonstrate the interdisciplinary interactions that can take place among students, faculty, and researchers.



INTRODUCTORY REFLECTIONS

The domain over which the term "interdisciplinary" ranges is vast. The topics which interdisciplinarians discuss in this domain were "caused" by a great number of problems, issues, or challenges.¹ The debate about interdisciplinarity is necessary in part because we appear to know too much; this confronts us with the problem of how to introduce younger people to the enormous domain of human knowledge, only a very small part of which they will be able to conquer. This fact confronts us also with the problem of how to employ this vast knowledge over which no individual still has control. In part we speak about interdisciplinarity because specialization appears to be necessary and unavoidable. It may be that we have specialized in the wrong manner; but even so, specialization in some form or other is necessary and all specialization in due time leads to interdisciplinary issues.

In part the debate about interdisciplinarity was spawned by the negative influence of government, industry, and above all by the professions upon our institutions of higher learning. The ever increasing and new demand that our students be made ready for the jobs that are actually available in our society today often led to a very one-sided, disciplinary kind of education which

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appears to be inadequate in different respects: the student is not well educated in such a framework; he or she is often not even well-trained; the students find it difficult to find new jobs when the old ones are to be eliminated; the students are unable to accept a "leading" position in society because of the lack of knowledge in areas of specialization different from their own.

In part our problems stem from the fact that our institutions of higher learning have grown beyond all proportions. This development brought with it the development of ever more small educational units. In the past these units were erected mainly along disciplinary, professional, and vocational lines. In addition to the issues mentioned, other factors should be mentioned here also; I plan to discuss some of them in the pages to come; yet those touched on here may suffice for the present purpose.

An important factor which has played an unfavorable part in this entire development is the implicit positivism that suggests that one does things well when one does them scientifically, and then understands by "science" not that which Hegel once understood by this word, namely the harmonious unity of all knowledge known on the basis of a solid historical and philosophical foundation, but rather one of the individual scientific disciplines of today, or even worse, just one of the formal sciences such as logic, decision theory, cybernetics, systems theory, etc. The moment one questions this assumption which suggests that there is no basic problem here, but only a question of lack of knowledge, method and information -- an assumption which in addition gives us some vague hope and promise that all our problems can easily be resolved as soon as some more knowledge becomes available -- one will see soon that the basic problem is not at all one of lack of knowledge, but rather a lack of genuine understanding of the knowledge known already. Those who wish to deal with the basic issue in a meaningful manner will find out soon that method can never be a substitute for thinking, critical reflection, wise decision, and responsible action.

It is my conviction that those who engage in a debate on the integration of knowledge and on issues of interdisciplinarity should not underestimate the enormous task which confronts them. It is mandatory that one familiarize oneself with the necessary dimensions of the problem which ranges from philosophy of education, via reflections on epistemology and logic, rhetoric, communication, and a concern with the proper distinctions and terminology, to a discussion of administrative decisions, educational structures, the curriculum, and finally economic, psychological, social, and political issues. Thus we must convince ourselves that the best terminological, epistemological, and methodological reflections will remain totally ignored by administrators,

educators, teachers, and students as long as we cannot convince them that what in education has grown historically is unacceptable, both from the side of education and from that of research. What worries me most here is that very few worry about this state of affairs. As long as administrators, teachers, and students are not really convinced that a drastic change in higher education is both necessary and possible, things will remain the way they are, regardless of how important our efforts may be to contribute something to a clarification of important epistemological, methodological, rhetorical, and logical issues. Obviously, these latter efforts are all necessary and helpful; yet it seems to me that they will remain ineffective as long as we do not dare to touch on the basic underlying issues.

In a short paper it is impossible to raise all the relevant topics. Yet I hope to make some important remarks; these I shall introduce with the help of some brief historico-critical reflections. These reflections will focus on two issues just mentioned: the development of higher education in the 19th century, and developments in our intellectual globe in the 19th century. I shall conclude these reflections with some observations on the debate about interdisciplinarity today.

THE DEVELOPMENT OF HIGHER EDUCATION IN THE 19TH CENTURY²

Anyone who compares the 18th century American college with our contemporary American universities will immediately perceive the drastic changes which our institutions of higher learning have undergone over the past 200 years. First of all there is the obvious change in curriculum caused by a long process of increasing diversification and specialization. Originally the curriculum comprised the study of the trivium and the quadrivium as well as the study of the scriptures; today we find a totally secularized curriculum consisting of more than 100 different courses of study. Secondly, there is the change in organizational structure. Here the transition has been from a residential college that consisted of a president who was also the head-master, two or three tutors, and a few dozen students, to a highly complex university that may consist of hundreds of administrators, several thousand faculty, and a student body ranging from 50,000 to 150,000 and more. Thirdly, there is the change in the kinds of students seeking post-secondary education. Originally the student body consisted of a rather homogeneous group of male students headed for civic leadership or the ministry, mostly selected from the higher classes of society. Today there is an incredibly heterogeneous population consisting of men and

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women of different age groups, religious views, social backgrounds, and with quite different interests, needs, and aspirations. Fourthly, toward the end of the 18th century the college attempted to educate devout Christians and good citizens; the modern university attempts to provide anyone who has a high school diploma with the kind of training that he or she may need to effectively compete for a job in any one of the numerous professions, vocations, trades, or crafts. Finally, the tutor of the original college was supposed to teach the predetermined course and to maintain strict discipline and high moral standards. The professor of the contemporary university has been socialized to strictly professional norms that stress research and scholarship and which literally determine the entire social and academic organization of the university.

It is not easy to come to an adequate understanding of this drastic change which has taken place over the past 200 years, in view of the fact that the development was influenced by a great number of factors, some immediately connected with developments that are intrinsic to the ever increasing structuring and articulation of our intellectual globe, and others caused by extradisciplinary, social, political, and economic factors and forces. In the pages to come I shall try to describe some of these factors briefly.

A first factor to be mentioned here is the increasing secularization of the curriculum. At first colleges and universities in the United States were meant for the education and the training of the clergy, medical doctors, lawyers, and military personnel in the 19th century the need was felt for the education and the training of an ever growing number of professionals, physicists, engineers, chemists, biologists, economists, business administrators, geographers, journalists, meteorologists, pharmacologists, and later the various social scientists. The classical curriculum which had consisted to a large extent of philosophy and theology was completely inadequate to deal with this growing need. Time and again the curriculum had to be adapted to an ever changing situation. This continual change would eventually lead from a simple and homogeneous curriculum to the point where students can earn the highest degree in approximately 130 different areas, each area having its own typical curriculum which is oriented to the student's professional training, and no longer to his overall education "as a Christian and a citizen."

Another factor to be mentioned here is the introduction of options for different types of students. We have seen that originally the college (and later also the university) provided all of its students with virtually the same education and training. When the curriculum was changed and new subjects were added to the curriculum, it became advisable to give the students a choice with respect to the curriculum. It was then not only the case that each student in principle

could choose his own field of study; but it gradually also came to be general practice to give the students a choice with respect to all subjects not expressly prescribed by the program of their choice. Even for the most rigorous program (theoretical physics), the curriculum still leaves 27 credits for non-physics related subjects (the humanities, the arts, and the social sciences).

In the 19th century it was still very often the case that all students had to take a great number of courses that they all had in common. Thus the students then still shared a large part of the intellectual globe and this made "interdisciplinary exchange" between people of different professions still relatively easy. Gradually this situation changed and today we find ourselves in a position in which our students of the different departments have very little in common as far as their education is concerned. I take this to be one of the most important reasons why today many professionals are incapable of understanding the concern of the interdisciplinarians and often simply reject the legitimacy of their efforts. For people who have very little in common it is very difficult to come to a meaningful cooperation. If the interdisciplinary movement is to have a promising future, one will have to focus on the question of how one can guarantee that all our students will receive a broad and deep education in the most important provinces of knowledge.

A fourth factor to be mentioned in this connection is the idea, first suggested by Wayland at Brown, that the University should adapt itself to the wants not of the highest class alone, but to the wants and needs of the entire community. This suggestion eventually led to the creation of a number of community colleges with diversified curricula, in which, in addition to the "traditional" subject matters, courses of study of a more practical and technical nature were included. In Wayland's opinion the sons of merchants, mechanics, and manufacturers had nowhere to go to further their education, since the traditional curriculum failed to serve them.

Where this development in continental Europe quite universally led to the creation of new types of schools of higher learning, different from the university (the technical institutions of higher learning for engineers, economists, business administrators, agricultural scientists, as well as those for musicians, painters, and architects), in the Anglo American countries this development led to the inclusion of ever new colleges and schools in the traditional university. It is understandable that from that moment on it would become ever more difficult to define the "mission" of the university.

In addition to these factors, all of which were directly related to the development of our modern society, there were other important factors which

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deeply influenced the development of the modern American university. The most important of these is to be found in the fact that in the 19th century a number of young American scholars went to Europe to further their education. There many of them were confronted with the German university. After returning to the United States some of these younger scholars systematically attempted to remodel the American colleges and universities on what they believed to be the German idea of higher education. One of the first of these younger scholars, George Ticknor, experienced quite soon that there is a great distance between a European and an American scholar. In fact, he noted that America did not yet know what a scholar was, much less how to produce one. In his view the private tutorial is the most effective and valuable instrument of university education. Lectures were in his opinion only an adequate vehicle for providing a comprehensive perspective of a broad topic as well as a sense of the significant relationships among the parts. However, Ticknor was mostly impressed by "the universal toleration in matters of opinions. No matter what a man thinks, he may teach and print it, not only without molestation from the government but also without molestation from public opinion."

In addition to the bringing about of administrative and structural reorganizations, the efforts of those who returned from German universities were to lead also to a new conception of higher education. The aim of higher education was no longer to create devout Christians and good citizens, but to train scholars. Some authors suggested making a distinction between commercial schools, polytechnical schools, etc. on the one hand, and the real university on the other. The university was not to train vocational or professional people, but scholars: it was to train thinkers.

Some people returning from Europe made the mistake of believing that an excessive concern with methodology had an inherent connection with the much more comprehensive academic purpose of the university. They even created a new expression, "scientific research," to express this purpose. These people totally overlooked the broad and foundational aspect of Wissenschaft and begin to view the significantly altered and abridged conception of science as the sole purpose of the university. Over a long period of time this error was to lead to the constitution of independent departments and, thus, to a compartmentalization of theoretical knowledge which was alien to the original conception of the German university.

When increasing specialization made it clear that it was no longer possible to include in a four-year course of undergraduate studies all available subjects, several universities adopted an elective system in which the undergraduates had considerable freedom in the selections of their subjects and

courses. I have mentioned this already. Let me add here just one of the consequences. This latter development together with the idea that the university must create "virtuosi" in each field of learning, the idea that students should be prepared for a profession or vocation, the combination of university and the German Hochschule in one institution of higher learning, gradually led to the conviction that each science or discipline should have its own department in the university, and that each department was to stipulate a course of studies for its majors without much attention being paid to the legitimate needs of students equally specializing in other disciplines or sciences. Thus around the beginning of this century the original elective system was replaced by the major-minor system. From then on a student could choose his or her major, but the department determined what course of studies was to be followed.

DEVELOPMENTS IN THE GLOBUS INTELLECTUALIS IN THE 19TH CENTURY: SPECIALIZATION

Turning from the local to the international scene I wish to trace the present organization of knowledge in special and separate disciplines backward in time in order to illuminate the essential features of this development. Some preliminary observations are in order first.³ It should be noted that there is no unanimous agreement on the question of precisely how a discipline is to be defined. Furthermore, each discipline had various aspects: educational, research, historical, social, political economic, etc.; depending upon the dimension one considers predominant in a given context, one will choose a definition of discipline which seems adequate to the purpose at hand. For our present purposes, let us assume that a discipline is a recognized branch of knowledge within rational learning with certain generally agreed upon canons and standards. There should be a sufficient number of people actually engaged in this branch of knowledge, some of these people should be relatively important or influential, their discipline should be regarded as significant in the academic community, there should be a national society and a special journal, and the society should be a member of one of the three American councils. Currently there are more than 100 disciplines for which these criteria hold.

The question to be considered here is: how did the division and separation of disciplines and specialties become the basic organizational feature of scientific knowledge and education? What function do the disciplines serve? What functions are they intended to serve? Ultimately, precisely what is the function of the university and even more generally, what is the function of higher education? One could obviously say at once that education serves as a social institution through which the members of a society are trained to perform

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productive tasks for that society; in addition, it plays a socializing role by installing acceptable social behavior and by reinforcing conformity in regard to basic values and attitudes. Thus all professionalization and specialization notwithstanding, education also plays an ideological role. But before trying to come to conclusions, let us first turn to the historical "facts."

We all know that the university is a product of the Middle Ages. There had been learning before, but it had never been organized on the highest level into permanent social institutions. The medieval university served a clearly defined social need as the universities of Salerno, Bologna, Oxford, and Paris clearly show. At any rate they were not institutions of abstract learning for learning's sake; nor were they research institutes. The sociopolitical structure in Europe had developed to a point where it became apparent that the society was in need of well-trained theologians, lawyers and jurists, medical doctors, orators, etc. It should be noted that this first form of specialization was demanded by society's need, not by the educational institution as such, nor by factors inherent in theoretical knowledge proper. The specialized learning was expected to yield a direct benefit to society.

In Paris there were four faculties (arts, theology, medicine, and law). Education placed great stress on logic and rhetoric; teaching consisted in commentaries on carefully selected textbooks (auctoritates); learning consisted in familiarizing oneself with the available knowledge in the field and developing the capacity to make this knowledge fruitful in some sense. The university was a school, an educational institution of society, not a research institute.

It is precisely because the university was meant as an educational institution where available knowledge was to be handed down and made fruitful for the life of society, that in the 17th century, as the main carrier of intellectual tradition, it was rivaled by the scientific academy concerned primarily with the growth of knowledge. Insofar as members of the classical university pursued research activities, they did so as a supplement to and not as an integral part of their educational function. The scientific academy, on the other hand, had no other function than the promotion of ever new knowledge in ever new fields. It is illustrative to note that in 1654 university professor Zachary Coke listed theology, law, medicine, and philosophy as the branches of learning, whereas Robert Boyle, one of the English virtuosi, mentioned disciplines such as "opticks, astronomy, hydrostaticks, and mechanicks" (1685).

Most members of academies were not connected with a university, and there was a strong rivalry between those who transmitted what was already known and those who were concerned with what could become known, and a

rivalry also between those who defended a hierarchy by tradition and those who defended a hierarchy by achievement.

Yet gradually, university and academy become integrated; this came about first in the Netherlands and Germany (Leyden, Halle, Göttingen), where large library facilities made creative research possible and soon various institutes focused on new domains of investigation. This development would gradually lead to two different types of higher education: the école polytechnique and the German version of the modern university.

Yet what we call disciplines and specialties today are products of the 19th century. Their development is connected closely with the evolution that took place in the natural sciences partly under the influence of the progress of industrialization.

What we now call biology did not exist before 1850; physiology, psychology, and sociology are obvious products of the 19th century, also. In many instances the development of new disciplines was closely connected with the development of new research institutes within the modern university or the polytechnical institute. Texts were still important in every field, but they began to play a secondary part. The classical treatise is a summary of the available knowledge, an overview of what is known already, written with the intention of pointing to areas which could be expanded further through research. It was mainly the institute where research in the specialties was carried out. It was there also where a mentality of belonging to the group of professionals was nurtured.

Since equipment necessary for research in most fields is extremely expensive, most institutes limited their research to investigations in narrowly defined fields. When research in a narrow field became very successful, it became the domain of a specialty, ultimately leading to a new discipline. Because of the expensive equipment to be developed and particularly because of the relevance of research in the natural sciences for government and industry, gradually a very close relationship developed between the institutes, government, and industry.

Science was no longer the province of the amateur who thought and worked in his own little workshop, nor the work of the virtuoso connected with an academy, but of the specialist trained in an institute connected with a university; indeed, science became synonymous with specialization. Furthermore, the opening of an industrial marketplace for the practitioner of a specialty obviously enhanced the attractiveness of these specialties and facilitated

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both the recruitment and placement of the specialized disciplinarians. Finally, the creation of societies and specialized journals maintained the solidarity of specialists even when they were no longer in close physical contact with their colleagues. They gave the specialist an opportunity to keep abreast of the latest research findings and a forum for the publication of his own work. Both in the scientific society and the scientific journal the specialist did not need to compete for an audience with members of other specialties, nor did he need to even consider perspectives other than those of his own speciality. The development of vocabularies particular to specialties also favored segregation rather than unification.

It should be understood that this development was not always an easy one. It is not the case that every institute ultimately led to the development of a new discipline with its educational facilities, its societies, journals, and standards for socialization. It is not correct either to assume that this development was always smooth.

Perhaps it is interesting to note that even philosophy underwent a deep-going change because of this development. Philosophy gradually became a discipline of philosophy, although it was originally conceived of as the faculty. Contemporary academic philosophy is also characterized by disciplinary specialization and segregation. In order to maintain an aura of relevance as a discipline, philosophy has spawned a series of "philosophies of....," the relevance of which is often questionable, to say the least.

Be this as it may, the perpetuity and the homogeneity of disciplines, once constituted, are ensured by factors which flow from two different sources. Some are inherent in the disciplines themselves; others result from factors extrinsic to the disciplines proper.

For our present purpose, it is important to note that the initial stimulus for the increasing segregation of disciplines and subdisciplines came from sectors of society where such specialized knowledge could be applied directly and without constant reference to broader, related issues. Industrialization in particular played the key role. This is obvious when one carefully compares the development of increasing specialization in Germany (where university, Hochschule, and industry cooperated closely) with the lack of a parallel development in England where at first most classical universities did not promote specialization and had no ties with industry.

We have seen that in the United States colleges were originally modeled on their English predecessors, but that a reform movement which originated

toward the middle of the 19th century changed this picture altogether. This change in the institutions of higher learning was immediately reflected in the growth of academic societies and scientific journals. We have pointed out also that the reformed American university of the second half of the nineteenth century was modeled mainly on a typical American interpretation of the German institutions of higher learning. In this interpretation the extension and intensification of specialized knowledge was carried far beyond the German model and the reforms which set them in motion were initiated deliberately to produce social benefits. Specialized knowledge arranged along disciplinary lines was not intended to serve the promotion of the truth or to follow the demands of "pure" knowledge. In every instance, the justification for these reforms was expressed in terms of applicability and utility. It was not pedagogical issues, but socio-political issues which promoted the development in the United States. According to Andrew D. White, the first president of Cornell, the university was to train the "captains in the army of industry" and even Daniel Coit Gilman, first president of Johns Hopkins, stressed the social function of the university together with the necessity of the pursuit of pure research.

It was primarily the creation of research facilities which transformed the American college into the American university. The research orientation, in turn, furthered the development of separated and independent disciplines, taught in separate and independent departments, and promulgated via appropriate societies and journals. All concern for social relevance notwithstanding, most disciplines remained primarily self-contained and self-regulating enterprises. This is most obviously the case for the so-called pure sciences and the humanities. But at the turn of the century this was true also for chemistry, where of the 9,000 graduates only 276 were employed in chemical industries.

It should be noted that whereas in the traditional American college teaching was a primary concern, in the modern university research became primary and teaching secondary. In the long run this development would lead to grave difficulties within the universities. The entire reward system was built then upon productivity in research; people who wished to "make it big" had to devote all of their energy to innovative research and to publications; thus their courses were often badly prepared and taught or, as in many instances, left to others. Yet this obvious potential for conflict between teaching and research in the various closed disciplines soon became evident also in the ambiguity it projected into the student body. Is a student to search for a rich education or for a narrow training in one of the specialties; and in the case of the latter, is he to be trained as a possible future teacher of the discipline or as a competent and innovative researcher? In view of the enormous amount of achieved knowledge in each discipline, more and more disciplinary departments began to

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develop curricula in which there was room only for the discipline itself and the absolutely indispensable auxiliary disciplines. The idea that the university had also to concern itself with a student's education gradually faded into the background and in some instances disappeared altogether.

From the preceding reflections it should be clear that the structure of our contemporary university is not the result of a concerted effort on the part of faculty, students, and administrators to improve higher education, but the indirect result of the origin and development of a new social institution, called the contemporary discipline, with its closed membership, societies, journals, research institutes, training centers, university departments, guidelines and norms. Allegedly created to enhance the social relevance of the universities' activities, the disciplines were in fact created primarily for purposes immanent and essential to this very social institution. One can state without any exaggeration that this social institution most certainly failed in making a positive contribution to the main task of the university: to educate its students in a manner which in addition to concern for vocation or profession, skill or craft, would first of all guarantee that the students would be able to live a rich and rewarding life both as individuals and as citizens. Secondly, it is also fair to state that the discipline failed to guarantee its own members a meaningful future within the domain of the discipline itself: there are too many specialized people in any given field who neither in the institution itself (professors and researchers in an educational setting) nor in government and industry are able to find meaningful employment, and who because of too narrow a training are unable to compete for a meaningful position in fields beyond that of their specialization.

The moral of this story need not be that the university abandon its departmental structure; in my opinion this is economically impossible, not desirable educationally, nor necessary "philosophically." Yet the moral of the story certainly implies that faculty, students, and administrators need to focus once again on the question of what the primary goal of our institutions of higher learning should be and, in light of this, reexamine the priorities of the university. It seems to me that the most effective step one could take would be to make certain that before a student is permitted to specialize, as well as during the entire time of his specialization, he receives a genuine, broad, and deep education. This can be accomplished only by means of a proper introduction to the natural and the social sciences on the one hand, and to the humanities and the arts on the other.

INTERDISCIPLINARITY AND THE UNIVERSITY:
DREAM AND REALITY

When fifteen years ago I began to devote serious attention to the interdisciplinarity issue I had my dreams and hopes, like everyone else who has become involved in this important and much needed movement. I found myself at a very large university and saw myself being confronted with problems and issues for which, I believed, some form of interdisciplinary interaction alone could be the solution.

In my view people working in small liberal arts colleges (where interdisciplinarity usually is the label for multidisciplinary education in the humanities and some very carefully selected sciences), very seldom fully understand the enormous problems one faces at large universities. Such universities may have more than 50,000 students and more than 3,000 faculty members; they may have more than 120 different undergraduate programs, all developed along disciplinary, vocational or professional lines. The curriculum for these units is determined by the faculty of the unit, with some minimal control by the senate. Each university sets some credits aside for the purpose of general education. In large universities this is very seldom more than 25 to 30 credits from the 125 credits required by most programs. At any rate, most of these program curricula are extremely one-sided and the majority of these curricula is developed along strictly disciplinary or professional lines.

When I turned to the interdisciplinarity issue I argued that the professions and the vocations ultimately would take care of the professional and vocational needs of our students. The professions and the various vocations communicate with the university and "tell the people there" what kind of graduates they need and want, and how they are to be trained. It seemed to me impractical to try to change this. People who are involved in the training of new aspirants for the various professions and vocations prefer not to listen to philosophers and educators; they listen rather to those who will provide their students with jobs. Obviously, it is not my intention to suggest that this area, too, would not be a domain of grave concern for an interdisciplinarian. Yet it is one with which I decide not to concern myself, simply because I was convinced that in my situation not much could be accomplished in this domain. If others see possibilities and options, I certainly hope that they will pursue the relevant issues vigorously.

It is perhaps important to note here that, contrary to my assumption of fifteen years ago, today there is quite common agreement with respect to the fact that our highly specialized undergraduate students, trained in disciplinary

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departments and in vocational and professional units, often do not really fit the positions offered at the job-market, and that for that reason they often are to be retrained on the job, very often in a clearly interdisciplinary manner. This is true particularly for those students who seek jobs at large firms and companies. Today there are companies who prefer liberal arts students with a training in the general arts and science option, over students trained in the economic or engineering departments. It would be worthwhile to make a study of the training programs for incoming professionals at IBM, General Dynamics, General Electric, AT&T, etc. Often one will see that incoming people are to be retrained in order to fit into the multi-dimensional production process in which they are going to play an important part.

I conclude from this with some caution that even though the university often completely ignores the interdisciplinary issues as far as education and research are concerned, even in these areas government and industry are convinced that the one-sided instruction and training we give our students in these units, is often still very inadequate. In medical schools, too, one sees a development in a new direction. One begins now to look for students who know more than just biochemistry and anatomy. At this very moment large corporations are approaching the universities with the request of establishing a greater form of cooperation between education and industry in order to make certain that students indeed are properly trained for the variety of activities they are later expected to engage in. In many instances the proposals made by industry stress interdisciplinary education and interaction. But let me return to my main concern.

Given the actual situation in which I found myself in 1970 I was predominantly interested in two issues which I took to be basic: 1) how is one to improve the education of our undergraduate and graduate students in a large university? 2) how is one to bring about a meaningful dialogue between members who belong to different disciplines or to different vocational or professional units. My first concern led to a number of proposals which were meant to enrich each student's general education by means of specially developed, excellent courses in the sciences, the arts, and the humanities, to be taught by the best scholars and teachers in each field. They have also led to active cooperation with efforts in the newly developed STS program. It goes without saying that in these efforts my colleagues and I were guided by interdisciplinary concerns insofar as interdisciplinary interaction is practically impossible by strictly disciplinarily trained people.

As for my second concern, we have made a deliberate effort to create interdisciplinary faculty seminars for faculty and graduate students of different

units of the university who focus on issues or topics that they all have in common. In addition, we have proposed a number of typically interdisciplinary courses, some of which were to be team-taught. Our cooperation with the STS program has been very important in this area, also. Finally, we have created an interdisciplinary program for students who wish to earn the Ph.D. degree in a typically interdisciplinary area for which our university has no program. Looking back at the last fifteen years, I can say that in some of our efforts we have succeeded; yet there were others in which we have failed. Speaking generally, I think that our efforts have been more than worthwhile. There are many faculty members and graduate students who highly appreciate our efforts.

I am convinced that each one of you can tell a similar story. Let me now conclude with a very brief reflection on where all of us together stand today.

If we as a group of like-minded interdisciplinarians after fifteen years look back at our efforts and at what has been achieved, I am convinced that we have reasons to be proud and optimistic. There are today a small number of interdisciplinarily organized universities. There are also many interdisciplinary research centers in many universities. The curriculum of a great number of students is no longer strictly disciplinary in the "classical" sense of the term. Finally, there is an ever growing body of high quality literature on interdisciplinary issues.

Yet all successes notwithstanding, there is still ground for caution and perhaps even disappointment and frustration. We are not really heard by most of our colleagues and peers. The educational and research units of most universities most of time still operate in complete isolation; in most of these units no effective interdisciplinary interaction between faculty, students, and researchers has taken place. There are still no real roads between the independent disciplinary, professional, and vocational units. Finally, an all-around, sound, and deep education for most of our undergraduate students which is to include the humanities, the social sciences, the arts, and the natural sciences has not materialized, either.

Yet these black clouds are no reason for despair. What we need in my view is a better understanding of the "causes" of the developments in higher education between 1800 and 1985. It is clear to me that some of them cannot be changed. Yet others were just arbitrary, accidental, and often very counter-productive. If we would focus on the latter factors and make constructive and realistic new proposals, things will change. Let us not forget that evil often prevails simply because one decides to refrain from action.

NOTES

1 Cf. Joseph J. Kockelmans, "Why Interdisciplinarity?," in Joseph J. Kockelmans, ed., Interdisciplinarity and Higher Education (University Park, PA: The Pennsylvania State University Press, 1979), pp. 123-160.

2 Cf. In this section I have made use of ideas developed by Hans Flexner in "The Curriculum, the Disciplines and Interdisciplinarity in Higher Education," in Interdisciplinarity and Higher Education, pp. 93-122.

3. Part of the historical details mentioned in this section are taken from an essay by Wolfram Swoboda: "Discipline and Interdisciplinarity: A Historical Perspective," in Interdisciplinarity and Higher Education, pp. 49-92. See also the essay by Hans Flexner quoted above.

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