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TOWARD A PRACTICAL APPROACH TO
HEALTH PROFESSIONS CURRICULUM DEVELOPMENT

DISSERTATION
Presented in Partial Fulfillment of the Requirements
for the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By
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The Ohio State University
1970

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"The Geology Series." A series of six single concept films for use in geology autotutorial laboratory. The Ohio State University, 1968.

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INTRODUCTION

During the two-hundred and five years since the founding of the first medical school in the New World by John Morgan and William Shippen at the College of Philadelphia in 1765, medical education in the United States has fluctuated between periods of innovation and status quo. Curriculum changes have usually been characterized by localized efforts to improve the quality of medical education over a limited period of time, followed by slow deterioration of whatever advances had been made.

Efforts toward improvement have most often been dependent upon the insightful leadership of a few men and have thus had limited scope. Such improvements have understandably lost momentum with the passing of their founders. Deterioration has most often resulted from an inability to continue to change to meet new scientific and social demands, or from an undue emphasis on meeting the needs of the present at the expense of preparing for the needs of the future.

The thesis of this dissertation is that significant, consistent progress can be made in medical education by systematically taking full advantage of the many inspired suggestions of medical teachers, students and practitioners, and by systematically applying the growing store of knowledge about teaching and learning to the medical school environment. Corollaries are that only through regular reexamination and revision will periods of complacency and deterioration be avoided.
Only through consistent and persistent application of what we know how to do well can we hope to develop and sustain needed programs.

This dissertation proposes a practical system for educational change and development that may be a step toward evolutionizing the medical curriculum. A parallel treatment of change in medical learning is being developed by Warren R. Aiken. Both papers arise from experiences gained between 1969 and 1970 with The Ohio State University College of Veterinary Medicine's concentrated effort toward educational excellence. An earlier study of veterinary medical education at Ohio State (Brumley and Charters, 1939) has been an interesting reference in the development of this paper, because it pointed to some of the same problems and solutions that are relevant today. Its failing seems to have been the lack of a systematic way to change in keeping with changing needs.

At this point it is appropriate to present definitions of the major elements in an educational program (suprasystem) as well as a simple model (Figure 1) of the relationships between those elements as they will be developed in the two dissertations.

CURRICULUM DEVELOPMENT SYSTEM: A structured set of activities and events, guided by established criteria and designed 1) to select from the organized bodies of knowledge, skills and attitudes the elements that best interpret those bodies for the student, and further 2) to structure those elements in patterns that will be meaningful for the student, resulting in a new or improved curriculum.
VALUES AS CRITERIA

CURRICULUM

DEVELOPMENT

SYSTEM

AVAILABLE, TEACHABLE HEALTH SCIENCE KNOWLEDGE, SKILLS

LEARNING

CHANGED SYSTEM STUDENTS

FIGURE 1. AN EDUCATIONAL PROGRAM

CURRICULUM: A structured set of selected intended learning outcomes, designed to guide the planning, execution and evaluation of interactions between the learner and his environment.

INSTRUCTIONAL SYSTEM: A structured set of planning, implementation and evaluation activities and events guided by curriculum and intended to change learner behavior through meaningful interaction between him and his environment.

Two short quotations from the work of Mauritz Johnson may help clarify the distinction being made:

Curriculum prescribes (or at least anticipates) the results of instruction. It does not prescribe the means, i.e., the activities, materials or even the instructional content to be used in achieving the results.

Whether experiences are viewed subjectively in terms of the sensibility of the experiencing individual or objectively in terms of his actions in a particular setting, there is in either case no experience until an interaction between the individual and his environment actually occurs. Clearly such interaction characterizes instruction. (1968, pp. 129-130)

The first chapter of this paper, which analyzes the current context for change in medical education and synthesizes an approach (systemization) for meeting changing needs, shares common characteristics with Alken’s Chapter One, and was developed jointly.
The necessity for a chapter having common elements arises from the integral relationship between curriculum and learning in the development of educational programs. Curriculum and learning will be treated separately as a matter of convenience after Chapter One, although the intention is not to excise curriculum neatly from the concepts of learning and of a total medical education program. It is hoped that the reader will take serious note of the major points of interaction between the two systems.

In chapters two and three carefully analyzed curriculum functions, acts and roles are discussed with respect to each of four curriculum development subsystems: Philosophy, Synergistic Support, Outcomes and Structural Dynamics. The result is a developmental map for use by curriculum change agents in health professions institutions. The map (Summarized in Figures 7 through 14) is intended to be a master plan into which the program develops rather than a prefabricated structure that is superimposed on the medical school. Toward this end a general scheme for initiating a systematic, evolutionary program for curriculum development is suggested in Chapter Four.
HISTORICAL OVERVIEW

A brief historical overview of the development of medical education in the United States will serve to support our contention that many potentially useful concepts have been suggested and even tried but never broadly implemented for the general improvement of medical education. Such an overview will also provide an historical perspective for the dramatic developments of the 1950's and 60's. Those developments will later become the basis for the synthesis of an approach to solving the problem of systematic change in medical curriculum and instruction.

The First Century of Medical Education in the United States (1765-1893)

One might wonder at the slow start made by American medical education between 1765 and 1893 because the beginnings seemed most promising. Both William Shippen and John Morgan were scholars trained at Edinburgh, one of the finest medical schools of the time. When they founded the medical school at the College of Philadelphia (now the University of Pennsylvania) they expressed high ideals, some of which might have set new and unique directions for American medical
education, but unfortunately the time was not right for their proposed changes.

Throughout this section on historical perspective we will quote notable leaders of American Medical education to illustrate both their advanced ideas about education and the conservative forces that kept some principles almost unchanged for 200 years. The following passages are from an address by John Morgan to the Trustees of the College and the Citizens of Philadelphia in 1765:

The various branches which compose the science of medicine are Anatomy, Materia Medica [pharmacology], Botany, Chymistry, the Theory of Medicine [physiology and pathology], and the practice. (Wartman, 1961, p. 176)

The scientific discipline approach to the organization and teaching of medicine, as expressed here by Morgan, had its beginning in the first systematic codification of medical knowledge by Avicenna (980-1037) in his Canon. Underlying this approach was a strong feeling that medicine must be taught inductively; that only by first teaching the facts of anatomy could anatomical concepts be understood, and only in the context of anatomical facts and concepts could the student learn first the facts, then the principles of physiology, and so forth. Again Morgan:

A person may be a good practical Anatomist, and yet be ignorant of Physiology; but it is impossible to be a good Physiologist, without being an able Anatomist... As every disease we labour under is a disorder of the vital, animal or natural functions; a thorough acquaintance with these in their sound state is implied before we can pretend to understand their morbid affections, or how to remedy them. (Wartman, p. 176)

It is important to note that Dewey and many after him have taken exception to the theory-practice paradigm, and have suggested that in
many learning situations practice-theory is more appropriate:

The failure arises in supposing that relationships can become perceptible without experience—without that conjoint trying and undergoing of which we have spoken. It is assumed that "mind" can grasp them if it will only give attention, and that this attention may be given at will irrespective of the situation. Hence the deluge of half-observations, of verbal ideas and unassimilated "knowledge" which afflicts the world. An ounce of experience is better than a ton of theory simply because it is only in experience that any theory has vital and verifiable significance.

(Dewey, 1916, p. 169)

We now recognize that a physician cannot learn in a few years of study, enough to carry him through a lifetime of productive practice, and if he could his knowledge would soon be obsolete. In 1765 Morgan suggested that:

A contracted view of Medicine confines a man... to a few partial indications in the cure of diseases... He repeats over and over his round of prescriptions... and, although he is continually embarrassed, has the vanity to believe that... he has within himself all the principles of medical knowledge. [This notion] flatters the imagination... and chains [one] down to a dangerous routine of practice, unworthy of the name of art.

(Wartman, p. 183)

The most celebrated academicians... strongly recommend "to let none of those discoveries escape us, which are daily brought to light by the labours of masters of the art." Without this care, say they, the most consummate practitioner, within the space of twenty years, will be ignorant of those truths which are then familiar to novices.

(Wartman, p. 188)

Some contemporary leaders in medical education are making efforts to prepare and present to the student the objectives of his studies. Others are beginning to propose programs in which the major responsibilities of the faculty member are to motivate him, guide his path through subject studies and inculcate those intangibles of ethics and professionalism that can be gained only by direct contact.
Morgan (1765):

The business of a Professor is to place before students in a full light, at their first entrance upon any study, the true object of that study, and to ascertain their proper pursuit. In performing this, he first explains to them the terms of art, and renders the language and ideas thereof familiar. He afterwards directs them to what is the most proper course of study, and to the best authors to be consulted on the subjects of which he treats. He points out the mistakes which any of them may have run into, and puts them up on their guard against such errors as are apt to mislead students. He supplies the defects of those authors, and mentions what new light the latest disquisitions and discoveries have thrown upon every subject. He confirms his steps, smooths the rugged path he has to tread, assists him in climbing the steep ascent, and, before dismission, informs him how he is to conduct himself, in order to reach at length to the summit of his profession. Having a plan before him, a fixed end in view, and the means of attaining it within his reach, the student impelled with an irresistible ardor, presses forward, eager to reach the goal of knowledge and the height of all medical attainments; and since he is so well instructed in his career, has the apparent prospect of wished for success...

(Wartman, p. 190-191)

The germ of significant reform seems to have permeated the first American medical school. However, in the one hundred or more years that followed Morgan's address, medical educators saw a continual deterioration in the art of medical teaching, and indeed in the profession itself. Many appealed for change, but little was done to turn the tide until "in 1877, William Pepper...reported the results of a well-documental survey of medical schools in the United States, Europe, Asia and South America" (Wartman, p. 193). Pepper reiterated the inductive discipline approach to curriculum organization, and listed five major reforms:

The first part of the course is devoted to chemistry, botany and such other branches of the natural sciences as are fundamental to the science proper of medicine, after which anatomy and physiology... are taken up, to be followed by the study of pathology.
and of morbid anatomy, and later still, of the theory and practice of medicine, surgery and obstetrics, together with that of the chief specialities.

The needed reforms...are as follows:
1. The establishment of a preparatory examination.
2. The lengthening of the period of collegiate studies to at least three full years.
3. The careful grading of courses.
4. The introduction of ample practical instruction of each student both at the bedside and in laboratories.
5. The establishment of fixed salaries for the professors, so that they may no longer have any pecuniary interest in the size of their classes.

(Wartman, p. 199)

These recommendations came at a time when formal medical education was a minimal part of the student’s training. In some places students served a year-long preceptorship before entering medical school. Having completed eighteen weeks of formal training, the remaining thirty-four weeks of the second year were again spent in the community as a preceptor. After the third year, which was identical to the second, an examination was given and the student became a physician.

(Carnegie Quarterly, 1970, p. 3)

The Establishment of American Medical Tradition, (1893-1946)

The suggestions of Pepper and others were not broadly applied at any school, and for that reason perhaps more than any other, they had no far-reaching effects on medical education until the establishment of Johns Hopkins Medical School in 1893. At Johns Hopkins many reforms were designed into the program including three innovations not listed by Pepper, which remain integral parts of medical education today:

1. Adoption of the English system of clinical clerkships.
2. Introduction of resident house officers in the hospital organization.
3. Selection of teaching faculty on the basis of their "productive capacity" (i.e., "their contributions, and in general their published contributions to their subjects.") (Wartman, p. 202)

The Johns Hopkins model was emulated by a number of medical schools across the country, but most important it set the stage for a national evaluation of medical schools and an irreversible stimulus for change: Abraham Flexner's, *Medical Education in the United States and Canada* (1910).

Flexner exposed a grossly inefficient system for physician training that stood in bold relief against the improvements at Johns Hopkins and a few other schools. Added to the experience of those programs, his report was stimulus enough to form a whole new pattern for medical education—a pattern that soon became so well established that it was not seriously challenged until the late forties, and has not been substantially altered in most medical schools today.

There is little question that Flexner's organizational approach was well accepted. However, a number of his comments in other areas either fell on deaf ears or more likely were lost in non-systematic flurries of change that left little time for more than the pedantic. He called for a drastic shift of the medical student from being an observer to being an active, involved participant—to learn by guided doing:

-On the pedagogic side, modern medicine like all scientific teaching, is characterized by activity. The student no longer merely watches, listens, memorizes; he does. His own activities in the laboratories and clinic are the main [our italics] factors in his instruction and discipline. (Wartman, p. 213)
Laboratories are not now the main factor in at least the first two years of medical instruction. In fact, even today watching, listening and memorizing seem overwhelmingly predominant. For this reason, watching, listening and memorizing become the skills that the student is actually taught, quite different than Flexner's concern for development of intellectual abilities and habits for continuing self education:

The student must be taught the positive exercise of his faculties; and if so trained the medical school begins rather than completes his medical education. It cannot in any event transmit to him more than a fraction of the actual treasures of science; but it can at least put him in the way of steadily increasing his holdings. (Wartman, p. 216)

Although Flexner argued that the medical faculty should be active in the pursuit of scientific knowledge, he must have been most unhappy to see research become the almost exclusive yardstick of a faculty member's worth, for he also emphasized the need for "men of another type,—the non-productive, assimilative teacher of wide learning, continuous receptivity, critical sense and responsive interest."
(Wartman, p. 218)

On the matter of integration of the sciences, Flexner expressed an important principle that many individuals have pursued, but that few schools have adopted even since Western Reserve's pioneering program in 1952. He said:

Medical education is a technical or professional discipline; it calls for the possession of certain portions of many sciences arranged and organized with a distinct practical purpose in view. That is what makes it a "profession". Its point of view is not that of any one of the sciences as such. It is difficult to see how separate acquisitions in several fields can be organically combined...in the realization of a controlling purpose, unless this purpose is consciously
present in the selection and manipulation of the material. (Wartman, pp. 220-221)

In 1925, (fifteen years later) Flexner compared the developing patterns of medical education in the United States with those in well-established European schools. In this report he supported the inductive approach to teaching medical science and gave heavy emphasis to the practical laboratory experience.

Medical education improved so dramatically during the first quarter of the twentieth century that few entertained further thoughts of change until the late forties. Tremendous increases in medical knowledge and changes in practice from the Second World War and post-war research stimulated some to sense the need for a new approach. But tradition had a firm hold, and a deep schism between clinical and basic science faculties militated against any cooperative effort toward a sweeping re-evaluation.

Born out of studies begun in 1946, and commencing with the implementation of a revolutionary change of curriculum at Case Western Reserve in 1952, a new period of evaluation and change in medical education was launched. But again change was slow. In the eighteen years since then a fairly small number of schools have made meaningful changes in curriculum or instruction, and many of those have been newly established schools with relatively little in the way of vested interests and tradition.

It is clear that in the past there has been no dearth of insight or creative suggestion for change; apparently following the historical pattern, new and increasingly potent forces for change are resulting in changes that some analysts believe are largely scattered, isolated, uncommunicated and ineffective. A new approach to the problem of
change in medical education is indicated. The remainder of this chapter will be devoted to an analysis of medical education of the 50's and 60's and to a new approach to planning and change in medical education.

THE CONTEXT OF THIS STUDY OF MEDICAL EDUCATION (1946- )

We have identified what we consider the four major developments in the scientific world and in society in general that have been most instrumental in effecting profound changes in the role of medicine and medical education during the last two decades or more: The knowledge explosion, integration of the sciences, public demand, and social concern.

These developments have had ample exposure in the literature and will be considered only briefly here. Related to each of the major developments we suggest a number of trends in the practice of medicine, which have in turn suggested new curricular and instructional needs and attempts to meet those needs.

Following this section we will show that the developments, trends, needs, and attempts at their fulfillment suggest the need for a total, integrated education program made up of several functional categories as well as some organizational patterns through which change activities operate. This analysis is summarized in Figure 2.

Knowledge Explosion

"If a fast reader were to begin now and read for twenty-four hours a day, it would take him more than one hundred years to read the biomedical literature for any month." (Humphery, 1970). The explosion of information in all areas of science is indisputable, and is inextricably
involved with the well-established trend toward increasingly specialized training for the individual. In medicine this has led to the near extinction of the general practitioner and to longer periods of specialty training in the form of internships and residencies. It has led not only to further divided specialities but also to the addition of new specialities, and the proliferation of allied professions.

The knowledge explosion and specialization in medical practice have led some medical educators to design curricula in two parts: a core of learning essential for every physician of whatever speciality, and a series of elective courses intended to allow some early specialization or an opportunity to choose a specialty after exposure to two or three alternatives.

Another approach to solving the information problem has been to teach concepts, principles, and modes of operation (processes) early in the curriculum and save exemplary details for later. This deductive approach is in sharp contrast to the more traditional inductive situation where a student is given all the facts and is expected to integrate them essentially on his own. The knowledge explosion has made this latter approach increasingly more difficult to use because of the seemingly insoluble question of which facts can be omitted, without destroying pattern trends which inductively lead to basic concepts.

"Learning to learn" has been another phrase stimulated by the explosion of knowledge. In ten years half of the information a medical student learns now may be useless or dangerously obsolete. Therefore the student can no longer be a walking encyclopedia; he must be a complexly cross-referenced indexing system, and must know where to look for information and how to use outside sources quickly and accurately.
### Changes in the Scientific World and Society that have acted as an impetus for change in structure, concept and role of medicine

**Curricular needs and developments that have been suggested and tried in attempts to adjust curricula to the trends and changes listed**

- Core-electives
- Process or discovery approach
- Continuing Education/Immediate update
- Flexibility for specific interests
- Proliferation of allied professions
- Residencies

**Learning needs and developments suggested and tried due to increased awareness of learner and learning process in the context of rising expectations**

- Learning for mastery
- Learning outside institution
- Self-actuated study and learning
- Modular units in a continuum

**Functions generated by the interaction of curriculum and learning that tend to suggest a systems approach for their fulfillment**

- Objectives and Appraisal
- Selection of learnings
- Total, Integrated Education Program (TIEP)

### Knowledge Explosion

**Specialization**

- Flexibility for specific interests
- Proliferation of allied professions
- Residencies

**Health Team Approach**

- Integrated courses
- Greater need for physical sciences, electronics, math, cybernetics
- Less morphology, more role differentiation function and integration

**Team teaching**

- Reality in learning environment
- Innovation and Experiment
- Faculty coordination and information exchange
- Equipment and facility management

**More mediated instruction**

- Teaching assistants
- Improved teaching techniques
- Increased availability of resources/concentrated
- Optimization of learning-practice-application

**Managment and control**

- Office of Medical Education (OME)
- Support
- Learning Resource Center (LRC)

**Teaching Hospital**

**Evolutionary Learning System**

**FIGURE 2 Analysis of The Context of Medical Education 1946--**
He must form habits of continuing education so that his mental filing system is constantly up-dated.

In response to an increased awareness of the learner and the learning process, several new instructional concepts have developed. These concepts which have been tried in the context of expanding medical knowledge, are: (1) learning for mastery (2) self-actuated study and learning (3) a continuum of modular instructional units, and (4) formal learning outside the institution.

A specialist is likely to be working near the frontiers of knowledge in his special area; he therefore must be able to interpret intricate relationships and to generate new knowledge, or see new relationships. Such capability comes from (1) a frame or reference (2) concentration on problems in a specific context. Thus specialization obliges the student to enter in great depth a particular aspect of the general field. Access to the more sophisticated levels of knowledge is through mastery of the concepts of underlying principles and details. This comes partly by repeated application of basic and intermediate science knowledge to more complex specialized problems, and partly by study and restudy of all that can be known that is contributory to the special area.

Specialization is by nature primarily an individually pursued learning activity. It is critical for the specialist to be continually updated; he must initiate inquiry, rather than depend wholly on formal courses presenting others' findings. His quest also leads to study wherever the potential for new knowledge exists; particularly in places where new problems are likely to be found. Capabilities of this kind require learning experiences outside the school itself.
Specialization and self-actuated learning become practical through the integration of information into single concept modules that can be easily arranged into a tailor-made continuum of study. The view of a course of study as a continuum has long been voiced in precept, but the prevalent example is a "loosely related series of isolated compartments." (Cooper, 1959, p. 33) The modules facilitate a learning experiences continuum in the way that elements and their isotopes comprise the spectrum of matter.

Integration of the Sciences

Up to recent times, the corpus of laws of nature was almost identical with theoretical physics. Few attempts to state exact laws in non-physical fields have gained universal recognition. However, the impact and the development of the biological, behavioral and social sciences seem to make necessary an expansion of our conceptual schemes in order to allow for systems of laws in fields where application of physics is not sufficient or possible. (Bertalanffy, 1956, p. 18)

Bertalanffy points out that our main problem today is that of organized complexity. He sees concepts like wholeness, self-regulation, directiveness, control, differentiation, as indispensable for dealing with living organisms or social groups. He considers that the basic problem posed to modern science is a general theory of organization, and he suggests the interaction of biological, behavioral and social sciences as a basis for the derivation of such a theory.

Robert R. Wagner of Johns Hopkins University School of Medicine sees a revolution in biology that will profoundly affect medical education. Biology, in his opinion, has gone through a descriptive period, and an analytical period; beginning in the decade of the 1960's it is starting a new era marked by the thesis that all biological events
can be explained logically and simply by fundamental laws governing spatial arrangements and interaction of molecules and their component parts. The examples he gives relate to genetics and protein synthesis, explained by information theory and feedback mechanisms as functions coded in DNA and RNA molecules. (Wagner, 1962)

We see an integrating trend in the practice of medicine that stems from ecumenicism in the sciences. Interdisciplinary cooperation has emerged, and with it the health team approach to providing health services. The team concept prompts increased role differentiation and specificity, but at the same time requires integrated efforts.

This is reflected in curriculum by attempts at integration of courses. In instruction, attempts at team teaching are made, necessitating increased faculty coordination and information exchange. Requirements for physical sciences, mathematics, cybernetics, psychometrics, sociometrics and applied sciences such as electronics are generated by the resultant need to communicate or translate among the disciplines, and by the integral role played by these disciplines in medical science. The emphasis in medical courses has begun to shift toward function and away from morphology of organisms, because similarities of function have become more significant than differences in morphology.

Increased awareness of the learner and the learning process is leading to attempts to provide more realism in the learning environment and in learning experiences. Innovation and experiment are encouraged in instructional approaches in attempts to meet the rising expectations of students.
Public Demand

Whatever is made available to any members of a responsible society tends to be assumed as the right of every member of that society. One statistical example will show the magnitude and potential effect of the demand for medicine, the practice of medicine and medical education: three-hundred and thirty-seven member teaching hospitals of the AAMC report a 41% increase in clinical outpatient visits and 66% increase in emergency care from 1961-2 to 1967-8. (Parks, 1969, p. 5) Under conditions like these, it is most difficult to give the teaching of office practice and home care the attention appropriate to public demands.

Demand for medical services now exceeds the means of providing those services. Many disparities in kinds, quality and amounts of services are the result. Yet, as Dr. James Dennis, Dean of the School of Medicine, Oklahoma City, states:

Although the development of a critical mass of health care deficits did not occur suddenly, many in academic medicine seem to be unaware of, or insensitive to, the realities of the social pressures that have been generated by unmet needs...but there can be little doubt that the population expects the medical schools to fill its physician manpower needs...many of the pressures that now impinge upon us reflect the fact that the most important "patron" of medical education is no longer the philanthropist but the taxpayer...and he can make powerful demands that his health be protected and his life prolonged. (Dennis, 1969, pp. 18-19)

Health team manpower is approaching a critical shortage, and deficits can only be reduced by growing numbers of professional and allied health personnel coming out of the schools. Dr. Frank McKee, Director of the U. S. Public Health Service Division of Physician Manpower says, "Expert medical observers have estimated that our present needs are for a graduating class each year of 16,000 physicians."
The class of 1968 was 7,966 for all U. S. medical schools, about half those needed according to Dr. McKee's estimate. Dr. P. R. Lee, in the *Mayo Alumnus* (1967), estimates that by 1975 we will require 3.4 to 3.6 million health workers. The Surgeon General has estimated that the current shortage is 50,000 physicians in the U. S. with the deficit in dentists, nurses and other health professionals just as serious. (Cooper, 1969, p. 32) Dr. John Cooper states that, "To meet this need, we must have a net increase of about 100,000 health workers a year—agrowth rate 50 per cent higher than it was in the past decade." (1969, p. 33)

Thus it is no surprise that the AAMC and AMA jointly and strongly stated an endorsement of the position that all medical schools should now accept as a goal the expansion of their collective enrollments to a level that permits all qualified applicants to be admitted.

The crisis is not only one of numbers but is also the inadequate system through which health care is provided. Bergner and Yerby ask, "Which of our students are presently receiving didactic or practical instruction for the provision of comprehensive health care? Do they have any notion of working as part of the health care team? The failure of most of our medical, dental, nursing and other schools to move ahead in these areas may turn out to be more important than all the other factors in the health care equation." (1968, p. 545)

Public demands and manpower shortages are reflected in several attempts at a solution: Some schools have shortened the time from college entrance to medical school graduation. A cooperative effort was initiated between The Jefferson Medical College of Philadelphia and The Pennsylvania State University to enable highly qualified students
to earn both the B.S. and M.D. degrees in five calendar years after high school. In National Board examinations and in performance at Jefferson, there were no observable differences between the accelerated and the non-accelerated groups. (Herbut, 1969)

There have been increases in enrollment. Entry twice yearly has been introduced in a few schools. Efforts at reducing attrition have saved some students. New schools have been organized and new facilities have been constructed.

Changes in curriculum and instruction are less obvious and not yet much implemented. A biomedical program which provides an intensive science-based education and an analytical approach to biology, has been established for the six-year B.S. and M.D. accelerated program of Rensselaer Polytechnic Institute and Albany Medical College. The curriculum is designed to give the student superior preparation for a career in medical practice, research or academic medicine. Results have been reported as promising. (Kanter, 1969)

The university medical center is being set forth as facilitating acceleration. Acceleration as one way to individualize instruction is intended to attract the exceptional student who would otherwise be bored or who would avoid the long period of study before attaining professional status. (Parks, 1969)

Other instructional developments include increased use of television, programmed text and computer-mediated presentations. The emphasis is beginning to shift toward improved teaching techniques from a heavy orientation toward research in medicine. Teaching assistants are being sought. Self-actuated learning is being studied, and the practice and application of learning are being optimized.
Resources for learning are being made more available to the teacher and the student through production and distribution services as well as assistance in planning and design of materials by media specialists and educational professionals.

Social Concern

There is a growing awareness on the part of medical students that portends changes in the delivery of health care. Until recently, students had a largely introverted concern for their own career in practice or research. Students today are becoming more concerned that a child born to poor parents has twice the risk of dying before its first birthday as a child from a non-poor family; that infant mortality in rural communities in the South for Negroes is 3 to as much as 7 times as high as it is for the white population; that 50% of poor children do not receive adequate immunization and 64% have never seen a dentist. (Cooper, 1969, p. 32) Such social awareness will shift the emphasis from "patient", "diagnosis" and "specialist" to "person", "health" and "team".

The emphasis on the patient as a person draws a wide circle that takes in the ecological and social welfare of that person. World food problems and agricultural well-being, animal herd and pet health, population and preventive medicine problems are all within this circle of concern.

Social awareness is actively involving medical students in seeking solutions. Robert Ebert, Dean of Harvard Medical School, predicts these students will act as the "necessary prod to a conservative profession and to a conservative educational process." (Cooper, 1969, p. 34) Areas of immediate interest will be the assuming of
responsibility for the health of a cross-section of the people of the community around the teaching hospital. A fine example is the Ohio State University College of Dentistry, where a program of carrying the dental services to the invalid and aged in the place of their confinement is underway under the personal efforts of Dr. Wendell Lotz.

Another area of interest will be the expansion of the out-patient department to preventive medicine, reliable patient medical history, equal treatment of private and charity patients, and the model teaching of group office practices in keeping with trends. (Parks, 1969)

One emerging learning experience that has developed out of the "patient as a person" concept is first year medical student contact with patients and the responsibility for following the health needs of a family. For example, at Case Western Reserve:

Instead of waiting two years to encounter a live patient, in the first week of his first year the student now assumes limited responsibility for his own "family"—husband, pregnant wife, and young child—whom he sees for at least two years with a pediatrician. (Carnegie Quarterly, 1970, p. 5)

A major concern currently in the forefront of student interest is the unequal educational opportunities of minorities. Hutchine et al., identify the two largest minority groups in America today as women and Negroes. (Hutchins, 1967) The admissions process is the key decision point, and if society would be best served by including less qualified members of minorities, medical educational programs will be obliged to make special efforts to provide qualifying experiences to the disadvantaged.

There will be increasing interest in performing service in developing countries early in a medical career. To enable the young doctor to cope with the primitive facilities and the diseases endemic to a
region, as well as the sociological barriers, education will be prompted by cooperative world health and U. S. legislated programs to place more emphasis on these aspects of health care preparation. (Merrill, 1967)

The foregoing problems provide curricular and instructional emphasis that must respond to social concerns, and the "whole patient in the environment" concept. One additional consideration is probably most significant: students view themselves as potential colleagues in the practice of medicine. They expect to be treated as persons and as professional aspirants. Provision for their involvement in planning a program of medical education and their individual courses of study can no longer be overlooked. The students must not only be invited to participate with faculty and administration in the total process of education, but a formal structure must be set up to cause their responsible participation.

AN APPROACH TO PLANNING AND CHANGE IN MEDICAL EDUCATION

In the context of massive demands and external change, medical education must address the many pressures for internal change, and at the same time continually provide a functional program to educate physicians. This is perhaps why new schools have been the most innovative, but older schools must also make significant changes very shortly if the nation is to fill the health care gap.

Functions of a Total, Integrated Education Program

The means suggested here for medical schools to reach their overall goals through systematic implementation of the necessary operational and ideologic changes will be called a Total, Integrated Education
Program (TIEP). A TIEP is total because it identifies and takes into account all functions necessary to meet desired goals. It provides the capability for recognition of and action on any problem relevant to its operation whether the appropriate solution lies in an established faculty rule or an honest, intuitive approximation. It incorporates rigid organizational patterns where they are appropriate and flexible non-organization where it thrives. TIEP is an integrative concept because all program elements are designed to interact meaningfully in the achievement of a common set of goals. Oneness is an essential quality of TIEP, but so is individuality, because education can happen only to individuals.

The most distinguishing characteristic of a TIEP, however, is its dynamism. Participants—students, faculty, administrators—contribute actively to its progress. They anticipate, prepare for, become involved in, critically evaluate, and change the program on a daily basis. As a result there is a constant state of orderly flux.

Several broad functions must be accounted for if the TIEP is to begin to answer the demand to provide more effective medical education for more students. Six functions are discussed below because they reflect the trends and needs that have arisen from the knowledge explosion, integration of the sciences, increasing public demand, and social concern. They are: the learning process, assessment, selection of learnings, teaching as communication, management and control, support, and program validation.
The Learning Process

The first function necessary within a TIEP is learning, and some
commonly accepted understandings are necessary if there is to be agree­
ment on what constitutes institutionalized learning. We will suggest
four areas that must be considered when any institution attempts to
understand learning: the nature of learning objectives; the context
of the learning experience; the type of learning activities; and the
ultimate outcomes of learning.

For the consideration of the nature of learning objectives, a
slight modification of Bloom and Krathwohl's taxonomy is suggested.
It may be useful to emphasize the distinction between facts or know­
ledge per se and intellectual abilities and skills, yielding the follow­
ing gross outline:

I. Knowledge
II. Intellectual Abilities and Skills
III. Volition and Value Judgement
IV. Motor Skills

The context of any learning experience is different for every
student, because each brings a different array of experiences to the
learning encounter. To be meaningful learning must relate to what the
student already knows in a substantive (non-verbatim) fashion. (After
Ausubel, 1968) This kind of learning can only take place if the learner
has established a learning set (mind set) to learn. Not only must the
student be mentally prepared for learning, but he must be taught in
terms of previously learned concepts.

Meaningful learning might be considered as one end of a learning
context continuum with memory learning on the other end. Memory
learning takes place 1) when wholly arbitrary associations are made
(e.g. associating a name with a structure, 2) when a student lacks prior knowledge necessary to make a learning task meaningful, or 3) when the learner decides merely to internalize the learning task verbatim despite previous knowledge with the potential to make the task meaningful. Although memory learning of the first type (naming) is sometimes necessary, most often learning experiences fall between the extremes of meaningfulness and memory for individual students. We will show how improved curriculum and instruction programs can make learning more meaningful and thereby more effective by upgrading the learning context.

Another learning continuum describes the type of activity in which the student participates. The extremes are discovery at one end and passive reception at the other. In a purely passive reception activity the student is presented the information to be learned in final form and asked to internalize it for replication at a later time. Discovery activity requires that the student discover the principal content:

The learner must rearrange information, integrate it with existing cognitive structure, and reorganize or transform the integrated combination in such a way as to generate a desired end-product or discover a missing means-end relationship. (Ansubel, p. 22)

Neither a pure passive reception exposure nor a pure discovery approach to knowledge acquisition is suggested as ideal; rather, careful consideration of learning goals and the ultimate use of learning are necessary, to decide on the extent of passive reception or discovery learning.
Physicist Phillip Morrison adds an interesting dimension to discovery:

Linguists say that one characteristic of knowing a language is productivity. Productivity does not mean the number of words uttered per day. Productivity for them means the ability to create and understand new sentences, sentences which combine already known elements in new ways. Nobody knows a language who cannot do that at some level. (1967, p. 21)

The inference for medicine is that medical students must know enough of medical language (facts, cognitive and motor skills, and values) to enable them to achieve productivity, which is the ability to know and do new things by recombining known language elements.

Finally, the ultimate outcome of learning must be considered. In this respect we distinguish between training and education. Both predictable learning outcomes and unpredictable outcomes are sought in medical education. Training implies learning for the predictable and education for the unpredictable outcomes.

According to Plimpton:

Training is a preparation for only one thing, and once trained, one is finished and completed. Education is a preparation for many things; both those currently known and those to be discovered. It is never completed. (1963, p. 205)

Curricula for education are developed by selecting among and between the organized bodies of knowledge, skills and attitudes for the elements that analysis identifies as having the greatest interpretive value. The items selected depend on how fundamental and crucial they are to the organized body of content, how well they explain its structure, and how powerful they are in furthering its characteristic thought processes and modes of inquiry.
Assessment

A second function of a total, integrated education program has to do with assessment of the learning program. This process begins with the formulation of goals and objectives and involves the comparison of actual functions with intended functions.

All educational institutions have goals that guide their operation and provide the philosophical base from which they build. The general goals of medical schools are often based on the three traditional areas of teaching, research and service, with more specific areas of operation and special emphases defined within each category.

We have defined curriculum as a set of intended learning outcomes. This is another level of criterion that expresses the kinds of activity that are expected of graduates of the curriculum in each of the major areas within the total domain of medical knowledge.

Further we have mentioned the importance of understanding the nature of learning objectives. That is, at each step of the way, how can we determine whether the student is making progress?

These three levels of goals or objectives--program goals, intended outcomes, and learning objectives--will all be shown to be necessary criteria for the ongoing assessment of the total integrated education program at various levels.

Because definitions of and understandings about learning objectives abound and rarely agree, a short explanation of the concept as we understand and use it is in order. Later discussions in this chapter depend upon this common ground.

Specific instructional or learning objectives are used to translate the medical education program into learning experiences. To
provide the basis of mastery, specific objectives are stated in terms of behaviors that are measurable. They show what action is taken, the degree of performance necessary for successful completion, and the criterion conditions. (Mager, 1962). Goals do not have these characteristics, but give an overall description of the aims of a course or other large curriculum unit.

In speaking of overall goals and their translation into learning objectives, George Miller says,

A sober analysis of what goes on in medical schools, however, must suggest to the observer that not infrequently individual instructors either have no clearly defined objectives or that those they do have are unrelated to those of the department or school. (1961, p. 91)

If a program of excellence with learning for mastery is to be realized, something must be done so that all learning activities are organized and guided by real goals and measurable objectives stated in meaningful, understandable terms.

This study assumes that the facts of life in respect to learning objectives are: (1) they are seldom formulated in a formal way, or more often than not, remain vague ideas in the minds of teachers and students; (2) they may be established during development of a course of study, but are not communicated to teachers and learners with clarity and effectiveness; (3) evaluation of student mastery in the basic sciences is usually based on a sampling of content facts and principles recall, with few problem-solving or application type measures. For the clinical sciences, exposure and evaluation are presumed to take place for all essential experiences, yet it is reported that for such significant
areas as radiology, formal learning experiences are not likely to exist. (Squire, 1969)

Therefore, it is proposed that documented statements of desired learning outcomes be published by a college of medicine, and that a regularized procedure be established for producing and reviewing such statements on a scheduled basis. This crucial mandate must be given special priority and recognition. It will come closest to achieving its purpose where the mandate is imposed by the faculty on themselves.

As Dewey noted, "Education as such has no aims. Only persons, parents, teachers, etc. have aims, not an abstract idea like education." (1916, p. 107) It is postulated that any exercise establishing an objective for someone else has little effect if that someone doesn't subscribe to this objective. Moreover, unless the objective is clearly communicated, it will have an effect different than the original intent, though it is ostensibly achieved.

The documentation must contain provisions for diffusion to each student so that he has primary responsibility to achieve the objectives, hence the goals they implement, as well as to inquire concerning any aspect of an objective that is not clear. Such feedback must be built into a reporting scheme. Objectives are bound to have more potency if formulated in terms of the learner's contextual map and goals. The learner himself is thus eligible to play a role in formulating objectives in the beginning. In fact, a regularized procedure for preparing and maintaining, and promulgating statements of objectives requires student participation. To be effective both the faculty and students must be mutually involved in the terms and means of developing such a procedure.
Selection of Learnings

A third function of the total integrated education program arises from the fact that it is infeasible to teach all medical knowledge to every student. The TIEP must identify those learnings that will guide each student to the program objectives.

There has been considerable discussion in medicine and other areas about identifying the core content that every student must master before he goes on to practice or to become highly specialized. Selection of content areas and topics by the faculty is the operational crux of this approach, which is beset by the paradox that the faculty man who is apparently most qualified to identify essential elements of his field is usually least able to identify those that are non-essential.

Most of the popular and apparently successful science curriculum movements in public education have taken a somewhat different approach. They have assumed that it is most important for students to be able to approach and work with knowledge in the way a scientist might. This way of thinking about curriculum, often identified as the process approach, is differentiated from the content approach, and is associated with cognitive psychology, and the discovery emphasis of the passive reception-discovery learning continuum. It has been espoused in recent times by Dewey, Bruner, and many others. Perhaps one of the most eloquent statements on the subject is in *Emile*, by Jean Jacques Rousseau (1762):

Teach your scholar to observe the phenomena of nature; you will soon rouse his curiosity, but if you would have it grow, do not be in too great a hurry to satisfy this curiosity. Put the problems before him and let him solve them himself. Let him know nothing because you have told him, but because he has learnt it for himself. Let him not be taught
science, let him discover it. If ever you substitute authority for reason he will cease to reason; he will be a mere plaything of other people's thoughts...

Undoubtedly the notions of things thus acquired for oneself are clearer and much more convincing than those acquired from the teaching of others. We develop greater ingenuity in discovering relations, connecting ideas and inventing apparatus, than when we merely accept what is given us and allow our minds to be enfeebled by indifference. (Rousseau, 1911, pp. 131, 139) [A cautionary note: Dewey, in answering criticism of progressive education that grew out of excesses in permissiveness and non-direction, outlined needs for teacher control in the discovery process. (Experience and Education, 1938)]

"Learning to learn", a popular phrase mentioned either in relation to continuing education, by many accounts embodies the principles of discovery and problem solving. Bradford (1968) has suggested a "Cognitive Development" approach for medical education which is centered around the cognitive abilities and skills portion of Bloom's taxonomy, and which incorporates a learning system based on the student's solution of increasingly complex problems.

It is clear that careful consideration must be given to the nature of the experiences included in a four-year medical program. Further, consideration is due the question of who selects those experiences. Traditionally this has been the sole responsibility of the faculty. There are increasingly strong indications that at least two other groups within the medical school should have major roles in program definition.

Professional medical educators are essential in helping faculty members to interpret program requirements so that the learning experiences developed from those requirements do for the student what the faculty originally intended. Perhaps most important, the individual student must play an increasingly significant role in selection of his own learning experiences. This will happen through membership on
college educational program committees, and more directly through each individual's selection from a range of alternative experiences—each designed for a different type of student to reach the same general end.

Teaching As Communication

A fourth function to be accounted for by the total integrated education program is teaching as an intent to communicate. If teaching is not communication, it is not teaching. Edgar Dale characterizes teaching as sharing—a two-direction process—intercommunication. He says that it includes "the collision, the creative interaction of minds." (1967, p. 167) In such a "reciprocal liking and understanding arising from a community of interests" (1967, p. 167), the teacher makes things plain by "spreading them out," (1967, p. 168) so that learners "can see what needs to be done." The teacher "transforms by informing, to develop a zest for lifelong learning..." (1967, p. 170)

Teaching is viewed by the writer as an intent to communicate totally. It involves speaking and listening, writing and reading, observing and visualizing. These manners of dealing with real things, with their icons and their symbols, take place in special kinds of places, times and contexts termed the learning environment. The messages are specifically designed to inquire into the nature, meanings and processes of cognitive, affective or psychomotor aspects of the object of inquiry.

Health preparation provides a rich intercommunicative opportunity for teaching and learning. In the main, the concrete and the abstract can be in close juxtaposition. Although an extensive and complex set of
symbols must be used, there are facilitating terms for their acquisition. The patient is a focal point for creative interaction, and the interaction can be at any of several levels of complexity to fit the learner's readiness. This is the kind of complex context that learning requires—one involved with seeing, with hearing, with smelling and tasting, with feeling, with doing; but medicine also has elegant deductives that have power and value for some learners.

Management, Control and Support

Another function that must be accounted for is that of management, control and support. In order to offset the sense of powerlessness felt by administrators and planners faced with the need for radical change, sophisticated management tools have been developed. Some colleges of medicine have phased these tools into specific activities such as curriculum design, instructional media usage, student evaluation, facilities design, scheduling, budgeting, personnel management, inventory control and equipment maintenance.

Management systems analysis is an approach that permits order to be imposed on what actually may be random events. "It provides a framework that permits the judgment of experts in numerous fields to be utilized so as to yield results which transcend individual judgment. It enables persons to achieve solutions and raise probing questions in a universal language, i.e. systems analysis." (Hartley, 1969, p. 515)

The University of Toronto Medical School provides a good example of the use of a productive management information system. They were pushed to increase enrollment, to turn out allied health personnel, to change the curriculum, to enhance instruction. They were faced with
short funds and rising costs. A team of 12 to 15 physicians, systems analysts, computer programmers, mathematicians and economists asked, "what would happen if we adopted this alternative educational program, or this alternative measure to solve our problems?" (Wilson, 1969)

The team used a tool called simulation analysis, a computer-based approach. Models accurately describing the most basic aspects of health care and education were formulated, then projected for requirements that would be generated by given simulated constraints, inputs and outputs. Questions were then asked of the model to determine what would happen with such things as a minimum number of people, maximum salaries, minimum funds, maximum research or maximum graduate outputs, etc. University of Toronto's Dr. Richard Wilson says that this does not give all the answers, but does give an idea of where a given policy or practice is headed. Better decisions can be made on allocation of resources to attain educational objectives, and the effect of any plan becomes apparent in a computer readout in one day instead of a costly trial over years. New imaginative concepts can thus be tested for feasibility, revised and retested until a workable model is achieved.

Program support includes planning, programming and budgeting for all aspects of educational resource needs. The Planning, Programing, Budgeting System (PPBS) is one tool for development and presentation of relevant information on the costs and benefits of major alternative courses of action (Alioto and Jungherr, 1969) using data on teaching personnel, staff, teaching loads, patient loads, policies, plans, procedures and similar variables.

Whether they are a part of a sophisticated computerized system or just a few individuals dedicated to meeting faculty needs for
learning assistance, the support services rendered as part of the TIEP are perhaps the single most important function.

Program Validation

Educational program validation concludes the functions of a TIEP. Are the goals that have been established goals that actually meet changing needs of society and the individual? The state of health of the nation, and even the world, is the final test of validity of the TIEP. Surveys that indicate the relative progress being made on overcoming health care deficiencies are one means of feedback to determine program validity.

A second aspect of validity is the performance of interns and practitioners in being able to handle the health problems presented in daily practice. Records, examination and observation by health care professional experts are required for carrying out evaluation and making recommendations for change. Continuous monitoring of both the general capacity and specific ability to provide health care are called for. Means of disseminating and acting on such information are found at both institutional and governmental levels.

The Department of Health, Education and Welfare has some effect through grants that selectively increase outputs of personnel, and that encourage development of quality of programs. Only the institutions themselves through the design of their educational programs, can have a significant and long-lasting effect on the abilities of graduates to cope with existing and anticipated problems.
Organizations Contributory to TIEP

Organizational patterns are introduced here and discussed in greater detail later because of their potential to contribute to the successful functioning of a total, integrated education program in medicine.

Central to the integrative functioning of the TIEP is an OFFICE OF MEDICAL EDUCATION (OME). Such an office should serve the specialized educational needs of the whole college, coordinating educational program and materials design, implementation and evaluation, as well as providing professional expertise for college planning and for applied educational research projects.

The guiding principle of the OME must be to serve and anticipate student and faculty needs while imposing a minimum number of constraining, artificial requirements. In short, it must work to reduce the complications of an extremely complex educational situation by acting as soothsayer, errand boy, interpreter, judge, expeditor, banker, mechanic and psychiatrist for students, faculty, administrators, curriculum and learning.

Part of the office of medical education's function should further be identified as a LEARNING RESOURCE CENTER (LRC). Learning materials are conceived and educationally designed by college faculty and OME educators; they are then artistically designed, produced, catalogued, distributed and maintained by learning resource center staff. With increasing emphasis on multi-media materials, it is essential that there be close communication among all individuals in the process. For this reason educational staff members coordinate all aspects of materials preparation on a project basis.
The learning resource center combines into a single group the functions previously assigned to divisions of medical illustration, medical photography, medical television, laboratory supply, central duplicating, and the medical library. Aiken describes how such an arrangement makes possible the production of more effective materials, largely eliminates duplicate productive efforts, makes possible unified budgeting to meet specific needs, and provides many other advantages.

Neither the TEACHING HOSPITAL, nor more broadly, the university medical center, are new organizational concepts, but some aspects of their function bear heavily on the success of a total, integrated medical education program. One of the most discussed functions is to make practical the growing concern for social problems by providing a dynamic interface with the community.

In the future the teaching hospitals, along with the related medical education institutions, must assume a much more responsible role in total planning for comprehensive health services in the areas in which they are located in full concert with other providers, consumers, and public officials in such a way as to assure the individual and his family of excellent comprehensive health care. This is essential to the educational function if the teaching hospital is to play its full role in preparing health professionals for the future.

(Jones, 1969, p. 335)

The last sentence above implies two additional and related functions of the teaching hospital. First, health professionals must be prepared for the future. That is, they must be trained and educated to work as members of health care teams, they must learn what it means to practice community medicine, and so forth. Second, health professionals must be prepared for the future. University medical centers can no longer prepare physicians, dentists, veterinarians, and a few
allied professionals; they must prepare teams of health professionals of all types who are trained to function not as individuals but as a unit.

Another important function of the teaching hospital is communication with other hospitals and with members of the profession generally. The regional medical programs are an expression of this function as are computer instruction links and other similar activities. Teaching hospitals will play a significant though not exclusive role in inter-institutional programs for sharing, exchange and distribution of instructional materials, programs, facilities and expertise such as those currently under investigation by the Council for Institutional Cooperation (Big Ten), and the American Veterinary Medical Association.

Organizational patterns of the types outlined above have developed in non-systematic attempts to carry out the various functions of medical education programs. Here they will be considered as existing to carry out a total, integrated education program in a systematic way.

CHAPTER CONCLUSION

We have pointed to the major functions of a total integrated educational program (TIEP), and have suggested some aspects of the medical education environment that indicate the need for such a program. It is important to note that this first chapter as well as succeeding chapters have been developed from the perspective of the system approach to planning and change as it applies to the educational setting.

Maccia points to the crucial need for a system approach to educational problems when, after describing the highly interactive
character of many educational functions, he states:

Such interaction makes for an organization of great complexity, one which does not lend itself readily to the characterization of variables one at a time. What is needed, therefore, is educational theory based upon an acceptance of complexity and interaction, and so involving characterizations which leave complexity and interaction intact. General Systems Theory presents such a point of view for educational theory. (1962, pp. 1-2)

Within the six TIEP functions there has been no attempt to identify every aspect that should be associated with curriculum development or learning. The details of curriculum development as a system follow in Chapters II, III and IV, and the details of the learning system are under development by Aiken. Two additional systems are suggested for the TIEP—support system and assessment system. Some aspects of support and assessment will be noted in this paper as they relate to curriculum development, but a complete systematic analysis is beyond the present scope.
This chapter will translate the requirements for an orderly approach to the problem of curriculum development into a theoretical model of a curriculum development system or "synergystem." The term synergystem is coined from the words synergism and system. System is defined here simply as a set of clearly interrelated parts, all directed in their functions toward a common purpose. Synergy means combined or cooperative action or working together, and one definition of synergism is: "An ancient theological doctrine holding that in regeneration there is cooperation of divine grace and human activity." (Webster's, 1961) This mutual will and inspiration or participation in the "spirit of the endeavor" is closest to our meaning. A synergystem, then, is a set of clearly interrelated parts—including people who share an inspiration—all working toward a common purpose.

Gale Edward Jensen, writing about human organization in educational systems says this:

If educational practitioners are to gain effective control over the organizational environment in which they work, they must develop proficient ways for perceiving, analyzing and reorganizing educational systems. Without effective control over the organizational environment, the best knowledge and procedures for instructional programming and practice can be rendered ineffective; a great deal of time and energy is likely to be invested in non-productive conflict; the social behavior unconsciously acquired by incumbents through day-to-day
participation in the system can be antagonistic to the effective operation of the system. (1969, p. 101)

The curriculum development synergystem was presented in the introduction as one of two major systems contributing to the educational program. It was defined as a structured set of activities and events, guided by established criteria and designed 1) to select from the organized bodies of knowledge, skills and attitudes the elements that best interpret those bodies for the student, and further 2) to structure those elements in patterns that will be meaningful for the student, resulting in a new or improved curriculum.

The activity of curriculum development is identified as distinct from its product, the curriculum, and from the complementary activity of learning. In practice curriculum development as an ongoing process is not detached from learning, but highly interactive with it. However, the theoretical model developed in this chapter will cite only major points of interaction between the two synergystems.

This chapter is divided into three parts. First are discussions of four major concepts around which curriculum development is centered. Second, a broad sketch of the system approach and the basic components of an educational system are given. Finally, the theoretical curriculum development model is formulated.

CONCEPTS CENTRAL TO A CURRICULUM DEVELOPMENT SYNERGYSTEM

There are four major concepts that influence the curriculum development synergystem: 1) it is necessary that there be an established PHILOSOPHY to guide all curriculum development activities. 2) Learning OUTCOMES must be identified and selected in light of the educational philosophy. 3) There must be a STRUCTURAL DYNAMIC
that provides curriculum organization and meaningful guidelines for patterning outcomes and experiences within the learning system.

4) The curriculum development effort must be bound together and catalyzed by organized SYNERGISTIC SUPPORT--sharing in a mood of mutuality. Each of these major concepts will be discussed in turn.

**Philosophy**

It is quite clear from the discussions of trends in health professions education in chapter one that most if not all of the assumptions underlying the structure of and preparation for the professions have undergone much scrutiny in the last several years. There is and will continue to be concern about the best position to take on such questions as the role of the teaching institution in the community, the characteristics of a medical graduate, and the nature of the best learning environment. However, an explicit position must be taken by each school as the basis for rational decision-making in every area, and particularly for the formulation of coherent curriculum and learning programs. This is not to say that any position taken should be a final commitment--because the need for flexibility is increasingly apparent--but change at this level is bound to be slow so the need is for broad, clear guidelines that allow a certain amount of accommodation of change at more specific levels.

A philosophy is a system of values. Cooper (1969) presents the five major values held for higher education in the words of Merrimon Cuninggim:

> By its nature, then, the university believes in values, five of which appear to be central: truth, universality, freedom, relevance, and a belief in human worth...Truth says 'Be true, be honest.'
Universality says, 'Give up your parochialisms of time and space, of subject matter, and human association.' Freedom says, 'Treasure your own; work for your neighbors.' Relevance says, 'Talk sense; be useful, get involved.' And the belief in human worth says, 'Respect all men, not because they are equal, but because all men have their dignity and their rights.'

Cooper then goes on to explain each value in more detail for his health profession audience.

It is the amount of emphasis, the priority, given to each of these basic values as each is applied to the goals of the professional school that shapes the school's philosophy. These values, therefore, are important criteria for a faculty to use as it examines its philosophy.

Magraw (1969) suggests that to begin an examination of changing health education philosophies one might look at the way vocabulary is changing in the profession as a whole and in his institution thus helping to identify the most important philosophical changes. For example, the fact that the word health has replaced many of the more specific words (medical, dental, nursing) when we talk about programs of education and care focuses quickly on the fact that the professions can no longer be considered separately but must be part of a much larger health professions construct. Similarly one might note a broadened use of the word colleague, and identify a trend away from the encyclopedic professor toward the learning advisor and exemplar, and toward recognition of the student as an intelligent, interacting individual.

In reality, the philosophy of a medical school is the synthesis of the philosophies of its students, faculty and administrators.
The academic aspect of the philosophy resides primarily with the faculty and is effectively, though often not intentionally, transmitted to the students. Whether or not the "real" or operational philosophy is the same as the more or less explicit formal philosophy becomes a critical question only when the formal statement becomes the dynamic base upon which systematic changes are made. Systematic change requires criteria for evaluation of both the present position and the changed position. Under these conditions statements of philosophy become the milestones within which more specific evaluation criteria are structured. If the milestones do not reflect faculty values, then none of the other criteria can be meaningful for operation.

Sanazaro reports a methodology for assessing faculty attitudes that might be used to align an institution's philosophical statements with operational philosophies actually used by faculty, students and administrators. He describes the approach taken:

Faculty attitudes were surveyed...to identify pressing local problems and define the nature and range of faculty opinions concerning their school. When opinions were shown to be at variance with facts, the stage was set for appropriate modification of those practices which were based on erroneous perceptions. When opinions were neither supported nor refuted by facts, informed judgment was required in deciding whether existing practices should be modified. (1967, p. 46)

Below are listed some hypothetical statements of philosophy based on the current rethinking of health professions education, and drafted by the author as examples of the kinds of statements on which a systematic education program might be built:

1. The process of educational change is continuous; there cannot
be a "final" draft of a curriculum or a "finished" unit of instructional materials; every time an element of the education system is used it should be evaluated against current criteria, and improved if possible.

2. The process of training-education for the health professions is continuous; it is important to understand the background of the entering student and to prepare him for and assist him in a career of further study after graduation.

3. The health professions learning center is an integral part of the community which it serves, and it plays an important role in the lives of many members of the community.

4. The curriculum should spring from current knowledge of the art and science of medicine—including both its practice and its disciplined study—as well as from the personal values of those who teach; curriculum must also be drawn from the practiced intuitions of those who anticipate the role of medicine and the physician in years to come.

5. The question of what students will be taught from the best fund of knowledge is far less significant than the question of how students can most effectively form habits and tastes for learning. (The process of learning is seen as a major value.)

6. Learning is fundamentally communication; ideas shared in a meaningful way. Only individuals, not classes or groups, learn; where there is teaching there is not necessarily learning and learning often does not require direct teaching. (Mediated Instructors)

7. Medical graduates should be capable of acting independently
or as part of a health team to solve medical problems unpredictable during their formal schooling. They should also have a fund of current knowledge and be capable of quickly identifying and solving predictable problems.

**Identification of Outcomes**

Broad statements of philosophical position are not viable criteria for evaluation of the educational program. Increasingly specific expressions of educational goals must be formulated as guidelines for decision-making. Two types of criteria that should be identified in curriculum development are overarching outcomes and unit outcomes. Both are descriptions of the kinds of terminal behaviors that are expected of the student. Overarching outcomes describe general attributes that the student will be expected to have as the result of the cumulative effect of all learning in various units (courses, teams, departments) of the curriculum.

Unit outcomes describe those attributes that are expected as the result of a curriculum unit whether they are unique for that unit or shared with others and contributory to overarching outcomes. It should be noted here that the unit chosen is dependent upon the organizational structure of the curriculum, and may in some cases be subdivided (e.g., department, course).

Criteria of greater specificity than unit outcomes (i.e., learning objectives) are determined by the learning system, and are discussed by Aiken.

At least two further concepts should be kept in mind before turning to some examples of outcomes. First, outcomes may be content
or process centered. Parker and Rubin define content as "the compendium of information which comprises the learning material for a given course," and process as "all the random or ordered operations which can be associated with knowledge and with human activities."

The sciences, particularly at the high school level, have been giving increasing emphasis to the process approach to learning outcomes, as was noted in Chapter One (p. 32).

Second, outcomes should be considered in light of their position on the training-education continuum. Education was defined earlier as learning for unpredictable outcomes, and training as learning for predictable ones. It must be noted that here, again, the extremes are the exception rather than the rule, and that most outcomes will fall somewhere on the continuum nearer one extreme than the other. That is, training outcomes become more and more educative as they become broad enough to allow some associations or interpretations to be made for unpredicted situations.

Statements of Philosophy, if functional, affect all overarching and unit outcomes. Let us then consider some of the overarching and unit outcomes that might then be influenced by one of the hypothetical statements of philosophy suggested earlier:

The process of education-training for health professions is continuous.

We will assume that this statement is part of the philosophy of a college of medicine whose curriculum is organized around the teaching of organ systems by interdisciplinary teams of faculty, and that the teams are coordinated by a council of the team leaders, students, and administration representatives. Outcomes like those suggested
below might be developed—overarching outcomes by a curriculum coordinating council and unit outcomes by organ system teams.

Overarching Outcomes

1. The graduate of a medical school exhibits habits for continued learning in the health professions including the following:
   Regularly reads current literature.
   Recognizes important workshops, conferences, RMP programs, in his chosen areas of interest.
   Is able to select and categorize new useful learnings so they are meaningful in his context.
   Recognizes and uses new generative concepts to which he is exposed.

2. The graduate recognizes the need for and values the above habits as exhibited by the following traits (e.g.)
   Is continuously alert to and curious about new developments that relate to his area of practice as well as some that have no immediately obvious relationship.
   Other factors equal, he will favor a situation offering opportunities for continued professional growth over one with greater monetary or other rewards, but less growth.

Unit Outcomes (Prepared by digestive system team)

Having completed his digestive system studies the student will (e.g.):

1. Exhibit his familiarity with the contributions of the following associations and journals by describing the role each might
play in the continuing education of a gastroenterologist:

- Gastroenterology Abstracts and Citations
- Journal of Nutrition
- American Physiology Association
- American Society of Parasitologists
- American Journal of Veterinary Research

2. Describe how he, as a gastroenterologist, might contribute to the continued learning of all specialists in this field.

3. Show how given unfamiliar digestive system information could become a useful part of his conceptual filing system of knowledge, skills and attitudes.

4. As part of a simulated health team make choices reflecting his positive value position with respect to continued learning [might be an outcome shared and participated in by several teams].

The above overarching and unit outcomes are illustrative. It is hoped that they begin to point out the utility in explicating increasingly detailed goal statements that are based on the philosophical position of the medical school. The true value of such statements, however, is realized only when they are incorporated into a learning program as objectives and used as evaluation criteria.

One common problem with such statements of outcome is to test students against the criteria, but to fail to make meaningful assessment of the criteria themselves at all levels.

Stake (1970), Stufflebeam (1969), and Sanazaro (1967) are among the relatively few educators to address this problem.
Stake's well documented article presents a conceptual framework which might be used as a beginning in identifying overarching outcomes.

It is modified slightly below for professional education:

A. Intellectual Dimensions

1. Possession of knowledge: A fund of information, concepts.
2. Communication of knowledge: Skill to acquire and transmit.
3. Creation of knowledge: Discrimination, synthesis and imagination.

B. Social Dimensions

5. Man to Man: Cooperation in day-to-day relations.
6. Man to Profession: Professional rights, responsibilities, loyalties.
7. Man to Community: Role in maintaining community health.
8. Man to World: Contribution to well being of mankind.

C. Personal Dimensions

11. Ethical: Professional integrity.
12. Aesthetic: Cultural and leisure pursuits.

D. Productive Dimensions

15. Practice: Legal aspects, economics.

In addition to the personal values outlined above, Stake points to two other types of judgment data that are useful in identifying and assessing value-based educational criteria: priorities, indicating the relative importance of values; and standards, indicating importance due to values cited by outside authorities (e.g. national examining boards). He further points to three methods for gathering judgmental data (aggregate judgments, expert observation,
expert review), and briefly discusses some ways such data might be used to test objectives and to make other educational decisions.

Stufflebeam (1969) presents a carefully worked out model for educational evaluation called CIPP (Context, Input, Process, Product). The context portion of this model shows in broad relief how an inclusive program of evaluation can be channeled to assess and update program goals.

The method of context evaluation begins with a conceptual analysis to identify and define the limits of the domain to be served as well as its major subparts. Next, empirical analyses are performed using techniques such as sample survey, demography, and standardized testing. The purpose of this part of context evaluation is to identify the discrepancies among intended and actual situations for each of the subparts of the domain of interest and thereby to identify needs. (p. 32)

Sanazaro's work was referenced above in the discussion of philosophy. The instruments he discusses for medical school self-evaluation provide a good basis for comparing student performance with established criteria, and some might be quickly adapted to compare explicated criteria to the values of faculty, students, administrators and the community.

In summary, outcomes—the stuff of curriculum—are descriptions of the kinds of terminal behavior that are expected of the student. They do not specify the means by which the student learns, merely the traits through which he exhibits his learning. It is useful to identify overarching outcomes and unit outcomes, which are further specified in the learning system to learning objectives. Two assessment problems are related to outcomes and objectives: In what way does student performance compare with stated goals? Do goals reflect
the values of the school and the requirements of society?

**Structural Dynamics**

The third concept that is important to the understanding of curriculum development synergystem is structural dynamics. This involves what has traditionally been talked about under the heading of curriculum organization, e.g. continuity, sequence, integration (Tyler, 1950). In this case structural dynamics is considered a more appropriate concept because 1) curriculum here does not prescribe the order of or interrelationships between learning experiences— that is a function of instruction, and 2) organizations and structures tend to imply static relationships whereas static concepts are foreign to the synergystem approach. Structural dynamics, then are those flexible concepts or frameworks specified in curriculum as guidelines for instructional continuity, sequence and integration.

It should be noted that one reason for making the above distinction is that, although the goal is a flexible curriculum, learning patterns will always be more flexible, and this distinction will provide increased opportunity for varied learning patterns within the same curriculum.

Structural dynamics, then, describe 1) ways that curriculum outcomes might be grouped (e.g. disciplines, organ systems); 2) principles for sequential relationships within and between grouped outcomes (e.g. simple-complex, basic science-clinical science, practice-theory, principles-examples-practice); 3) integrative patterns for curriculum organization (e.g. meaningful spaced review, expansion of concepts in breadth and depth). Brief explanations of these three categories follow.
Grouping Outcomes

As noted in chapter one, the discipline approach to medical education probably started as early as Avicenna, and it has remained largely unchanged where there has been formal medical training since. Because of unwieldy stores of medical knowledge some categorical divisions have long been necessary merely to make the art and science manageable. Only recently has any other scheme for grouping medical knowledge been used for instruction. That, of course, is Case Western Reserve's organ systems approach.

It is significant that neither of these approaches is necessarily a good one for learning, as Tyler (1950, p. 63) points out:

Over the years there has been a general recognition of the distinction between logical and psychological organization. When such a distinction is made, it is an effort to point out the difference between the relationship of curriculum elements as viewed by an expert in the field and the relationship as it may appear to the learner... There are many cases in which a logical organization...is also an appropriate psychological organization... On the other hand, there are times when sharp differentiation can be made between the connections seen by the expert in the field and the developments which are meaningful to the learner himself.

For this reason it is important for schools that are examining their curriculum to approach the question with an open mind and to attempt to discover the patterns that are most meaningful for their students.

Practically, the decision to structure the curriculum around systems, disciplines, or perhaps patients will most likely be made before detailed outcomes are planned. Therefore the activity discussed here might more accurately be called "identifying outcome categories."
It has been labeled "grouping outcomes" with the hope that curriculum
designers will be reminded that it is basically a synthesizing process
(whether or not outcomes are formally stated first), and that such
grouping should be psychologically meaningful for the student rather
than intuitively obvious to the professor.

Sequencing Grouped Outcomes

Another tradition of medical education is to insist on a firm
grounding in the basic sciences before exposure to clinical studies.
This represents a theory-practice approach to learning. As noted in
chapter 1 (p. 6) practice-theory may be an appropriate alternative
approach. Within the basic sciences, some disciplines are traditionally
prerequisite to others—an inductive approach. The process involved
in each approach is fundamentally one of sequencing grouped content,
and is equally necessary for discipline or organ system oriented
curricula. The Ohio State University College of Veterinary Medicine,
for example, chose to sequence organ systems on the basis of functional
relationships between systems. A patient oriented curriculum might
be sequenced on the basis of increasing complexity of disease involve-
ment. Any sequencing pattern, should be examined for its psychological
relevance for learning as discussed in connection with approaches to
grouping. Perhaps we should assume that any grouping or sequencing
is non-relevant until proven relevant. Students are particularly apt
consultants in such discussions.

Integrative Patterns

There is another class of structural principles in the realm of
curriculum development. That is, principles which promote integration
of learning experiences between and within sequences of objectives. Integration here refers to the student's recognition of the relevance of one concept to another. A simple example is the increased understanding of the nervous and endocrine systems that is achieved by discussing them as bodily control systems first independently, then with increasing reference to their interaction. Thus, an integrative principle might be that key curriculum concepts be progressively expanded in breadth and depth as they appear in succeeding or concurrent courses. Another might be that real or simulated case histories be used as problem exercises regularly from the beginning of the curriculum to continually demonstrate the relevance of learning. The implication is that each curriculum outcome must be seen by students and faculty as part of a hierarchically organized set of skills, knowledges and attitudes, sub-skills, sub-sub-skills, and so forth.

There are many other guidelines that curriculum developers will be tempted to hand down. However, as more framework is prescribed by curriculum, less flexibility is left in the learning system. Therefore, principles for sequencing objectives, for organizing learning experiences and the like are best left with the learning system.

Synergistic Support

Up to this point in the discussion of concepts underlying the synergystem approach to curriculum development there has been only implicit reference to the essential human element that makes the other concepts viable. If curriculum is to be meaningful for learners, curriculum development cannot be mechanistic. If curriculum is to foster involvement, curriculum development cannot be pursued in isolation.
Some public school educators are beginning again to talk of the humanistic curriculum, as many did before the events of the 50's made curricula strongly discipline centered. Such an emphasis is particularly relevant for medical education where students are sophisticated enough to learn ordered facts and concepts from books, films, computers and other mediated forms, and where the real need of the medical student is to learn how physicians think, act, order their lives and relate to others. The most significant role of the medical teacher is to communicate these things by his example and wise counsel. Such learning strategies are concerns of the learning system but a climate of inspired concern and involvement must be established in curriculum development.

It is important to note that the arena directly effected by synergistic support is curriculum development (process)—not curriculum (product)—although presumably humanistic values would be reflected in curriculum outcomes through philosophy. Curriculum development as a process requires the continual involvement of those most vitally concerned with its product—curriculum. Involvement is not automatic, but requires the concerted effort of all participants to communicate freely, and further requires a diffusion (inspiration) strategy. Three major elements of synergistic support are introduced below: commitment, diffusion, and communication. Each will be discussed more fully in the context of the proposed synergystem.

Commitment

It would seem hardly necessary to state that basic commitment of administrators, faculty and students to curriculum development is
needed if the venture is to meet a measure of success. However, the
general and deep commitment of all participants from the start is not
only unlikely, but unheard of. Further, one might surmise that a
major reason for the often slow progress of medical curriculum change
is the continued lack of commitment even after considerable deliberation.

If this problem is to be solved, there must be a nucleus of
faculty, students and administrators at the beginning who are committed
to change. This group should contain at least some of the college's
opinion leaders, those to whom others look for insight and information.
Although the group is convinced that changes should be made, they
should not assume a unified position with regard to the direction of
the change, but as individuals with opinions, should make an effort to
seriously entertain any and all of their colleagues' suggestions.
Their commitment to change and their individual work toward that goal
will be more effective in overcoming the general inertia than will an
organized, power based propaganda program (e.g. a series of memoranda
and seminars promoted by the curriculum committee or the dean).

Diffusion

The next aspect of synergistic support is a strategy that can be
used for semi-formally encouraging change on an interpersonal basis.
In the literature of planned change, diffusion is given many defin­i­tions, but perhaps the most useful way to characterize the process is
in Rogers' (1966) five stages:

1. Awareness: The individual learns of the existence of the innovation.

2. Interest: The individual seeks more information and considers the merits of the innovation.
3. Evaluation: The individual makes mental application of the innovation and weighs its merit for his particular situation.

4. Trial: The individual tries the innovation on a small scale.

5. Adoption: The individual accepts the innovation for continued use on the basis of previous trial.

Traditionally diffusion has been a concept used when technical innovations were introduced to a sociologic unit. However, the concept seems equally applicable to the diffusion of concepts such as change itself. Guba (1967) further suggests seven diffusion strategies or design approaches that can profitably be used to diffuse attitudes for change:

1. Value strategy
2. Rational strategy
3. Didactic strategy
4. Psychological strategy
5. Economic strategy
6. Political strategy
7. Authority strategy

All of these strategies are based on "the implicit or explicit assumptions which are made about the nature of the adopter who is to be caused to accept the innovation." Specific examples of diffusion strategy statements formulated as part of the curriculum development program in which the author is currently participating are included as Appendix A. The point here is that the synergystem is not complete unless specific efforts are made to promote understanding and acceptance of change among the human participants.

Communication

Diffusion is a somewhat structured, formalized concept that is necessary if the business of change is to continue. There is an
additional, broader need for open communication between participants. Communication is "the sharing of ideas and feelings in a mood of mutuality." (Dale, 1969, p. 10) This implies an open, interactive two-way phenomenon in contrast to the one-way implication of diffusion. It also implies a relative lack of predisposition; a willingness to listen and to be influenced. However, communication cannot be left to chance. Means for easy communication must be formalized and the desirability of open communication must be diffused.

CHARACTERISTICS OF A SYSTEM APPROACH TO EDUCATIONAL PROBLEMS

Concepts central to a curriculum development synergystem were outlined above. Before a synergystemic model is formulated, however, a general understanding of the system approach as it will be used to develop the model will be helpful.

The System Approach

The system approach has been characterized as a "logical step-by-step approach to problem solving which we use continually, even though we perform many of the steps unconsciously." (Lehmann, 1968, p. 144) As such it is cited to be no more than what we have always called the scientific method. However, Trzebiatowski (1969) points out that, despite a great deal of similarity in the process, the two approaches have significantly different purposes and therefore lead to different ends:

The system approach is interested in the arrangement of the components in a manner that tends to constrain action toward a specific end. The scientific method seeks understanding by measuring the correspondence between a set of observations and a set of concepts... The key
difference between the scientific method and
the system method can be found in the final
step of both methods; that is, in the scientific
method the research findings lead, hopefully, to
a greater and more comprehensive theory, and in
the system method the research findings yield a
direct and immediate plan of action." (p. 3-4)

The system approach, then, is a way of formulating a plan of
action for achieving a specified goal through a series of analytic
and synthetic steps. Below are listed the major steps of the system
approach as it will be used subsequently in this paper. The eleven
steps given here were synthesized from Trzebiatowski (1969) and
Lehmann (1968).

1. Perform Need Assessment - what is required
2. Define Goals - changes required to meet needs
3. Identify Constraints - real world limitations
4. Generate Alternative Solutions - means toward goals
   within constraints
5. Define Selection Criteria - most desirable
   solution characteristics
6. Select from Alternatives - possible vs, criteria
7. Organize Selected Solutions - pattern for
   implementation
8. Prepare Operational Model - working version based
   on pattern
9. Assess Model Function - against goals and operational
   criteria
10. Adapt or reject model - for fit with goals and
    operational criteria
11. Continue updating process - review all steps and revise

The steps given above constitute the process aspect of educational system development. The product of curriculum development is curriculum. A third aspect of an educational system is its elements. The elements are those acts of men or machines that in combination, guided by the system process, result in the planned system product. Elements may be of three types: technical work acts, communication acts, or decision-making acts (Jensen, 1969). Elements are defined during system analysis, and are assigned specific functional relationships within the system. However, the functional relationship between elements does not usually correspond to the set of acts assigned to a given man or machine in the system. Such a set is identified as a role.

The Importance of Role

Role, according to Jensen (1969) is "a set of behavioral acts that comprise an integral part of a long chain or sequence of differentiated actions that are taken to accomplish the immediate and long-range objectives of an educational system." As noted above, acts may be one of three types. Technical work acts are those tasks that directly contribute to products of the system. In education discussing an unclear point with a student, writing a text, projecting a film, grading an exam would all be technical work acts. Communication acts are those that relay "between roles information about the status and progress of the work contributing to the end-product." (Jensen, 1969, p. 103) Posting exam grades, informing the department chairman of an
equipment requirement, chewing out an intern, and unconsciously setting an example are all communications acts.

Decision-making acts solve problems that arise as a result of lack of coordination between technical work acts and communications acts. Coordination is routinely handled by established rules, which in effect are pre-made decisions. For example, if a bad example is regularly set for clinical students during ward rounds by a faculty member, there may be an unwritten rule that prompts his colleagues to talk to him about the problem in an attempt to resolve it quietly. If these attempts fail a special decision may be required of the department chairman to solve the problem.

It becomes quickly obvious that there are many possible combinations of acts that might make up roles in a system as complex as a medical curriculum development synergystem. Beyond role identification, Jansen suggests six additional tasks that are necessary to this aspect of the educational system: (pp. 105-108)

1. Formulation of a set of set educational goals that are to be attained and the identification of the clientele that are to be served. This has been shown to be part of system analysis.

2. Building an inter-role structure that will be effective for mobilizing resources and for implementing the educational programs that will be utilized as means to achieve the educational goals.

3. Building an organizational culture that will enable role incumbents (men and/or machines) to clearly perceive the acceptable (and non-acceptable) behavioral responses that should be made to different kinds of organizational situations.
4. Determining whether the inter-role actions generated by role incumbents produce the kinds of actions that lead to the accomplishment of the instructional objectives.

5. Utilization of human resources available to the organization.

6. Making adjustments in and periodic reorganizations of the goals, structure, culture, role interactions and personnel placements of an educational system.

Educational change agents are urged to study Jensen in detail, for it is impossible to give more than a flavor of his work here.

We have looked at some basic concepts of the system approach to solving educational problems, and have perceived the educational system from the perspective of role identification and interaction. Let us now relate these concepts as they might be related in a curriculum development synergystem.

Through system analysis we identify those functions that, taken together in a certain pattern will achieve the system goal. Functions (e.g. Formulate alternative approaches, for improving synergistic support) are made up of a variety of tasks or acts (e.g. write possible strategies that will meet needs and produce changes, combine possible strategies to formulate alternative approaches, communicate alternative approaches to decision-maker). Each act may be performed by a different person or machine; on the other hand any given person or machine performs acts that contribute to a number of functions, and collectively make up his (its) role(s). The point is that functions, having been identified through system analysis as necessary to meet system goals, must be further analyzed into acts and regrouped into roles to fit the organizational constraints of a man-machine organization. (Fig. 3)
Figure 3. ACTS AS THEY RELATE TO FUNCTIONS AND ROLES
The theoretical curriculum development model to follow is in the form illustrated in the center of Figure 3. Chapter Three will rework that model so that it is more like the practical organization on the right.

A THEORETICAL MODEL FOR CURRICULUM DEVELOPMENT

The theoretical model presented here is the result of an analysis of the curriculum development process as it has been realistically and idealistically described by many curriculum writers. It is also the result of the author's deliberate observation of the strengths and weaknesses of a development program that has recently produced its first fruits: a highly innovative professional curriculum for The Ohio State University College of Veterinary Medicine. In addition to the above sources, there is inevitably a certain amount of the author's bias about what curriculum and curriculum development should be like.

Below is the schematic view of an education program upon which this paper is based as it is described in the introduction:

VALUES AS CRITERIA

AVAILABLE
TEACHABLE HEALTH
SCIENCE KNOWLEDGE, SKILLS

CURRICULUM
DEVELOPMENT → CURRICULUM → LEARNING → CHANGED
SYSTEM SYSTEM STUDENTS

FIGURE 4. AN EDUCATIONAL PROGRAM
A more comprehensive view of the educational program is shown in outline form:

SUPRASYSTEM (ENVIRONMENT): HEALTH PROFESSIONS INSTITUTION
MULTISYSTEM: TOTAL INTEGRATED EDUCATION PROGRAM
SYSTEM: CURRICULUM DEVELOPMENT
INPUT: KNOWLEDGE, SKILLS, VALUES
SUBSYSTEMS: PHILOSOPHY
OUTCOMES
STRUCTURAL DYNAMICS
SYNERGISTIC SUPPORT
OUTPUT: CURRICULUM
SYSTEM: LEARNING*
INPUTS: CURRICULUM/STUDENT CAPABILITIES
SUBSYSTEMS: TRANSLATING
INTERACTING
SERVICING
COMMUNICATING
OUTPUT: CHANGED STUDENT CAPABILITIES

As discussed earlier in this chapter, and reiterated above, the four major components of curriculum development are philosophy, outcomes, structural dynamics and synergistic support. The relationships between these components and the most significant inputs to the curriculum development system are illustrated in Figure 5.

* For detail see Aiken
Each of the four curriculum development components is being considered as a subsystem and will therefore be described in terms of the eleven step system approach discussed earlier. Summary tables of the four subsystems are included at the end of this chapter (pp. 94-97).

**Inputs To The Philosophy Subsystem**

Philosophy has been described as a system of values. The inputs to the philosophy subsystem, therefore, are the values and value systems of those individuals and groups who participate in, and who are served by the education multisystem. Three categories of value inputs can be identified: cultural values, institutional values and personal values.

Broadly speaking, cultural values represent the society served by medicine; the immediate community of the health science learning center, and national and international society. They are reflected largely in the demands for medical services made by members of society and in expectations held by government and other social institutions. In our
society, for example, people have come to expect the best health care, and are now exerting considerable pressure toward the realization of this relatively new value. As Coggeshall states in his 1965 report to the Association of American Medical Colleges:

"Advances in science and in health care have stimulates the health expectations of individuals. Moreover, people today are being taught to expect good health care. Throughout history, man has tended to accept illness, plagues and personal injuries as "normal". Only in the present century have men begun to find that most health hazards can be eliminated, controlled, or subjected to amelioration. With this knowledge has come the expectation that health care will be made available. Today, few are willing to suffer needlessly. (p. 17)"

Institutional values are those values established by the university and/or medical college of which the medical education program is a part. In addition, expressed values of the profession or professions contributing to the program contribute to institutional values. Universities, colleges and professional organizations generally function under broad statements of purpose and procedural guidelines. These reflect the institution's value positions and will usually be adequate bases from which educational philosophy may be built. However, documents like the Coggeshall Report quoted above compose a more substantive basis for determining institutional values. Similar studies made periodically should become the serious goal of organizations interested in positively influencing the progress of education in the health professions.

The personal values of role incumbents in the health professions education program comprise the third category of input to the philosophy subsystem. As pointed out earlier in the chapter, the values and philosophy of students, faculty, administrators and others in the
medical school environment are the operational values and philosophy of the educational program at any given moment. The classes of values discussed above are potent only as they are able to influence the positions held by incumbents. This concept is missed when formal philosophies are established on the basis of known cultural and institutional values with little or no incumbent representation.

The Philosophy Subsystem

Having briefly identified the inputs to the philosophy subsystem, its function will now be analyzed following the eleven step approach presented earlier. The result will be a list of system functions, which represent the major acts necessary to work toward the system goal.

1. Identify existing statements of philosophy and those areas of curriculum for which new or revised statements are needed. Philosophy, of course, does not exist in a vacuum. As has already been seen, philosophy is an input for the other curriculum development subsystems. Identification of need in the philosophy subsystem, therefore, is dependent upon feedback from the other subsystems with regard to the effectiveness or ineffectiveness of philosophy as it is used in those subsystems. For example, let us say that it has come to the attention of a clinical faculty member that many of his fourth year students spend an undue amount of time doing background research for case work-ups. Brief discussions with students reveal that at no time in their previous training had anyone taken a few minutes to introduce time-saving ways to do such research. The faculty member might decide to lead a short discussion on the topic and partially alleviate that
problem for those students. The situation might come to the attention of other department members, and eventually this aspect of learning might be taken as the department's responsibility. However, the better approach would be to submit the problem to the curriculum coordinating group. A unit outcome to meet that specific need would then be written and fit into the curriculum structure in the most appropriate place. The greatest pay-off would come, however, if an examination of the philosophy showed that no existing philosophical statement covered this new outcome. A new statement would finally be developed that might significantly enrich the educational program. (e.g. The knowledge and skills that make the physician competent to communicate effectively with a variety of information sources are important to the present and future practice of his art, and each student should be encouraged and assisted in developing his abilities in these areas.)

Our example has gone well beyond the bounds of the first system function. It will, however, be referred to in the discussion of other functions with the intent of presenting the subsystem as a coordinated set of functions. Remember that the first function was simply to identify areas of need for new or changed statements of philosophy, and that this was done by way of feedback from the learning system and the outcome sub-system.

2. Define the changes in curriculum (outcomes, structure) that are desired as a result of the changes in philosophy. The purpose of formulating statements of philosophy is to guide the development of curriculum. It is therefore important to know what kinds of effects on curriculum are expected as a result of philosophical statements.
This, in effect, is identifying the goal for the philosophy subsystem.

In the example we suggested that one new outcome is sufficient to point out the need for a new statement of philosophy. It is likely, however, that in addition to the originally identified unit outcome, the definition of other desired outcomes or classes of outcomes would be stimulated by discussion of the need. The kinds of curriculum changes thus identified become the goal of the subsystem in this area.

3. Identify the value positions that constrain changes in philosophy. This is the point at which the major value inputs to the system are considered. These have been characterized as originating at three levels: cultural, institutional and personal. Major value positions on all three levels should be identified and updated on a regular basis by some responsible office of the medical school or health sciences learning institution. If this is done, explicit statements of constraint will be available whenever questions of philosophy arise.

Some positions that might constrain our example are: 1) the society in which physicians serve expects them to be all-knowing, and therefore increased ability to locate and use information sources at the expense of knowing things by memory will make their credibility suspect; 2) the institution (university) is divided into specialized units for a purpose, and the place for teaching communication skills may be education, library science or psychology, but is not medicine; 3) many faculty feel that the most appropriate and valuable thing they can do for students is to acquaint them with organized bodies of medical knowledge on the assumption that their future practice will
be built largely or entirely on such exposure.

These positions are not hypothetical. They are reflected in numerous educational programs and are verbalized by some citizens, administrators and medical faculty. Obviously such positions would be antagonistic to the change that is sought in the example. They are presented here to emphasize the need for making value positions explicit. Positions such as these have done much to forestall change in the past because they have too often been allowed to remain implicit, undefined, unchallenged. The author holds that such positions have little chance of survival in an academic environment if they are given the status of formal statements representing value positions, and thus are subject to rational scrutiny.

4. Identify alternative statements of philosophy that are within constraints, meet needs and can be expected to produce desired change. If the three positions given above were part of the constraints on this process, the effort would be stymied at this point, for it would be most difficult to write statements that would meet the needs described in 1., and at the same time satisfy the constraints. Let us assume, however, that the constraints in this situation are not antagonistic to the need so that we can go on. Some alternative statements might be as follows:

1. Communication skills are an important aspect of the physician's art and should be specifically fostered by the medical school.
2. Communication skills are an important aspect of the physician's art and each student should be encouraged and assisted in fostering them while in medical school.
3. The knowledges and skills that make the physician competent to communicate effectively with a variety of information sources are important to the present and future practice of his art, and each student should be encouraged and assisted in developing his abilities in these areas.

4. It is important for students 1) to be able to locate pertinent information sources among those available currently and in the future, 2) to have skills that permit quick effective use of those sources, 3) to be able to discriminate between information about a patient's disease that should be communicated to the patient and information that should not, and 4) to have skills of interpersonal communication that promote patient understanding with minimum unnecessary apprehension.

5. **Define criteria for selecting among alternative positions.**

The most important set of selection criteria is the existing base of philosophical positions. If the statement of philosophy is not consistent with another statement, then it must surely be in question at least until that statement is revised. Other general criteria that might be useful as guides for selecting statements of philosophy would be questions such as: Is this position forward-looking; does it account for future needs? Is the position based on well-established principles of training-education, medical practice, psychology, and so forth? What is the social orientation implied or stated in the position?

6. **Select statement of philosophy from among alternatives on the basis of criteria.** This step is self explanatory, however, one special note is relevant. A great deal of information that could be
useful to future operation of this subsystem will be lost if records of the decision process are not made. Decisions are typically recorded and reported but much less often does one see notes of the deliberations and rationale that led to a particular decision. For this reason committees tend to retread much ground unnecessarily.

Continuing with the example, the statement chosen along with a brief statement of rationale follows:

NEW STATEMENT OF PHILOSOPHY: the knowledges and skills that make the physician competent to communicate effectively with a variety of information sources are important to the present and future practice of his art, and each student should be encouraged and assisted in developing his abilities in these areas.

This statement was chosen because the faculty feel that 1) it reflects a concern for the individual student, 2) it reflects the previously established philosophy of preparing students for future roles, 3) it acknowledges both education and training needs, 4) it is not an outcome that establishes specific abilities, as is the fourth alternative.

7. Prepare statement for use in other subsystems by adding sufficient explanatory information so that any role incumbent of the system can readily use it in further program development. Any concise statement of philosophy, regardless of how carefully it is worded, will be subject to various interpretation by those who read and work with it. In order for it to have maximum utility, however, it must have the same meaning to each person who implements it in other curriculum development subsystems, and in the learning system.
To approach this goal of uniform understanding, explanatory information is added before the statement is forwarded to the other subsystems.

In the example information such as the following would be included: 1) explanation of the domains from which these knowledges and skills might be drawn, 2) definition and examples of information sources, 3) examples of the kinds of skills that might be useful, and 4) expectations for future sources and needed abilities.

8. Go to outcomes, structural dynamics and synergystic support subsystems. At this point the output of the philosophy subsystem (i.e. statement of philosophy) is made available to the other subsystems of curriculum development for implementation. The transfer should be assured by some mechanism like replacement pages in a looseleaf notebook, and it should be complete—involving diffusion to all involved incumbents.

9. Monitor use of new or changed statements of philosophy in other subsystems, and compare to desired changes specified in 2. If the type of changes expected in outcomes or structure was well defined as the goal of the changed philosophy, it should be little problem to compare the way philosophy is applied to the way it was intended to be applied. Because those involved in expressing the intent are likely to be the same individuals or at least in very close contact with those who develop outcomes or elements of structure, interpersonal interaction during the development-monitoring process will very likely be sufficient to make minor adjustments in philosophy or its application. However, if major questions arise, step number 10 is appropriate, and in any case step 11 should finally be implemented.
10. If changes do not correspond to those desired, begin again at 1. to determine if identified needs, desires, and resulting statements are appropriate.

11. If changes do correspond to those desired, establish a schedule for periodic review of statements of philosophy, each time beginning at 1. This step alone ensures that the subsystem will remain dynamic, and will provide the impelling force for constructive change. A scheduled review and opportunity for change will also have the effect of constructively sensitizing many faculty, students and administrators to educational program needs. The dangers are that a regular review will become mechanistic or that incumbents will become over sensitized. The first situation would result in review for the sake of review, and would probably foster little constructive change. The second might result in many hasty changes without sufficient controlled trial of any one.

The Synergistic Support Subsystem

Synergistic support was characterized earlier as an attempt to understand and guide the essential human element of curriculum development, as a climate of inspired concern and involvement, and as a construct with three contributing elements: commitment, diffusion, and communication. It is an input to both the outcome subsystem and the structural dynamics subsystem, and is therefore considered before them.

1. Identify program needs for commitment, diffusion, and communication. An initial analysis of synergistic support needs and feedback from the subsystems in which support is implemented provide means for identifying this subsystem's needs. An initial analysis
should answer questions such as: 1) To what extent are incumbents committed to the proposed change? 2) How well are new ideas diffused to system incumbents? 3) In what way and through whom are changes normally introduced? 4) Is there good interpersonal communication between incumbents? 5) Is there good communication between incumbent groups (administrators, faculty, students) and between subgroups within those groups? 6) Where does communication break down?

2. Define the differences in the curriculum development and/or learning program that are expected to result from changes in the synergistic support subsystem. The purpose of synergistic support is not only to enhance commitment, diffusion and communication, but is also to promote resultant changes in curriculum and learning. It is necessary, therefore, to identify the changes that are intended so they can be used to guide subsystem functions and to later assess subsystem effectiveness.

3. Develop framework for strategy formulation. A framework around which specific synergistic support strategies can be formulated is the next element in subsystem development. For example, the seven strategies presented by Guba (1967) and cited earlier would provide such a working base for development of a diffusion strategy: The following is a partial summary of Guba's explanation:

1. A value strategy. The adopter is viewed as a professionally oriented entity that can be obligated through an appeal to his values...
2. A rational strategy. The adopter is viewed as a rational entity who can be convinced on the basis of hard data and logical argument...
3. A didactic strategy. The adopter is viewed as a willing but untrained entity...
4. A psychological strategy. The adopter is viewed as a psychological entity whose needs for acceptance, involvement, and inclusion
can be employed to persuade him to adopt...

5. **An economic strategy.** The adopter is viewed as an economic entity who can be compensated... or deprived...

6. **A political strategy.** The adopter is viewed as a political entity who can be influenced to adopt...

7. **An authority strategy.** The adopter is viewed as an entity... who can be compelled to adopt...

Other guides for the development of synergistic support might be adopted or adapted from the literature of planned change, educational administration, or organizational psychology.

4. **Formulate alternative approaches for improving synergistic support to meet each of the identified needs.** Knowing needs for and goals of synergistic support, it is possible to develop strategies to meet those needs using a framework like that developed by Guba. Strategies to meet specific needs should, in fact, be multi-strategy approaches because no single strategy is likely to change complex human entities. For example if the need is for acceptance by medical faculty of planned change as a continually necessary part of the educational program, the following diffusion strategies might be chosen: 1) value strategy—it is best for the students; 2) rational strategy—it is most effective to meet faculty goals; 3) didactic strategy—these are the things you need to know about it. Another alternative might include psychological and authority strategies if means for implementing these were available and acceptable.

5. **Identify characteristics of the program and incumbents that constrain selection of an approach to change.** To select an approach to change it is further necessary to know the context in which change will take place, including a knowledge of the attitudes of various incumbents toward change in general and toward the specific change needed.
This involves understanding value positions and vested interests of individuals and groups. Another element of the context is the institutional environment. Some characteristics of the institutional environment that can affect synergistic support are patterns of administrative responsibility, formal and informal relationships with other institutions, level of fiscal support for proposed changes, and capabilities of an in-house office of medical education.

6. Select approach(es) best suited to meet synergistic support needs. After formulating alternative approaches and identifying relevant selection criteria an approach (two or more strategies) is selected for implementation in the program. The process is to examine each approach to determine how it will be accepted by incumbents with various values and vested interests, and to determine how compatible it is with administrative authority—responsibility structure, fiscal support capability, and other existing context elements.

7. Design operational mode for implementing the selected approach. Once an approach has been selected, implementation techniques must be applied to each of the contributing strategies. Continuing the diffusion example, Guba identifies six techniques that might be involved in implementing a diffusion strategy:

1. Telling
2. Showing
3. Helping
4. Involving
5. Training
6. Interviewing

A value strategy might be implemented by telling faculty how a program benefits students, or by involving students in program development with the intent of thereby demonstrating its value to them.
Telling and showing are readily apparent ways to implement a didactic strategy, but a more effective way may be involving. According to Cuba, it is possible to implement any of the seven strategies using any one or more of the six techniques.

8. **Implement strategies as designed.** Each approach to improving synergistic support, having been selected to meet needs and to satisfy criteria, and having been designed for implementation, is now implemented in the subsystem(s) for which it was intended. This is the output function of the synergistic support subsystem.

9. **Monitor each implemented strategy to determine the extent to which it effects desired changes defined in 2.**

10. **If changes are not evident, begin again at 1, and examine factors in other subsystems that might have blocked desired change.**

11. **If changes are evident, establish a schedule for periodic review of synergistic support.**

The Outcomes Subsystem

If curriculum is a structured set of selected intended learning outcomes, it is clear that the outcomes subsystem and the structural dynamics subsystem are the two parts of curriculum development that directly contribute to curriculum. This relationship is illustrated in Figure 5. The double ended arrow between the two subsystems indicates continual interaction of developing outcomes and structures rather than a simple combination to form curriculum.

In addition to the interactive input from the structural dynamics subsystem, there are two other inputs shown that contribute to outcome development. Statements of philosophy from the philosophy subsystem
are used as guidelines, and available, teachable health science knowledge and skills are the major content-process input. Many curriculum writers identify the total available culture as the source of curriculum; a narrower slice is suggested here because of the specialized nature of the professional health sciences curriculum. This emphasis is not meant to imply that available, teachable health science knowledge and skills constitute the only content-process input. If a doctor is to learn how to learn, certain education knowledge and skills become an input; if he is to learn about the society of which he will be an important part, certain sociological knowledge and skills become an input, and so forth.

The modifiers "available teachable" (Johnson, 1968) are important in the definition of content-process input to the outcomes subsystem. It may be highly desirable philosophically to include certain elements of content-process in curriculum, but practically impossible to do, as Johnson explains:

Not all cultural content is of a sort that could be incorporated into the curriculum. Only that which is teachable and available is eligible for inclusion. Artifacts and social institutions are components of culture, but they are not teachable. Even source knowledge and skills, though teachable and very much a part of culture are not available for curriculum, since they are kept secret by families, craft groups, corporations, or governments. (p. 132)

The way each kind of input is used in the outcomes subsystem will become more clear in the step by step analysis of subsystem function.

1. Identify potentially educable traits of current and future practitioners in light of stated philosophical positions. If medical schools were asked to state their single major goal, most would be similar to this: to prepare students to become successful physicians
in whatever field of endeavor they choose. The next step is to identify those traits that make a man successful by the school's definition as evidenced in its philosophy. That, of course, is one thing to write and another to do.

It is possible to identify all the professional and personal traits that make a physician successful by carefully studying a number of eminently successful men and by researching the subject using knowledgeable observers. Extensive studies of the traits of teachers have been done using these kinds of techniques (Charters and Waples, 1929; Barr, et al. 1961). It is unlikely, however, that such an approach would find many participants in any medical school or other health science institution. In addition, it is unlikely that any institution would be satisfied with an averaged definition of success. Each school has its own strengths and weaknesses and prides itself on having graduates with some unique qualities.

It is more realistic in the view of this author to begin identifying traits by gleaning insightful intuitive responses from the faculty, who are, after all, practitioners in many academic, research and service areas. Starting with a base of intuitively identified traits, we can compare those traits with more rigorous studies of reality in areas where further definition or clarification is needed.

2. **Identify new or changed traits that require outcomes in the curriculum.** Few schools have explicitly identified traits as described here. For the purpose of continuing the hypothetical example, however, we will assume that our school has identified traits, but that an additional one was called to the attention of the curriculum council by a clinical faculty member. As you will recall he suggested that
graduates needed to be able to quickly locate and use references pertinent to clinical case work-ups. Eventually a new statement of philosophy was formulated with the suggestion that certain types of outcomes were anticipated for implementation of the philosophy. Guided by these philosophical considerations and by potentially educable traits identified in 1., any other traits related to the one noted by the faculty member are identified at this point. It might simply be acknowledged that skills such as those mentioned are needed for competencies other than clinical case work-ups.

3. Identify teachable health science knowledge and skills that contribute to traits already identified. This is where the major content-process input discussed above enters the subsystem. Knowing the traits that should be developed by the student, it is necessary to identify those aspects of the various scholarly disciplines that when learned are expected to enable the student to acquire the desired trait.

In the example most of the contributory knowledge and skills would come from the domains of education and information science, which we pointed out are among the secondary inputs. An additional input would be the structure of knowledge in relevant medical areas, because it is necessary for the student to use his understanding of these structures to guide his location of specifics.

4. Write alternative intended outcomes for each of the identified traits using appropriate knowledge and skill inputs. Often it will be appropriate to identify both overarching and unit outcomes that are appropriate to the trait under consideration. For the sake of simplicity, however, the example will consider only that unit outcome which initially prompted a clinical faculty member to stimulate the change
We will assume the faculty member was a gastroenterologist. Some alternative statements of that outcome follow:

1. Students will be aware of available sources of information for preparing case work-ups and will have skills that help them make quick, effective use of that information.

2. Each student will be able to identify a variety of useful sources of information that have enabled and will continue to enable him to better understand cases of gastroenterologic disease, and will demonstrate his ability to quickly locate and use unfamiliar sources through application of basic skills.

3. Each student will show that he can locate information in the Physiologist that is pertinent to the understanding of a given intestinal disorder, and can integrate that information with additional from the Archives of Internal Medicine to formulate a treatment strategy.

5. Define characteristics of a viable outcome. Before selecting outcomes, those characteristics that are considered to be vital for a workable outcome must be defined. Once defined, these characteristics serve as selection criteria, and are relatively constant. However, they should be restudied and updated regularly. Outcome characteristics are based primarily on an understanding of the learning process and practical considerations necessary to make outcome statements compatible with the rest of the development process. Several characteristics that suggest themselves are:

1. An outcome describes a desired student behavior.
2. An outcome states or implies a content and/or process emphasis for learning.
3. An outcome states or implies education and/or training aspects.

4. Reading an outcome, it is quickly clear whether it is intended to be overarching or unit.

5. An outcome does not describe particular learning situations or experiences.

6. An outcome is designed so that a number of learning objectives may be needed to reach it.

Practically, outcome characteristics are useful tools to use when writing alternative outcome statements. They appear after outcome writing in the system sequence, because functionally in effect they function as a screen for alternatives at the point of selection.

6. Select outcomes that promise to produce graduates with appropriate traits, and that have appropriate characteristics.

As in the philosophy subsystem, selection involves a comparison of statements against the available criteria. Again, specific reasons for the selection should be given.

Glancing back at the three alternative outcomes (function 4) given in the example, a quick study reveals that the first alternative: 1) does not describe student behavior (aware, have); 2) is vague about content-process and 3) education-training emphases; 4) was supposed to be a unit outcome, but does not indicate this; 5) does not describe particulars; 6) would be difficult to translate to learning objectives.

Example two: 1) describes student behavior (identify, demonstrate, locate, use); 2) emphasizes content (sources) and process (ability); 3) emphasizes education (use unfamiliar sources) and training (able to identify, quickly locate); 4) is clearly a unit outcome; 5) does not describe particulars; 6) could be translated into specific learning
objectives.

Example three: 1) describes student behavior; 2) has process (locate, integrate, formulate) and content (given intestinal disorder, etc.) emphases; 3) is mainly training oriented; 4) is clearly unit oriented; 5) does not describe particulars; 6) is, in fact, a general learning objective around which many specifics could be designed.

This kind of comparison with the criteria indicates that of these alternatives, the second is clearly the best outcome statement.

7. **Interact with structural dynamics subsystem to be sure that outcomes are compatible with framework.** The framework for organizing outcomes established by the structural dynamics subsystem may require special outcome orientation (e.g. unit outcomes may have to be written for disciplines, organ systems, diseases). For this reason, interaction with structural dynamics in the course of outcome development is essential. Such interaction may take place at any point in the outcome subsystem, but is considered here because at this point selected outcomes can be compared to the framework, and final revisions of one or the other accomplished.

8. **Merge with structural dynamics for structured set of selected intended learning outcomes.** Once all outcome requirements are complete under the guidance of structure, the structured set of outcomes that is curriculum emerges.

9. **Monitor use of outcomes in learning system, and compare changed traits to those identified in 2.** To test the usefulness of particular outcomes it is necessary to determine whether or not the intended traits identified in 2 above become traits of students through the identification of objectives and application of learning
experiences. This determination is made in the learning system evaluation program. Trait deficiencies thus identified indicate a need for revised outcomes. A broader indication of the effectiveness of the educational program is possible using a variety of in-school, immediate and intermediate criteria. (Sanazaro, 1967, p. 57)

10. If changes are not representative of those sought: begin again at 1, noting specific trait discrepancies and modifying outcomes.

11. If changes are representative: establish a schedule for periodic review of desired traits and the outcomes designed to attain them. This step is essential for a dynamically changing program in which student learning experiences are relevant to the changing demands of practice.

The Structural Dynamics Subsystem

The purpose of the structural dynamics subsystem is to order outcomes in a framework that will be meaningful for learners. Identification of such a framework depends upon an understanding of the learning process as well as an appreciation for the logical organization of the disciplines to be learned.

1. Identify areas of need for grouping, sequencing, and/or integrating outcomes. Again, the first function of the subsystem is to identify needs using feedback from other subsystems. In this case interaction feedback with the outcomes subsystem is particularly important to identify new or revised outcomes that require grouping. Feedback from the learning system also indicates groups or patterns that are not functioning effectively and therefore may require a change in structure.
2. **Define student behaviors that will be considered evidence**
of improved curriculum structure. The goal of the structural dyna­
metics subsystem is to improve learning opportunities for students.
It is therefore necessary to identify student behaviors—such as
increased ability to integrate concepts of endocrinology and neurology
under a concept of body control system—that will show the effective­
ness or ineffectiveness of changes made by subsequent subsystem
functions.

3. **Identify assumptions about the learner and the learning**
process, and about the organization of knowledge that constrain the
development of alternative structures. A second input from the learn­
ing system is the position taken with regard to the way students learn
best. Assumptions that might be made in this regard are: 1) students
can and do learn both by building complex concepts from simple compo­
nents and by filling in the details of an initially grasped whole;
2) sometimes almost random and seemingly fruitless searching will lead
to a sudden synthesis and meaningful discovery (Eureka!); 3) some
students learn well despite logical or psychological structure, while
others are highly dependent upon such guidance; 4) students learn from
interacting with other students on a one-to-one basis; 5) problem
solving is an effective way for students to learn many things; 6) learn­
ing in the context in which knowledge and skills will be used is
effective. Many additional assumptions might be made with regard to
the learning process.

Assumptions about the organization of the knowledge, or disciplines
represented in the outcomes to be structured also need to be identified.
Knowledge within a discipline may be rigidly structured so that each
concept developed is completely dependent upon the next, or relatively small groups or clusters of concepts may be internally dependent, but virtually independent of one another. These kinds of organizational assumptions will affect the flexibility of curriculum structure.

4. **Define alternative frameworks for curriculum organization** that meet needs and incorporate principles. Let us say that we have assumed, among other things, that most medical students need a broadly structured learning program and further that it is the nature of medical knowledge to be divisible into large blocks (e.g. disciplines, systems) which consist of clusters of knowledge that are not rigidly interrelated. Reading other assumptions between the lines, we might write broad alternatives for curriculum organization like these:

1. Outcomes should be grouped by scientific disciplines; within disciplines they should proceed from simple to complex; the outcome groups should be sequenced in a theory-practice relationship; and integration between disciplines should be left to the individual instructor and students.

2. Outcomes should be grouped by organ systems; within organ systems outcomes should proceed from basic principles to exemplar diseases to practical application; outcome groups should be sequenced from those systems with more integrative, general body functions to those with more exclusive, specialized body functions; and integration between groups should be accomplished by coordinating consideration of diseases that involve multiple systems.

3. Outcomes should be grouped by diseases that affect patients; within groups outcomes should proceed from those that are least debilitating
to those that are fatal; outcome groups should be sequenced from those etiologies that tend to be least complex and best understood to those that are highly complex and least understood; integration should be accomplished by consideration of the patient as a whole.

More specific organizational principles for groups (units) might then be written as guides for the ordering of learning experiences by the learning system. It is possible, however, that further structuring of outcomes within units would limit seriously the flexibility of the learning system, and thereby make learning less effective for many students.

5. **Identify criteria for selection among alternatives.**

Selection of an organizational approach from alternatives like those above must be done on the basis of the relative weight of certain value positions and certain necessary constraints. The value positions are established in the philosophy subsystem and might include a statement to the effect that the school exists to serve the students, therefore the curriculum should be designed first for most effective learning. A corollary might be that psychological (as opposed to logical) organization is believed to be the best for learning, therefore the structural approach most nearly providing psychological organization should be chosen. Careful study might show that the third alternative in the example is most nearly psychologically organized. On the other hand, assuming it is socially unacceptable to selectively admit patients to the hospital because their disease is needed in the curriculum, it might be most difficult to implement the third choice.

6. **Select framework for grouping, sequencing, and/or integrating outcomes from alternatives.** The criteria identified for selection
are bound to be many and complex. The selection is apt to be a trade-off between highly prized values and practical limitations. Such as trade-off will be facilitated if values and limitations are ranked; values from most valued to least, limitations from most inflexible to most flexible.

7. **Interact with outcomes subsystem to assure compatibility of outcomes with framework.** When both outcomes and an organizational framework have been selected, the curriculum is synthesized by fitting outcomes onto the framework. If this involves more than a small curriculum segment, it is likely that there will be some outcomes that do not fit well. Much of this problem should be solved by interaction between participants in the two subsystems during the development process, but those outcomes that are not compatible can be put back into the outcomes subsystem for further refinement.

8. **Communicate curriculum as output to learning system for implementation.** At the time of curriculum synthesis it is important to record carefully the rationale for assigning outcomes within the framework, and in addition a summary presentation of the whole curriculum development process should be written from the records of the various subsystems. This document amounts to a functional transmittal paper from the curriculum development system to the learning system. The intent is to facilitate effective implementation of curriculum for learning.

9. **Monitor use of curriculum through feedback from the learning system; compare with student behavior defined in 2.**

10. **If behavior is not as defined:** begin again at 1., also reexamining outcomes subsystem.
11. If behavior is as defined: establish a periodic review of structural dynamics, beginning at 1.

SUMMARY OF CURRICULUM DEVELOPMENT
SYNERGISTICS FUNCTIONS

Below are summarized the major functional steps of the four curriculum development subsystems.

Philosophy Subsystem

1. Identify existing statements of philosophy and those areas of curriculum for which new or revised statements are needed.
2. Define the changes in curriculum (outcomes, structure) that are desired as a result of changes in philosophy.
3. Identify the value positions that constrain changes in philosophy (cultural, institutional, personal).
4. Identify alternative philosophical positions that are within constraints and meet needs.
5. Define criteria for selecting among alternative positions.
6. Select philosophical position from alternatives on basis of criteria.
7. Prepare statement for use in other subsystems by adding sufficient explanatory information so that any role incumbent of the system can readily use it in further program development.
8. Go to outcomes, structural dynamics and synergistic support subsystems.
9. Monitor use of new or changed philosophical statements in other subsystems and compare to desired changes specified in 2.
10. If changes do not correspond to those desired, begin again at 1. to determine if identified needs, desires and resulting statements are appropriate.

11. If changes do correspond to those desired, establish a schedule for periodic review of statements of philosophy, each time beginning at 1.

**Synergistic Support Subsystem**

1. Identify program needs for commitment, diffusion, communication and role monitoring.

2. Define the differences in the curriculum development and/or learning program that are expected to result from changes in the synergistic support subsystem.

3. Develop framework for strategy formulation.

4. Formulate alternative approaches for improving synergistic support to meet each of the identified needs.

5. Identify characteristics of the program and incumbents that constrain selection of an approach to change.

6. Select approach(es) best suited to meet synergistic support needs.

7. Design operational mode for implementing the selected strategy.

8. Implement strategies as designed.

9. Monitor each implemented strategy to determine the extent to which it effects desired changes defined in 2.

10. If changes are not evident, begin again at 1., and examine factors in other subsystems that might have blocked desired change.
11. If changes are evident, establish a schedule for periodic review of synergistic support.

The Outcomes Subsystem

1. Identify potentially educable traits of current and future practitioners in light of stated philosophical positions.

2. Identify new or changed traits that require outcomes in the curriculum.

3. Identify teachable health science knowledge and skills that contribute to traits already identified.

4. Write alternative intended outcomes for each of the identified traits using appropriate knowledge and skill inputs.

5. Define characteristics of a viable outcome.

6. Select outcomes that promise to produce graduates with appropriate traits, and that have appropriate characteristics.

7. Interact with structural dynamics subsystem to be sure that outcomes are compatible with framework.

8. Merge with structural dynamics for structured set of selected intended learning outcomes.

9. Monitor use of outcomes in learning system, and compare changed traits to those identified in 2.

10. If changes are not representative of those sought: begin again at 1., noting specific trait discrepancies and modifying outcomes.

11. If changes are representative: establish a schedule for periodic review of desired traits and the outcomes designed to attain them.
The Structural Dynamics Subsystem

1. Identify areas of need for grouping, sequencing, and/or integrating outcomes.

2. Define student behaviors that will be considered evidence of improved curriculum structure.

3. Identify assumptions about the learner and the learning process, and about the organization of knowledge that constrain the development of alternative structures.

4. Define alternative frameworks for curriculum organization that meet needs and incorporate principles.

5. Identify criteria for selection among alternatives.

6. Select framework for grouping, sequencing, and/or integrating outcomes from alternatives.

7. Interact with outcomes subsystem to assure compatibility of outcomes with framework.

8. Communicate curriculum as output to learning system for implementation.

9. Monitor use of curriculum through feedback from the learning system; compare to student behavior defined in 2.

10. If behavior is not as defined: begin again at 1.; also reexamine outcomes subsystem.

11. If behavior is as defined: establish a periodic review of structural dynamics, beginning at 1.
CHAPTER THREE - ROLES IN A CURRICULUM DEVELOPMENT SYNERGYSTEM

In chapter two the major functional steps of a theoretical model for curriculum development were made explicit. The steps were functional because they resulted from analysis of the process using a function-based (analytic-synthetic) systems approach. The model was theoretical because it answered the questions of what should be done, and in a general way when it should be done, but the questions of who should do it, and exactly how it should be done were touched only briefly in the examples. These last two questions of roles for curriculum development and mechanisms for implementation will be the themes of chapters three and four respectively.

The place of roles in the fabrication of a curriculum development synergystem was introduced earlier, and illustrated in Figure 3. Roles were said to be combinations of acts governed by the practical constraints of man-machine organizations (e.g. a medical school). Acts were derived from detailed analysis of system functions as identified during systems analysis. Further, acts were said to be of three major types: technical work, communication and decision-making. In this chapter, then, system functions will be examined to identify the major acts that contribute to each one. Those acts will then be grouped into roles for curriculum development. In the next chapter attention will be given to the way a fully operational curriculum development synergystem might evolve.
ACTS WITHIN SUBSYSTEMS

It would be pointless to try to identify every individual act that contributes to curriculum development. Such an undertaking is not within the realm of this paper but even if it were, the best that could be hoped for would be one of a large number of possible listings. It seems more reasonable and useful, therefore, to identify only the major acts or activities that relate to curriculum development functions.

Each subsystem function is listed below as it appears in Chapter Two, and the major emphasis of each act is indicated in parentheses after the act description using (C) for communication acts, (Tw) for technical work acts, and (D-M) for decision-making acts.

Acts of the Philosophy Subsystem

Function 2 - Identify existing statements of philosophy and those areas of curriculum for which new or revised statements are needed.

a. Communication is received from other subsystems in the form of feedback. (C)

b. Existing documents are examined for available statements of philosophy. (Tw)

c. Feedback from other subsystems is evaluated to identify curriculum and learning areas requiring philosophical guidance. (Tw)

d. Existing statements and identified requirements are compared to determine new needs. (Tw, D-M)
e. Written statements of new needs are communicated within the subsystem for goal definition, constraint identification, development of alternative statements, and preparation of an output statement (Function 2, 3, 4 and 7 respectively).

(C)

Function 2 - Define the changes in curriculum (outcomes, structure) that are desired as a result of changes in philosophy.

a. Stated needs are received from Function 1. (C)

b. Possible changes in the curriculum that will reflect the needed philosophy changes are identified and recorded. (TW)

c. Those changes that can be expected to best reflect philosophy change and that can be used for assessment are selected. (D-M)

d. Goal descriptions are written and communicated to other subsystem functions (4, 7 and 9) for development of alternative philosophy statements, preparation of an output statement, and monitoring of statement effectiveness. (C)

Function 3 - Identify the value positions that constrain changes in philosophy (cultural, institutional, personal).

a. Cultural, institutional and personal value positions are identified by using existing documents as indicators as well as by performing specially designed studies. (TW, C)

b. Value positions that may constrain the new statement of philosophy under development are identified. (D-M)
c. Possible consequences of a philosophical stand that opposes each of the constraining value positions are determined. (TW)

d. Priorities are assigned to each value position on the basis of constraints. (D-M)

e. Constraints, consequences and priorities are communicated within the subsystem for development of alternative strategies and for preparation of the subsystem output statement. (C)

Function 4 - Develop alternative philosophical positions that are within constraints and meet needs.

a. Statements of need, desired curriculum changes and possibly constraining value positions are received from previous subsystem functions (1, 2, and 3 respectively). (C)

b. A statement of philosophy is written to meet the need; it is checked and revised to produce desired changes; it is studied with respect to value constraints and rewritten if a high priority constraint is violated. The process above is repeated until alternative statements have been written. (TW)

c. Drafted statements are critiqued and finalized. (D-M)

d. Alternative statements are retained within the subsystem for selection (Function 6). (C)
Function 5 - Define criteria for selecting among alternative positions.

  a. Existing statements of philosophy, future needs, the learner and learning, etc. are received from other subsystems such as administration and learning. \( (T\cup U) \)

  b. Criteria for selecting from among alternative philosophy statements are written using above information. \( (A \text{ standard set of such criteria could eventually be identified for direct use or adaptation in this function.}) \) \( (T\cup U) \)

  c. Priorities are assigned to the criteria based on the extent to which each is essential to a viable statement of philosophy. \( (D-M) \)

  d. Criterion statements are prepared and communicated for use in selection of alternatives (Function 6). \( (C) \)

Function 6 - Select philosophical position from alternatives on basis of criteria.

  a. Alternative statements are received from function 4 and criteria and priorities from 5. \( (C) \)

  b. Alternatives are compared point-by-point to criteria and the one that best conforms to high priority criteria is selected. \( (D-M) \)

  c. The selected statement with reasons for its selection are prepared for use in preparation of the subsystem output statement (Function 7). \( (C) \)
Function 7 - Prepare statements for use in other subsystems by adding sufficient explanatory information so that any role incumbent of the system can readily use it in further program development.

a. The identified need; desired changes; constraints, consequences and priorities; criteria; and selected statement are received from other subsystem functions (1, 2, 3, 5, 6 respectively). (C)

b. Definitions and explanations that will be useful for incumbents to understand the selected statement and the reasons for its choice are written. (TW)

c. Explanations of the need that stimulated a new statement of philosophy, the changes in curriculum that are desired, and the constraints, consequence, priorities and criteria that affected the statement's development are prepared. (TW)

d. All above material is formalized as subsystem output. (C)

Function 8 - Go to outcomes, structural dynamics and synergistic support subsystems.

a. Selected statement of philosophy with accompanying explanatory material is communicated to incumbents representing the outcomes, structural dynamics and synergistic support subsystems, as well as any other incumbents interested in the new philosophy. (C)
Function 9 - Monitor use of new or changed philosophical statements in other subsystems and compare to desired change specified in 2.

a. Feedback is received from outcomes, structural dynamics and synergistic support subsystems indicating the actual changes made as a result of the new statement of philosophy; desired changes are also received from function 2. (C)

b. Intended changes are compared with actual changes and discrepancies are noted. (TW)

c. If a discrepancy warranting adjustment exists, this is communicated to function 10 for formalization. (C)

d. If no important discrepancy is found, this is communicated to function 11. (C)

Function 10 - If changes do not correspond to those desired, begin again to determine if identified needs, desires and resulting statements are appropriate.

a. Specific findings from intended - actual comparison are formalized. (TW)

b. Discrepancies are communicated to the beginning of this subsystem. (C)

Function 11 - If changes do correspond to those desired, establish a schedule for periodic review of statements of philosophy, each time beginning at function 1.

a. A schedule for review of this philosophy statement is established. [Actually this new statement will most likely be included in a previously established cycle for review of all statements. Such review might be scheduled every
five years in addition to special studies that are required because of feedback to function 1. [TW]

b. A mechanism for assuring the review at the appropriate time is provided. (C)

Acts of the Synergistic Support Subsystem

Function 1 - Identify program needs for commitment, diffusion, and communication.

a. Feedback is received from other subsystems with regard to the function of existing synergistic support. (C)

b. Feedback is evaluated to determine needed changes. (TW)

c. New needs are also identified. (TW)

d. New needs and changes are examined together and program needs are identified. (TW)

e. A statement of program needs is written for use in goal definition, framework development, and preparation of output statement. (Functions 2, 4 and 7). (C)

Function 2 - Define the differences in the curriculum development and/or learning program that are expected to result from change in the synergistic support subsystem.

a. Stated needs are received from 1 above. (C)

b. Alternative statements of the changes that are expected in curriculum and learning as a result of subsystem function are written. (TW)

c. The alternatives that can be expected to best reflect the change and that can be used for assessment are selected
for incorporation into goals. (D-M)

d. Goal descriptions are written for use in developing a framework; formulating approaches, designing an operational mode, and monitoring operation effectiveness. (Functions 3, 4, 7 and 9). (C)

Function 3 - Develop framework for strategy formulation.

a. Information on which to base framework development is gathered from the disciplines of planned educational change, organizational psychology, interpersonal communication, and so forth. (C)

b. Alternative frameworks are synthesized from above information based on present need. (TW)

c. The best of the alternatives is chosen on the basis of its applicability for the situation. (D-M)

d. An explanation of the way the framework is intended to be used in formulating strategies and in synthesizing approaches (Function 4) is prepared. It is also used within the subsystem for implementing synergistic support (Function 8). (C)

Function 4 - Formulate alternative approaches for improving synergistic support to meet each of the identified needs.

a. Alternative strategies that will meet needs and produce desired changes are drafted using the above framework as a guide. (TW)

b. Alternative strategies are synthesized to form multi-strategy approaches. (TW)

c. Alternative approaches are refined. (TW)
d. The best approaches are chosen for further consideration. (D−m)

e. Chosen alternative approaches are prepared for communication to function 6 below. (C)

Function 5 - Identify characteristics of the program and incumbents that constrain selection of an approach to change.

a. Relevant context information is gathered from various existing college sources.

b. The above information is analyzed to determine potential constraints to synergistic support change. (TW)

c. The probable consequences of violating each constraint are estimated. (TW)

d. Constraints and consequences are brought together for review and refinement. (TW)

e. Priorities are assigned to each constraint on the basis of the seriousness of its consequences. (D−m)

f. A complete statement of constraints, consequences and priorities is prepared for use in selection of an alternative approach (Function 6). (C)

Function 6 - Select approach(es) best suited to meet synergistic support needs.

a. Alternative approaches and selection constraints are received from functions 4 and 5 above. (C)

b. An approach (or approaches) that best meets needs within constraints is selected by studying a series of trade-offs (compromises) in light of consequences and priorities. (D−m)
c. The approach(es) selected is recorded with the reasons for selection and is used in designing an implementation-mode (Function 7). (C)

Function 7 - Design operational mode for implementing the selected approach.

a. Identified synergistic support needs; desired changes (goals); framework and explanations; constraints, consequences and priorities; and selected approach(es) with reasons are all gathered for reference. (C)

b. Techniques that might be used for implementing the various strategies within an approach are identified. (TW)

c. The compatibility of each technique with given need, change, consequence, etc., is considered, and those that are incompatible are eliminated. (D-M)

d. An operational mode for implementing the selected approach(es) is designed using strategies and techniques. (TW)

e. The designed mode is stated formally for use in other subsystems. (C)

Function 8 - Implement strategies as designed.

a. Approach(es), strategies, and modes are communicated to the other subsystems for which they were designed to be implemented. (C)

Function 9 - Monitor each implemented strategy to determine the extent to which it affects desired changes defined in 2.

a. Other subsystems' activities are monitored to record changes
made as a result of the new synergistic support strategies. (C)

b. Actual change noted in a. above is compared to intended change identified in function 2. (TW)
c. If a discrepancy between actual and intended change that warrants adjustment exists, this fact is communicated to function 10 for formalization. (C)
d. If no important discrepancy is found, this is communicated to function 11. (C)

Function 10 - If changes are not evident, begin again at 1, and examine factors in other subsystems that might have blocked desired change.

a. Specific findings from intended-actual comparison are formalized. (TW)
b. Factors other than synergistic support deficiency are investigated. (TW)
c. Discrepancies and findings are communicated to the beginning of this subsystem for recycle. (C)

Function 11 - If changes are evident, establish a schedule for periodic review of synergistic support.

a. A schedule for review of new synergistic support strategies is established as part of a standing schedule for review of all subsystem elements. This review is in addition to special studies stimulated by new needs. (TW)
b. A mechanism for assuring the review at the appropriate time is provided. (C)
Acts of the Outcomes Subsystem

Function 1 - Identify potentially educable traits of current and future practitioners in light of stated philosophical positions.

a. Curriculum philosophy statements are received through the philosophy subsystem output function. (C)

b. A set of traits that are presumed to be desirable for present and future practitioners is established using faculty wisdom and intuition. (TW)

c. The literature is searched to identify previously identified relevant traits. (TW)

d. The initial set of traits is reviewed in light of curriculum philosophy, and areas requiring additional definition or clarification are identified.

e. Studies are performed to resolve traits that are unclear or disputed. (TW)

f. A statement of desirable traits is prepared for use within this subsystem for goal definition, and in structural dynamics as part of the curriculum output document. (C)

Function 2 - Identify new or changed traits that require outcomes in the curriculum.

a. Graduates of the curriculum are studied to determine the traits that they exhibit as practitioners. (TW)

b. Present students are studied to determine the traits that can be expected to result from their participation in the learning system. (TW)
c. Traits that were identified as being desirable in function 1, but not found exhibited in a or b above are identified as those for which new or changed outcomes should be prepared. (D-M)

d. Descriptions of the traits thus identified are communicated within the subsystem for knowledge, attitude and skill contributions, and outcome preparation and selection (Functions 2, 4, and 6). (C)

Function 3 - Identify teachable health science knowledge and skills that contribute to traits already identified.

a. The knowledge, attitudes, and cognitive and psychomotor skills from the various medical and extra-medical disciplines that are necessary for the required traits, are determined by thorough study of each trait. (TW)

b. The contributions identified above are reviewed for inclusiveness and exclusiveness using the best intuitive, experience, or researched data available. (TW)

c. Identified knowledge, attitudes, and cognitive and psychomotor skills are formalized for each needed trait to be used in writing outcome statements. (Function 4). (C)

Function 4 - Write alternative intended outcomes for each of the identified traits using appropriate knowledge and skill inputs.

a. Using the discipline areas identified in function 3, alternative overarching outcomes are written for each needed trait. (TW)
b. Alternative unit outcomes that contribute to each overarching outcome are identified. (TW)

c. Overarching and unit outcomes are critiqued and refined. (D-M)

d. All alternatives are prepared for selection in function 6. (C)

Function 5 - Define characteristics of a viable outcome.

a. Relevant information on 1) the learner and learning, and 2) the use of outcomes to write objectives is gathered from the learning system. (TW)

b. On the basis of the above information, criteria for selection among alternative outcomes are identified. (TW)

c. Priorities are assigned to the criteria based on the degree to which each criterion is essential for a relevant, useful outcome statement. (D-M)

d. The ranked criteria are formalized for use in selection of outcomes. (C)

Function 6 - Select outcomes that promise to produce graduates with appropriate traits and that have appropriate characteristics.

a. Descriptions of needed traits, alternative outcome statements and ranked selection criteria are received from function 2, 4 and 5 of this subsystem. (C)

b. Outcome statements are selected by identifying those that 1) promise to produce graduates with the needed traits, 2) conform best to highest priority selection criteria, and 3) do not overlap, or duplicate one another. (D-M)
c. Selected statements are formalized along with the reasons for their selection. (Tw)

Function 7 - Interact with structural dynamics subsystem to be sure that outcomes are compatible with framework.

a. Outcomes and reasons for their selection as well as interactive input from structural dynamics are received. (C)

b. Selected outcomes are tested for fit with framework. (D-M)

c. Outcomes or framework are reworked as necessary for compatibility. (Tw)

d. Compatible outcomes are prepared for inclusion in the curriculum output statement (Function 9). (C)

Function 8 - Merge with structural dynamics for structured set of selected intended learning outcomes.

a. New or changed statements of outcome, the new structural framework into which they fit, and the existing formalized curriculum are brought together. (C)

b. New curriculum elements are described showing final placement of new or changed outcomes with respect to new or changed framework. (Tw)

c. Statements are written to show relationship of new curriculum elements to existing structured outcome (curriculum). (Tw)

d. The changed curriculum is given final approval before implementation. (D-M)

e. Outcomes subsystem output (b and c above) is communicated to structural dynamics function 9 for inclusion in the curriculum development system output. (C)
Function 9 - Monitor use of outcomes in learning system, and compare changed traits to those identified in 2.

a. Learning system feedback is received and analyzed for indications of changed traits resulting from changed outcomes. (TW)

b. Actual traits found in learning are compared to those intended as identified in function 2 of this subsystem, and discrepancies are noted. (TW)

c. If a discrepancy between actual and intended change that warrants adjustment is found, this fact is communicated to function 10 for formalization. (C)

d. If no important discrepancy is found, this is communicated to function 11. (C)

Function 10 - If changes are not representative of those sought, begin again at 1, noting specific trait discrepancies and modifying outcomes.

a. Specific findings from intended-actual comparison are formalized. (TW)

b. Factors other than outcome deficiencies are investigated. (TW)

c. Discrepancies and findings are communicated to the beginning of this subsystem for recycle. (C)

Function 11 - If changes are representative establish a schedule for periodic review of desired traits and the outcomes designed to attain them.

a. A schedule for review of new outcomes is established as part of a standing schedule for review of all subsystem elements.
This review is in addition to special studies stimulated by new needs. (T\&W)

b. A mechanism for assuring the review at the appropriate time is provided. (C)

Acts of the Structural Dynamics Subsystem

Function 1 - Identify areas of need for grouping, sequencing and/or integrating outcomes.

a. Information from the outcomes subsystem regarding new or revised outcomes for which a change in structure is required, and information regarding problems of existing structure as reflected in the learning system are received.

b. New or revised outcomes are examined in light of existing structural framework to determine needs for new framework elements. (T\&W)

c. Feedback from the learning system is evaluated to determine areas of need for a changed structure to facilitate learning. (T\&W)

d. Need statements are communicated for use in goal definition, framework identification and system output specification. (Functions 2, 4, and 8). (C)

Function 2 - Define student behaviors that will be considered evidence of improved curriculum structure.

a. As many possible changes in student behavior as can be identified to show need fulfillment are listed. (T\&W)
b. A few of the listed changes are selected as those will best represent a structure change, and become subsystem goals. (D-M)

c. Goals are communicated for use in constraint identification, framework identification, system output specification, and monitoring of structure effectiveness. (Functions 3, 4, 8 and 9). (C)

Function 3 - Identify assumptions about the learner and the learning process, and about the organization of knowledge that constrain the development of alternative structures.

a. Existing assumptions about the learner and learning are received from the learning system and information about outcomes to be structured is received from the outcomes subsystem. (C)

b. Assumptions about the organization of knowledge and the disciplines, that are held by members of the faculty and medical educators at other institutions, are identified. (Tw)

c. Constraints for the development of curriculum structure are identified by synthesizing the three groups of assumptions identified above. (Tw)

d. Priorities are assigned to constraints so that the highest priority are those deemed most essential to learning. (D-M)

e. Constraints and priorities are formalized for framework identification and system output (Functions 4 and 8). (C)
Function 4 - Define alternative frameworks for curriculum organization that meet needs and incorporate principles.

a. Approaches to organization that have been successfully used by other institutions are examined and modified as necessary to conform to constraints. (TW)

b. New or changed frameworks are devised based on given assumptions and constraints and designed to meet new needs. (TW)

c. A third type of alternative framework is developed by synthesizing aspects of a and b above. (Tw)

d. Alternative frameworks and explanatory material are prepared for selection (Function 6). (C)

Function 5 - Identify criteria for selection among alternatives.

a. Criteria for selection among alternative frameworks are defined from interpretation of philosophy statements and by analysis of relevant real-world restrictions. (TW)

b. Priorities are assigned to criteria based on the extent to which they can be altered or ignored without serious consequence (low priority). (D-M)

c. Statements of criteria and their priorities are prepared for selection and to become part of the system output (Functions 6 and 8). (C)

Function 6 - Select framework for grouping, sequencing and/or integrating outcomes from alternatives.

a. Alternative frameworks are measured against criteria to identify high- and low-priority aspects. (TW)
b. Trade-offs among the most likely possibilities are considered until a decision selecting the most desirable framework is reached. (D-M)

c. The framework and reasons for its selection are formalized for integration of outcomes in function 7. (C)

Function 7 - Interact with outcomes subsystem to assure compatibility of outcomes with framework.

a. Frameworks and reasons for their selection as well as interactive input from the outcome subsystem are received. (C)

b. Selected outcomes are tested for fit with selected framework. (D-M)

c. Outcomes or framework are reworked as necessary for compatibility. (TW)

d. New curriculum elements are described showing final placement of new or changed outcomes with respect to new or changed framework. (TW)

e. Statements are written to show relationship of new curriculum elements to existing curriculum. (TW)

f. The changed curriculum is given final approval before implementation. (D-M)

g. Structural dynamics subsystem output (d and e above) is communicated to function 8 for inclusion in the curriculum development system output. (C)
Function 9 - Communicate curriculum as output to learning system for implementation.

a. The following subsystem products are gathered: needs, goals, assumptions, constraints, criteria, priorities, framework and curriculum from structural dynamics; needs, goals, criteria, priorities and outcomes from the outcomes subsystem. (C)

b. A statement of the revised curriculum and appropriate explanation is prepared for communication to learning system incumbents and others affected by the change as the curriculum development system output. (C)

Function 9 - Monitor use of curriculum through feedback from the learning system; compare to student behavior defined in function 2.

a. Feedback from the learning system is analyzed to determine what actual changes resulted from the changed curriculum structure. (TW)

b. Actual changes found in learning are compared to those intended as identified in function 2 of this subsystem, and discrepancies are noted. (TW)

c. If a discrepancy between actual and intended change that warrants adjustment is found, this fact is communicated to function 10 for formalization. (C)

d. If no important discrepancy is found, this is communicated to function 11. (C)
Function 10 - If behavior is not as defined, begin again at 1; also reexamine outcomes subsystem.

a. Specific findings from intended-actual comparison are formalized. (TW)
b. Factors other than structural dynamics deficiencies are investigated (e.g. outcomes). (TW)
c. Discrepancies and findings are communicated to the beginning of this subsystem for recycle. (C)

Function 11 - If behavior is as defined, establish a periodic review of structural dynamics, beginning at 1.

a. A schedule for review of the new framework is established as part of a standing schedule for review of all subsystem elements. This review is in addition to special studies stimulated by new needs. (TW)
b. A mechanism for assuring the review at the appropriate time is provided. (C)

ROLES FOR CURRICULUM DEVELOPMENT

The acts of curriculum development must be accomplished by individuals and by individuals working together in groups. As Taba explains:

Curriculum work requires integration of many competencies not usually found in one person. Therefore, planned teamwork, in which each individual concentrates on his own task but also in which a range of needed competencies is combined in such a manner that they can support and supplement each other, is one essential requirement for productivity. (p. 472)
Roles, then, may be assigned to an individual or to a group. Generally, groups are most effective for decision-making in curriculum development, whereas individuals should be given the responsibility for most technical work. Communication can be effected by individuals and by groups through their members.

The assertion that groups should be given primary decision-making responsibilities bears further attention. It is based on the premise that successful curriculum development activities depend on full representation and support of faculty, student and administration incumbents. Fisher made the point well in an address to the National Symposium on Dental Curriculum (1969):

 Individual faculty and students must know and believe that their ideas on teaching and learning can get to a forum where they will be given serious consideration and accepted or rejected or modified on a rational basis.

If decisions are made by a group of peers with adequate public airing and if the rationales for the decision is made explicit, reasonable men are quick to accept the conclusion and support it.

For the same reason, communication is mentioned by many writers as an essential role of curriculum committees and individuals involved in curriculum development. Speaking to the same dental symposium about curriculum development activities at the University of Oregon Dental School, Sruckner said:

 A third general principle concerns communication. We have already noted that the faculty has reasonably easy access to the dean. It is important that they also be in contact with the study and planning groups...For a number of months the Task Forces were involved in serious discussions concerning the question of how and where to start...Most faculty members seemed to accept these necessarily somewhat cloistered preliminaries with equanimity. A few, however, gave vent to their
anxieties...These apprehensions were relieved considerably when the Task Forces and especially the Curriculum Councils began to deal with individual departments...This interaction [did] not leave every faculty member happy with the outcome but it...[did relieve] unnecessary anxieties based on uncertain information or speculation.

Fisher in the previously cited address gave additional emphasis to the communication function of curriculum committees, whose purpose he said should be to formulate educational policy:

Any curricular plan is put into effect only to the degree that it is accepted by the general faculty and student body, understood by them in operational terms, and within their capacity or range of abilities. If the faculty and students of a school do not support an idea--old or new--it can never be declared alive or even real in that environment. If we accept that premise, the essential tasks for the curriculum committee are (1) to keep communication channels to and from the faculty and students wide open; (2) to make certain that ideas of evident quality flow back and forth through those channels. (p. 3)

Assuming that communication is a major function of all curriculum development role incumbents, and assuming that groups are generally appropriate decision-making bodies, while individuals are most effective for accomplishing technical work, some types of role incumbents and corresponding classes of acts can be identified.

The acts identified as having the major emphasis for each type of incumbent are listed first, followed by less central act classes:
With these classes of incumbents in mind, it is possible to look again at the four curriculum development subsystems to identify the major roles required for each and the kind of incumbents that might be expected to participate. A numbered paragraph will be devoted to the ways specific roles are carried out in each function. Finally, the general role types within each of the incumbent categories will be discussed. It may be useful to refer to the summary flow charts at the end of the chapter for continuity.

Roles in the Philosophy Subsystem

1. Feedback from other subsystems indicating the effectiveness or ineffectiveness of philosophy as it is applied to the development of outcomes, the formulation of a structural framework, or the
implementation of synergistic support, is gathered and organized by staff educational specialists. They must be able to recognize and put into perspective elements of subsystem operation that are inconsistent with, or do not reflect sufficient grounding in established philosophy. Assuming that the identified inconsistency is at a team level (e.g., a particular unit outcome), the curriculum council chairman and the team leader are notified and the team leader quickly examines existing documents to find related statements of philosophy. Any existing statements are then presented to the team as a group along with the requirements earlier identified, and the group determines the nature of the new need after consideration of both elements. The decision thus made is formalized by the team leader and written need statements are transmitted to the team members including educational specialists.

2. Having received need statements, individual team members and educational specialists study the context of the need and write down several changes in curriculum that they feel will show that a change in philosophy has, indeed, met the need. These changes will become the goal of the philosophy subsystem. The educators pay particular attention to formulating goals in such a way that they can be tested. The team then meets as a group and decides which of the alternative goals can be expected to best reflect the needed change in philosophy and at the same time can be used as criteria to assess the latter. Again the team's decisions are recorded by the team leader, this time in the form of subsystem goal statements: descriptions of expected curriculum changes.
3. The major value inputs to the subsystem are received through carefully designed studies carried out by staff educational specialists. Sanazaro (1967) has suggested possible approaches for gathering these data. An up-to-date record of pertinent value positions should be maintained so that as soon as the need for a changed statement of philosophy is identified the team can meet as a group and determine which known value positions may constrain the needed change. Individual team members, administrators and educational specialists then study various professional, fiscal, sociologic and other consequences that might result from adoption of a philosophical position not in concert with those constraining value positions. The team meeting again as a group must then review all anticipated constraints and assign priorities to each of the constraints based on the degree to which the consequences impair the educational program (high priority). In some cases it will not be necessary to violate any major value positions, but most significant changes require at least compromise of the values of some incumbents or members of the system environment. A detailed statement of constraints, consequences and priorities is prepared as a working paper for further subsystem function and as a record of the value position taken.

4. At this point the team leader has a statement of need, descriptions of expected curriculum changes, and a record of constraints, consequences and priorities, and is able to begin writing possible alternative statements of philosophy. He drafts statements that meet the need and continually examines and rewrites them to conform to the desired change and high priority constraints. The role
of drafting the initial set of alternatives is given to the team leader because of his familiarity with all aspects of previous subsystem function and because an individual rather than a number of individuals can work most effectively (logically and inclusively) with this kind of synthesis function. Drafted alternatives are then critiqued by the team as a group and by educational specialists to add any additional perspective, and finalized in writing by the team leader.

5. Existent institutional statements of philosophy—including position statements relating to expectations for the future of medical education, the learner and learning, the role of the physician in health care, and so forth—are made available to team members for review through a staff educator who keeps updated records of all such positions whether they are explicit or implied in institution documents and actions. Before a team meeting, each team member and involved educational specialist defines criteria for selecting among alternative statements of philosophy. At the meeting the criteria are further discussed and some are chosen. It is also possible and desirable for a standard set of criteria to be designed and regularly up-dated to avoid frequent repetition of the design process. In either case, after relevant criteria have been identified, they are ranked so that those that are most essential for a representative and useful statement of philosophy are highest priority.

6. Having ranked criteria for selection of a statement of philosophy, the team group compares the alternative statements to the criteria and selects the one that most adequately meets the need
while conforming to the high priority criteria. During the selection process, the committee's reasons for eliminating some statements and selecting one should be carefully recorded, and later communicated through the team leader to an educational specialist. The Council on Education then reviews the team's selection and reasons and assures final coordination of the statement with existing curriculum and philosophy. Approval of the faculty at large is obtained before final transmittal to other curriculum development subsystems.

7. The team leader and an educational specialist now bring together the statement of philosophy selected above, the statement of need and descriptions of expected changes, as well as constraints, consequences, priorities and criteria from other subsystem functions. Working together they first write definitions and explanations of the selected statement and its elements. In addition they prepare summary explanations of the identified need and the desired change that prompted the new statement. The constraints, consequences, priorities and criteria that affected development of the new statement are also described with the intent of facilitating optimal carry-over of the philosophy to other subsystems.

8. The team leader then distributes the new or changed statement of philosophy accompanied by explanatory materials to all involved incumbents including faculty, students, administration and others, using the Council on Education to communicate with most incumbents through their representatives. Most important, he assures communication with the synergistic support, outcomes and structural dynamics subsystems by making the change a part of the standing
records kept by staff educators.

9. Educational specialists are responsible for monitoring and collecting feedback data from the other subsystems in which philosophy is used. By means of more or less formal research designs, the feedback showing actual changes in subsystem process or product is compared to the desired changes identified in function 2. In very informal designs the comparison itself might be done rather intuitively by the team group.

10. In any case, if the group decides that there is sufficient reason to believe that the changed philosophy has not resulted in the desired changes, this decision and the reasons for it are recorded by the team leader and the subsystem process is begun again at 1.

11. Even if the changed philosophy seems to be fulfilling the goals set for it, a schedule is established to assure its periodic review and renewal if necessary. The team leader makes the new statement part of his cyclical program for restudying philosophy statements that relate to the team. He is helped by the educational specialist to arrive at a schedule that will limit unnecessary review, but assure a vital program. Scheduled reviews are less frequent if feedback frequently signals the need for revision.

Roles in the Synergistic Support Subsystem

1. Monitoring of the level of commitment, and the effectiveness of diffusion and communication in the operation of the other subsystems is accomplished by educational specialists. That information along with specific feedback indicating new synergistic support needs are
combined and program needs for synergistic support are identified by a designated group of educational specialists and faculty curriculum leaders who have major responsibility for the function of this subsystem. Need statements are then formalized by the group leader (an educator) and redistributed to the group.

2. Working from the need statements, each member of the synergistic support group studies the needs in relation to curriculum and learning, and records changes that might be expected to reflect the needed change in synergistic support. The group then decides which goal statements best reflect the needed change and at the same time provide good criteria for assessment of subsystem function. Group decisions are recorded by the group leader in the form of descriptions of expected curriculum and/or learning changes.

3. The group leader and/or assigned group members work with their colleagues in education and psychology, and draw on their own expertise to identify known approaches to strategy formulation. They then synthesize new frameworks or guidelines to be used later for the identification diffusion, commitment or communication strategies and for the combination of strategies into approaches for the solution of synergistic support problems. If several viable frameworks are thus identified, the group decides on the one that is most likely to be useful for the situation at hand. The initiator of the chosen framework then writes a thorough explanation of the framework and how it is intended to be used.
4. The group leader now has a need statement, a description of the changes that are desired as a result of the synergistic support effort, and a framework or guidelines for formulation of strategies. These documents are distributed to all group members, who individually write down specific strategies that might be used to meet the need. Combining various strategies, they formulate multi-strategy approaches, all of which are submitted to the group for refinement. Two or more alternative approaches that can be expected to meet the need and are based on the determined framework are then chosen for the further scrutiny of selection constraints.

5. Selection constraints are based on a knowledge of the context in which the change will take place. The group leader, therefore, gathers all available data that is likely to be relevant to selection of an approach to synergistic support. This includes known value positions of incumbents on the issue in question as available from the philosophy subsystem. Also involved are established characteristics of the institutional environment.

Group members are assigned to analyze each context area to determine the specific value positions, vested interests, patterns of administrative responsibility, levels of fiscal support and so forth that will constrain each strategy and each approach. Simultaneously, the consequences of violating each constraint are estimated by the group member.

The group then reviews and adjusts the identified constraints and consequences from their collective knowledge, and assigns a priority to each constraint so that highest priorities are given to
those constraints whose violation would result in the most serious consequences. These decisions having been made the group leader puts in writing the identified constraints, the anticipated consequences of their violation and their priority.

6. The group can now meet with the alternative approaches and selection constraints in front of them to decide on the best approach for meeting the given need within the known context. This is not likely to be a clear cut comparison of approaches and constraints, with one approach meeting all high priority constraints. It will probably involve the examination of a series of trade-offs or compromises before a final decision can be made. When made, the decision and the reasons for it are recorded by the group leader.

7. The design of modes for implementing the strategies that comprise the selected approach to change in synergistic support is primarily the responsibility of a staff educational specialist, still under the direction of the group leader. He works from the need, the desired change, the framework and explanation of its development, the selection constraints, consequences and priorities and from the selected approach and reasons for its selection. He, with other educators, first identifies techniques that might be used to implement each strategy, then eliminates any techniques that are incompatible with the problem to be solved or the context. Using viable techniques, a design for implementation is formulated and refined through interaction of the group members. It is then made final by the group leader in a form that clearly communicates its goal, and procedure for its implementation.
8. Because the implementation of synergistic support will usually be initiated in a subsystem by a participating educational specialist, the group leader communicates the decisions for changed synergistic support to the educators who perform this task in each of the target subsystems.

9. As in the philosophy subsystem, educational specialists are responsible for monitoring and collecting feedback data from the other subsystems to which synergistic support strategies are applied. More or less formal research shows actual changes in each subsystem as compared to the changes identified as synergistic support goals. Sometimes this may amount to an intuitive assessment of the effect of synergistic support by those most closely involved. Ultimately the decision to take further action on the basis of feedback rests with the synergistic support group.

10. If the group decides that there is sufficient reason to believe that the synergistic support approach chosen has not resulted in the desired changes, their decision and the reasons for it are recorded by the group leader and the subsystem process is begun again at 1.

11. If the group decides that the new approach is fulfilling its goals, they establish a schedule for its periodic review and revision as necessary. This becomes part of the standing schedule for review of synergistic support that is maintained by the group leader, and does not replace reviews prompted by feedback input to 1.
Roles in the Outcomes Subsystem

1. Intended learning outcomes in the curriculum are based on those traits identified as being desirable for present and future practitioners. The Council on Education is responsible for establishing and updating a list of desired traits. The most effective way to initially identify traits is to take advantage of the background and foresight of faculty. The Council on Education, therefore, assigns areas of professional practice to groups of faculty members, who record the traits that they consider essential to that arena whether unique or shared with other types of practice. This initial group consensus is then reviewed by the Council in light of the institution's educational philosophy as well as any available studies of needed traits. If any major class of traits is shown to be missing, the faculty group is asked to consider that class and add it to their recommendations. If any class is disputed or needs further definition, appropriate studies are performed. The Council then studies all recommendations and votes to approve those that it considers valid for the education program. Approved statements of desired traits are then prepared by the Council chairman for further subsystem use.

2. Knowing what traits are considered desirable, it is next necessary to determine the extent to which the traits are being inculcated. A study by staff educators of the traits exhibited by graduates is of limited usefulness unless it can be done over a period of time. A less direct, but more useful approach is to analyze the kinds of experiences available to students in the learning system and make inferences based on educational theory and experience.
regarding the relationship of experiences and traits. This analysis-inference process is performed by educational specialists in cooperation with the Council chairman. Comparison of desired traits and presently inculcated traits reveals those traits for which new outcomes statements must be prepared. Descriptions of these traits are prepared by the chairman and approved by the Council for further subsystem use.

3. It is next necessary to study the needed traits and determine the general contributions to each from the various scholarly disciplines. This task is assigned to those Council numbers whose disciplines are closely related to the kinds of traits in question. Educators provide guidelines for the study as well as frequent consultation. Knowledge, attitudes and cognitive and psychomotor skill areas that contribute to each trait are thus identified. They are reviewed, approved, and formalized for use in the development of outcome statements by the Council chairman.

4. With statements of desired traits available as well as guidelines indicating the content areas that contribute to the learning of those traits, the involved Council members write alternative statements of learning outcomes. Such statements will, when tested, show them that a particular student can be expected to exhibit the desired trait when he becomes a practitioner. Outcomes at this level have been identified earlier as overarching outcomes. These are then recorded by the chairman and made available for analysis into unit outcomes. Alternative unit outcomes are developed in much the same way, using overarching outcomes as guides. However, they are
developed by team members and recorded for use by the team leader. The team being analogous in the process to the Council and the team leader to the chairman. From this point on both levels of outcomes are carried through the subsystem. For clarity, only unit level outcomes will be discussed here to correlate with the example developed in Chapter Two.

5. Staff education specialists define characteristics of viable outcome that can be used as criteria for outcome selection. The major inputs to this function are assumptions about the learner and learning, and procedures used in the learning system to develop objectives from outcomes. Educators with responsibilities for learning program development, curriculum development and assessment work together to define characteristics that are compatible within all three perspectives. These characteristics become criteria for selecting a good outcome statement, and are assigned priorities. The highest priority characteristics are considered most essential to a good outcome. Ranking is done by the group, and formalization of criteria and priorities is done by the curriculum developer as group leader.

6. The team leader brings together descriptions of the needed traits, alternative outcomes, and ranked selection criteria. The team then assembles to select the outcomes that 1) promise to produce graduates with needed traits, 2) conform most closely to highest priority criteria, and 3) do not significantly overlap one another. It is then the team leader's responsibility to summarize the team's
deliberations, showing the reasons for each selection and rejection. He retains these for further team use and also communicates them to the Council on Education chairman for coordination with the structural dynamics subsystem.

7. The team leader and Council chairman maintain close contact regarding the relationship of outcome development and structural dynamics development throughout the course of both processes. At this point, however, a final check and revisions can be made to assure compatibility of the two. This function can be accomplished by the leaders for the most part. However, approval for more than minor changes should be obtained from the constituent groups. Outcomes are now in final form for inclusion in the curriculum.

8. The Council chairman fits the new outcomes either into a new structural framework designed for them in the structural dynamics subsystem, or into the existing curriculum and gives it final approval for implementation. The team leader prepared all the materials necessary to communicate the change in outcomes to those that implement the curriculum, and forwards them to the Council chairman for inclusion in a general communication as described under structural dynamics function eight.

9. Educational specialists are responsible for monitoring and collecting feedback data from the learning system to assess the new outcomes. Informal and formal research shows actual changes in traits or potential traits as compared to the changes identified as outcome subsystem goals. The decision to take further action on the basis of
feedback rests with the team for unit outcomes and with the Council on Education for overarching outcomes.

10. If the team decides that there is sufficient evidence that the chosen outcomes have not produced or do not promise to produce the needed traits, then their decision and the reasons for it are recorded by the team leader, and the subsystem process is begun again at 1. (Identification of program needs).

11. If the team decides that the new outcomes are fulfilling their goals, they establish a schedule for their periodic review and revision. This becomes part of the standing schedule for review of outcomes that is maintained by the group leader, and does not replace reviews prompted by feedback input to 1.

Roles in the Structural Dynamics Subsystem

1. The Council on Education has the major responsibility for structural dynamics, because primary organizational patterns pertain to the curriculum as a whole rather than to any individual team or unit. Needs for a new or revised structural framework or framework elements are identified by educational specialists who continually compare needs for new outcomes (identified early in outcomes subsystem function) to the existing framework. Other education staff members evaluate certain types of feedback from the learning system and infer needed changes in structural dynamics. Identified areas of need are communicated as recommendations to the Council on Education through the chairman.
2. Individual Council members, now aware of the areas where change is needed, study the needs and describe changes in student learning behavior that they conclude will be evidence of need fulfillment. The Council, meeting as a group then decides which of these goal statements will be used to assess subsystem effectiveness. The chairman records the descriptions of expected learning changes for use throughout subsequent subsystem functions.

3. Information regarding assumptions about the learner and learning and about the structure of knowledge may be at least partially available from previous deliberations through records kept by staff educators. Additional information as requested by the Council on Education is gathered and presented by individual Council members and/or by educators. Consultants from outside the institution are also a helpful source of such information. Finally, personal interaction of the chairman with team leaders involved in outcome development provides a needed source for coordination of the outcomes and structural dynamics subsystems. All the assumptions mentioned above are presented to the Council, which identifies the constraints they place on the development of the needed curriculum structure, and assigns priorities to the constraints.

4. At this point each Council member has statements of need, subsystem goals and constraints. The chairman asks each member to modify a successful organizational approach used elsewhere, or to devise an entirely new framework based on the assumptions and constraints and designed to meet the new needs. Additional alternatives for framework design are derived from a group discussion of the
individually prepared plans. The chairman records all proposals for later selection.

5. Criteria for selection among structural dynamics alternatives are based on value positions recorded in the philosophy subsystem and upon real world restrictions. Council members are asked to identify as many restricting factors as possible relevant to the organizational change in question. These are pooled and synthesized at a group meeting and members are then asked to define as many selection criteria as possible before the following meeting. At the next meeting the group decides on a limited number of criteria after reading and synthesizing those presented, and assigns priorities to the selected criteria. High priority criteria are those that are difficult to change or ignore. The Council Chairman records criteria and priorities.

6. An initial examination of all alternative frameworks by the Council chairman yields a point by point analysis of how each conforms or does not conform to the high priority criteria. With this groundwork layed, the Council meets to consider the merits of each alternative and the trade-offs necessary to accept one over another. Finally, a framework is selected and is recorded along with the reasons for its selection.

7. Because the team leaders that prepare outcomes maintain close contact with the Council chairman regarding the relationship of outcome development and structural dynamics development, coordination of the two subsystems should be maintained. However, a final check is
made at this point to be sure that the two are compatible, and final outcomes are communicated to the chairman for inclusion in either the new structural framework or into the existing curriculum framework. The Council then reviews the changed curriculum approves it for implementation, and, if the change is of major proportion, votes to forward it to the general faculty for final approval. After faculty approval the chairman prepares a complete set of structural dynamics materials for function eight.

8. A staff educator takes the following materials and prepares a concise communication to incumbents in the learning system as well as other incumbents that will be affected by the changed curriculum: needs, goals, assumptions, constraints, criteria, priorities, framework and curriculum from structural dynamics; needs, goals, criteria, priorities, and outcomes from the outcomes subsystem.

9. Educational specialists are responsible for monitoring and collecting feedback data from the learning system to assess the new framework. Informal and formal research shows actual changes in learning as compared to the intended changes identified as structural dynamics subsystem goals. The decision to take further action on the basis of feedback rests with the Council.

10. If the Council decides that there is sufficient reason to believe that the framework chosen has not produced the expected learning changes, their decision and the reasons for it are recorded by the chairman, and the process is begun again at function 1 of this subsystem.
11. If the Council decides that the new framework does fulfill subsystem goals, they establish a schedule for its periodic review and revision. This becomes part of the standing schedule for review of outcomes that is maintained by the group leader, and does not replace reviews prompted by feedback input to 1.

**Role Types for Curriculum Development**

Curriculum development as defined earlier acts as an interface between culture and the learner. Its object is to identify and organize elements of the culture in such a way that learning effectiveness is maximized to reach cultural and institutional goals.

Curriculum development, then, plays what change theorists call a linking role between the culture (including non-medical disciplines) and institutionalized medical education. Taking this perspective, we can identify a number of role types that one might expect to find represented in a curriculum development synergystem.

Havelock (1969) identifies nine types of linking roles for dissemination and translation of knowledge. The **conveyor** is a role involving simple transmission of knowledge or culture from its source to those who use it (e.g. the drug detail man). The **consultant** assists in a specific task, bringing unavailable expertise to an organization and participating actively in the identification and solution of problems. The **trainer** is one who transfers knowledge like the conveyor, but he works in a formalized setting (e.g. medical school) that is unlike the conveyor's real world arena.

The **leader** has influence over the use of knowledge 1) due to his formally established position (e.g. dean, chairman, team leader),
2) due to his status as a channel through which information passes for interpretation (i.e. gatekeeper), or 3) due to his role as an opinion leader, to whom others look for reliable information. The innovator is one who is regularly the first to adopt new ideas in a social system. His role is to begin the diffusion process for new ideas. The defender calls problems, pitfalls, value inconsistencies, and so forth to the attention of an innovative system, thus providing useful practical input and helping the system avoid serious mistakes.

The knowledge builder (i.e. subject matter researcher, and applied researcher) is also a link between theory and practice because he integrates new knowledge into existing patterns, helps define future developments that will affect the educational program, and designs new ways for applying theory to practice. The practitioner (teacher, physician) is also a linker when he reflects some new knowledge in his public application of that knowledge.

Finally, the user (student, patient) may be his own linker in some instances, but as Havelock points out: "FOR THE FORESEEABLE FUTURE ALL FIELDS OF KNOWLEDGE WILL REQUIRE THE INSTALLATION AND SUPPORT OF A VARIETY OF LINKING ROLES IF EFFECTIVE UTILIZATION IS TO BE REALIZED." (1968, p. 90) The reader is directed to Havelock for a complete discussion of linking roles and an extensive bibliography.

Before identifying role types for the curriculum development incumbents cited earlier, some generalizations can be made about the incumbent classes. The analogy between the team working as a group and the Council on Education was mentioned in discussion of the outcomes subsystem, and can be carried further to reduce incumbent
classes from the ten on page 123 to five, as shown below:

<table>
<thead>
<tr>
<th>Team members working separately</th>
<th>Group members of all types working separately</th>
</tr>
</thead>
<tbody>
<tr>
<td>Council on Education members working separately</td>
<td></td>
</tr>
<tr>
<td>Individual administrators</td>
<td></td>
</tr>
<tr>
<td>Staff educational specialists</td>
<td></td>
</tr>
<tr>
<td>Team working as a group</td>
<td>Groups working collectively</td>
</tr>
<tr>
<td>Council on Education</td>
<td></td>
</tr>
<tr>
<td>Team leader</td>
<td>Group leaders</td>
</tr>
<tr>
<td>Council chairman</td>
<td></td>
</tr>
<tr>
<td>Outside Specialists</td>
<td>same</td>
</tr>
<tr>
<td>Students, Faculty, Administrators working independently of groups</td>
<td>same</td>
</tr>
</tbody>
</table>

**Group Members Working Separately**

The membership of groups, teams or committees should be representative of the designers and users of the product for which the group is responsible. For this reason every medical school curriculum development group should include students, faculty, administrators and educational specialists in its membership. The proportion of each will vary with the group's function.

One major function of all group members is communication with colleagues. This constitutes a *conveyor* role, but in two directions: information about curriculum development progress is conveyed to colleagues, and opinion, attitudes, research findings and so forth are carried back to the group. The educational specialists who are group members must act as *change agents* for curriculum development by providing instant services for problem identification, resource linking, and facilitation of all development processes.
It is expected that each group member will act to some extent as a trainer. That is, he will participate in formal programs such as workshops by sharing knowledge and experience in the areas of curriculum development that most interest him. A faculty member or student acting in this capacity is often more effective than a trainer brought to the program from outside. Group members may also be opinion leaders, in fact, it is advantageous to select some opinion leaders for membership in every group. This adds credibility to the group's work and increases the input to the group through its members. Group membership should include innovators, and defenders. When the members are asked to study a situation and develop recommendations for change these role types will tend to represent the opposite ends of the change-no change spectrum.

Perhaps the most important role for group members is that of knowledge builders. Faculty as knowledge builders represent their forte of medical science and provide a continually up-dated picture of the science to be integrated into the curriculum. They also provide insight into future developments and curriculum needs. Educational specialists represent their own "science" in a similar way except that theirs is largely applied to curriculum development rather than integrated into the curriculum.

The Group Working Collectively

The major role of the group working collectively is not a linking role, but one of decision-making. The reason for this was mentioned earlier (pp. 120-123), and it became quite apparent throughout the discussion of roles by subsystems. Two additional roles arise as the
result of the kind of decisions made by the group. That is, the group may play the role of an innovator or defender. This is particularly true of teams where one in a series of parallel teams (e.g. an organ system team) might be characterized by particularly innovative decisions and therefore innovative educational programs. Examples set by that team might be followed by others, and it might, in time, become an opinion leader. This fact is important to the educator acting as change agent, for each group can be developed as an innovator in a special area of interest.

The Group Leader

The group leader functions like a group member much of the time, however, he plays some special roles that will be considered here. The role of conveyor is crucial for the group leader. This is apparent in the subsystem role descriptions where it is the group leader who prepares all group materials for transmittal and who is responsible for the continuity of functions throughout the subsystem. He, more than other group members excepting the educational specialists, acts as a change agent. He assists group members with any problem, identifies source materials, and in every way possible facilitates all functions and roles for which he and his group have responsibility. He is certainly a leader by organization and a gatekeeper as well, because all formalized statements of group action pass through his "sieve" and reflect his orientation. However, within the medical school context his formal leadership roles are probably not nearly as important as the opinion leadership he has within his group and within the group of leaders.
Outside Specialists

The term "outside specialists" as used here includes a wide variety of authorities from education, medicine, government, industry, consumer groups and academia. Specialists may act as conveyors of information from outside the medical school, as consultants on the process of changing the curriculum or the curriculum development process, or as trainers in a concentrated workshop setting for the implementation of some aspect of curriculum development. One notable example of the use of outside specialists pertains to function four of the structural dynamics subsystem, which involves the identification of alternative frameworks. Existing approaches usually provide a good starting place, and to get the real flavor of an approach it is often necessary to talk directly to someone involved in its development. A dean for academic affairs, curriculum committee chairman, or heavily involved educational specialist can play the role. Generally the first is primarily a conveyor and the last primarily a consultant or trainer, but the second is capable of taking all three roles.

Students, Faculty and Administrators Working Independently of Groups

Although it might be theoretically ideal for the system for all incumbents to work through their representatives on the various groups, there are always some who make independent input to group leaders, administrators, educational specialists or others out of the context of group functions. Whereas groups and individuals working within a dynamic system tend to play innovator roles, individuals working outside the system tend to play defender roles. (With a relatively static
system independent actors tend to be innovators.)

It is important for change agents and others within the system to be aware of the valuable part independent defenders can play, and to provide a mechanism to take advantage of the unpredicted inputs. A single person can be designated to whom group leaders, group members, administrators, educators, etc. report defender feedback for redistribution to incumbents in the appropriate subsystem and function.

CONCLUSION AND SUMMARY OF SUBSYSTEM FUNCTION, ACT AND ROLE ANALYSIS

The analysis of functions, acts and roles suggest an approach to the organization of participants for total operation of the curriculum development synergystem. The major participant groups have been identified as students, faculty, administrators, staff educators, and participants from outside the college. Further, these participants have been shown to act 1) separately within the system, 2) as part of groups within the system, 3) as group leaders, 4) as short term advisors, or 5) as individuals working independently of the system. Finally, it has been said that the amount of representation of each participant class within a subsystem is dependent upon the function of that subsystem.

Working from the above premises, the organization shown in Figure 6 is suggested for curriculum development.
Dean for Academic Affairs

Chairman of Council on Education (Faculty)

Council on Education; Responsible for structural dynamics and overarching outcomes
50% Faculty
20% Student
20% Educator
10% Admin.

Student, Educator and Admin. Representatives

Group Leader (Educ)
Team Leader (Fac)
Add'l Team Leaders

Teaching Team
60% Fac
20% Stud
10% Educ
10% Admin

Add'l Teaching Teams

Synergistic Support Group
50% Educ
20% Fac
20% Stud
10% Admin

Teaching Teams; Each responsible for its unit outcomes

FIGURE 6. ORGANIZATION FOR CURRICULUM DEVELOPMENT
Figure 6 indicates that the chairman of the Council on Education has primary responsibility for seeing that curriculum development tasks are accomplished. He is given his authority by the dean for academic affairs, and delegates much of it to faculty and educational staff leaders. He does, however, chair the philosophy committee which is responsible for operation of the philosophy subsystem. It should be noted that in addition to the curriculum development functions shown here the chairman, the teams and the synergistic support group have responsibilities in the learning system.

The flow charts in figures 8 through 14 summarize the kinds of acts performed by each group or individual in each of the subsystems and the relationships between them.
THE PHILOSOPHY SUBSYSTEM

A-Philosophy Committee
B-Individual Member(s)
C-Leader

Function Communication Act Technical Work Act Decision Making Act

1 Receive Philosophy Statements A Receive Feedback B
Examine For Relevance A Evaluate Feedback B

Compare A
Determine New Needs A
State Needs C

2 Write Goal Statements B Select Altern.'s A Write Goal Descriptions C

go to 7

3 Existing Value Positions B Ident. Constraints A Analyze Alternative Consequences B

Assign Priorities A Constraints, Consequences, priorities C

go to 7

4 Draft Alternative Statements C Critique Finalize A

Formalize Alternatives C

go to 6

5 Philosophy Statements B Define Criteria A
Future Needs B Prepare Criteria Statements C

Assign Priorities A

go to 6 & 7

FIGURE 7
FIGURE 8
FUNCTIONS

1. Outcomes, Structure Feedback
2. Identify New Requirements
3. Evaluate Feedback
4. Synthesize New Program Needs
5. Formalize Need Statements
6. Write Alternative Statements
7. Select Alternatives
8. Write Goal Descriptions
9. Prepare Framework Explanation
10. Draft Alternative Strategies
11. Synthesize Alternative Approaches
12. Refine Alternative Approaches
13. Formalize Approach Alternatives
14. Select Approaches
15. Gather Context Information
16. Analyze Context Constraints
17. Review Constraints, Consequences
18. Assign Priorities
19. Estimate Consequences
20. Prepare Constraint Statement

THE SYNERGISTIC SUPPORT SUBSYSTEM

A-Syn. Sup. Group
B-Individual Member(s)
C-Leader

Figure 9
THE SYNERGISTIC SUPPORT SUBSYSTEM (CONT)

Function

Communication Act

Technical Work Act

Decision Making Act

A-Syn. Sup. Group
B-Individual Member(s)
C-Leader

Approaches & Constraints (From 4,5)
A

Select Approach A

Record Selected Approach C

Receive Information From 1, 2, 3, 5, 6
B

Identify Possible Techniques

Test Compatibility A

Design Operational Mode

Formalize Mode for Subsystem Output C

Communicate Model, Strategy for Implementation C

to other subsystems

Feedback from Other Subsystems G

from 2

Compare Intended and Actual

Communicate Discrepancy A

Communicate Specific Findings C

Communicate Discrepancies to 1 C

go to 1

Check other Factors G

Establish Review Schedule A

Communicate Need for Review C

go to 1

FIGURE 10
THE OUTCOMES SUBSYSTEM

FUNCTIONS

1. Receive Philosophy Statements
   - B
   - Establish Initial Traits
     - E, B
   - Review Traits
     - A
   - Perform Studies
     - B
     - Prepare Traits Statement
       - C

2. Study Student and Graduate Traits
   - B
   - Identify Needed Traits
     - A
   - Prepare Need Statement
     - C

3. Identify Knowledge, Attitude, Cog
   nitive, Psychomotor for Traits
   - B
   - Review Identified Contributions
     - C
   - Formalize Contributions for Outcomes
     - C

4. Identify Alternative Overarching Outcomes
   - B
   - Critique & Refine
     - A, D
   - Formalize Alternative Outcomes
     - C, F

5. Gather Information From Learning System
   - G
   - Identify Selection Criteria
     - G
   - Assign Priorities
     - G
   - Formalize Ranked Criteria
     - G

6. Receive Needs, Statements, Criteria
   - (2, 4, 5)
   - C, E
   - Select Statements
     - A, D
   - Formalize Outcome Statements
     - C, E

FIGURE 11
FIGURE 12
THE STRUCTURAL DYNAMICS SUBSYSTEM

Functions

Receive Outcomes Learning Information

Examine Outcomes For needs

Evaluate Learning Feedback

Prepare Needs Statement

Identify Possible Changes

Select Goals

Formalize Goal Statement

Receive Learning and Outcome Info

Identify Constraints

Assign Priorities

Formalize Constraints, Priorities

go to 8

Examine Existing Approaches

Devise New Frameworks

Synthesize Additional Frameworks

Formalize Alternative Outcomes

go to 5

Define Selection Criteria

Assign Priorities

Prepare Criteria Statement

Assign Priorities

Prepare Criteria Statement

go to 9

Identify Organization Assumptions

Or

FIGURE 13
THE STRUCTURAL DYNAMICS SUBSYSTEM (CONT)

B-Council Member(s)
C-Chairman

6
- Compare Frameworks, Criteria
- Select Framework
- Formalize Framework Statement

7
- Receive Frameworks & Outcomes
- Test for Fit
- Rework Outcomes, Framework
- Describe Curriculum Elements

8
- Existing Curriculum
- Relate to Existing Curriculum
- Approve Curr.
- Communicate Subsystem Output

9
- Gather Necessary Materials
- Prepare System Output
- Analyze Learning System Feedback
- Compare Intended, Actual Changes
- Communicate Discrepancy

10
- Formalize Specific Findings
- Communicate Discrepancies to 1
- Investigate Other Factors
- Establish Review Schedule

11
- Communicate Need for Review

FIGURE 14
CHAPTER FOUR - IMPLEMENTATION OF A CURRICULUM DEVELOPMENT SYNERGY SYSTEM

AN EXPERIENCE IN THE PRACTICE OF CURRICULUM DEVELOPMENT

The substance of much of this chapter is based on the author's experience with curriculum development at The Ohio State University College of Veterinary Medicine. Many examples from that program will be used throughout and many biases had their beginning there. Therefore, to illuminate this context for the reader, a brief account of the veterinary medicine development effort will be given here.

The professional curriculum of the College of Veterinary Medicine has traditionally been virtually identical to that in most American colleges of medicine and veterinary medicine. Two years of discipline organized basic science study were followed by two years of clinical study and experience. The departments - Anatomy, Physiology and Pharmacology, Parasitology, Pathology, Preventive Medicine, Medicine and Surgery and Radiology--functioned as discrete entities, each teaching its own courses in turn with the common goal of preparing qualified veterinarians.

With few notable exceptions one department's faculty knew little about what was taught by other departments. Courses were being crammed fuller and fuller with new information from medical research. The program which began in 1885 with four years past high school, had grown to thirteen quarters of professional work after an average of more than three years of university pre-professional work. Demands
for increased enrollments, a shorter program, more relevance to societal needs and many others noted in Chapter One, led to the beginning of an intensive faculty curriculum study by the summer of 1969. The initial inspiration and impetus for curriculum change came from the newly appointed Dean, Clarence R. Cole, early in January 1959. Dean Cole discussed innovative concepts in education with faculty members, and involved them in new ways of looking at education as they worked to complete plans for an ultra-modern veterinary teaching hospital. The dean had formulated a tentative approach for the college's professional education program during the time that he served as chairman of the pathology department, and had added to that experience by studying the Case Western Reserve program among many others.

As the dean worked with faculty he carefully introduced and used several words or phrases. Among them were organ system approach, team teaching, individual instruction, horizontal and vertical integration and core curriculum. These were words that if diffused and understood could markedly change the faculty's perception of curriculum, and they represented concepts that if implemented in an innovative program would attract funds.

Dean Cole's initiative was a successful catalyst for a number of faculty members who had for years been partially frustrated in their individual attempts to make far-reaching improvements in the educational program. Faculty from the College of Education spoke to the veterinary faculty about new concepts in education. Soon a climate favoring, in fact anticipating, change had developed. Hoping to take maximum advantage of the new climate, the dean suggested that a series
of faculty study committees meet during the summer. He also employed
a half time graduate associate from the College of Education to assist
the faculty in their deliberations.

The following study committees were appointed in June, 1968, by
the assistant dean for academic affairs after consultation with
faculty leaders:

Core Curriculum and Elective Time
Horizontal Integration and Team Teaching
Infectious Disease Block
Surgery and Anatomy Block
Off-Campus Instruction
Independent Learning
Concurrent D.V.M. - Ph.D. program

Each of these groups was to study the topic assigned and report
its findings to the faculty in a workshop scheduled for September.
The purpose of that workshop as stated in the workshop notebook was
to "develop a basic philosophy of curriculum structure and content
which [would] serve as the basis for formulation of a detailed
program for veterinary medical education." In effect, it was under­
stood that the fruits of the summer's study were to be evaluated and
blended into a program for further progress toward the new curriculum.

At the workshop--held at Atwood Lake, Dellroy, Ohio--faculty took
full advantage of the contributions presented by national leaders in
education by applying their suggestions to the formulation of final
study committee recommendations. Participating consultants included
Edgar Dale and Jack Frymier of The Ohio State University, Ralph Tyler
formerly of Stanford University, and Harvy Dworken of Case Western
Reserve University School of Medicine. Perhaps most important, faculty communication and morale soared.

The task of establishing a plan of action, however, was deferred to a small committee of faculty leaders, who several weeks later presented a report. This report, after acceptance by the faculty, became the guiding document for educational development. It is reproduced as Appendix 3 of this dissertation, but a brief overview of the direction it gave to curriculum development is appropriate here.

The report said that the ultimate goal of the curriculum is to develop self-reliant individuals capable of identifying and solving problems in veterinary medicine. Several general curriculum qualities were suggested as appropriate to reaching this goal. Among them were flexibility, individuality, integration of clinical and pre-clinical sciences, ability to incorporate innovation, efficient use of student and faculty time, and provision for student development of concepts and habits for self-education.

The curriculum was to consist of a core of learning essential for all graduates, plus electives to allow individuals to develop their own interests. The curriculum core was to constitute approximately 70% of the twelve-quarter program, and electives 30%. The curriculum was to be organized around inter-disciplinary studies of organ systems, with the focus of each system on solving disease problems of that system.

This division of the curriculum, although necessary to manage the science and assumedly better for the student than the discipline approach, was still considered to be somewhat artificial. Integration between systems, therefore, was to be accomplished through the
consideration of complex diseases involving multiple systems and in the practical application of knowledge, skills and attitudes in the clinical encounter.

In addition to organ system teaching by inter-disciplinary teams, and integrative clinical experience, the core curriculum was to include an introductory portion dealing with principles of biology and medicine common to all organ systems. These principles were then to be expanded in breadth and depth at the point of their application in an organ system. This pattern, it was hoped, would provide appropriate reiteration of important points, and would establish a framework around which each student could integrate his learning.

The leaders' committee also suggested that the following teams be established to implement further curriculum planning:

- Common Medical Principles
- Cardiovascular-Respiratory System
- Digestive System
- Endocrine System
- Hemopoietic System
- Integumentary System
- Musculoskeletal System
- Nervous System
- Reproductive System
- Urinary System
- Patient Studies
- Elective Curriculum

Beyond the recommendations summarized above, the leaders suggested some forms that faculty involvement might take and recommended
a general course for further action. After approval of this report by the faculty, team leaders and team members were chosen, and work toward identification and organization of course content began. A council to coordinate this work was established. Its members were the team leaders, and a representative of the college's newly formed Office of Veterinary Medical Education. Dr. C. Roger Smith, the elected chairman of this committee, became the curriculum's guiding light during much of the subsequent development.

Initially, progress was slow for the teams as they developed their new courses. Looking at familiar material in a new light posed many questions regarding the emphasis that would best enable students to learn organ systems. Some alternatives were 1) to proceed from anatomy through physiology, parasitology, pathology, and clinical sciences to preventive medicine; 2) to consider increasingly complex etiologic involvement using exemplar diseases to teach each class of agents including normal and contrasting abnormal structure, chemistry and function as well as diagnostic symptoms, therapy and prevention; 3) to teach in three phases: normal, abnormal and applied; or 4) to proceed topographically through the structures of an organ system, considering in sequence the important diseases of each area. Each of these approaches was considered and finally used by one or more teams, as is evidenced in the team syllabi that are included in the appendix as they were first officially approved by the university in June 1970.

Although progress began slowly during the winter and spring of 1969 due to heavy faculty teaching and research commitments, the decision was made in July to implement the first year of the curriculum
in October, so final preparations for that event continued in earnest during the summer. It was the philosophy of Dean Cole that, given too much time to study the program, "analysis paralysis" might set in and seriously hamper progress. Although the more conservative of his advisors at first questioned the feasibility of October 1969 implementation, it was soon evident that the concerted faculty response would make possible a most encouraging inauguration of the program.

The ideal would have been to have a structured set of learning outcomes for each of the first year courses with learning objectives, learning strategies and test items based on the outcomes also prepared. However, the time available did not allow for the theoretically ideal situation, as it rarely does, so teaching and learning began on the basis of detailed content outlines showing time available for each subject and the faculty member responsible for that part of the student's learning. The faculty had taught the same subjects—albeit in a different structure—for many years, so their intuition about how to teach in the new structure was a safe basis from which to work. The intent was to get the missile off the ground with the large amount of intuitive "power" immediately available, and to plan on mid-course corrections to guide it to its target. Admittedly, even the target was not defined in every detail, but that refinement would also be done after launch.

The key to this approach is that mechanisms for assessment and correction must be provided before launch, and an attitude of continual change must pervade the thinking of the participants. The general mechanism in this case was the Office of Veterinary Medical Education (OVME), which consisted of three educators and secretarial support.
It was their job to watch the program and keep it on track, while anticipating future problems. More detail of the function of the OUME will be discussed later in this chapter, but it is significant to note here that assessment of the first year—though it was somewhat informal—showed some specific strengths and some weaknesses, but almost unanimous faculty-student agreement that the program could and would improve education in the college.

Teaching one year of the new curriculum and three years of the old curriculum was the first faculty concern between October 1969 and June, 1970. The next goal for program development, however, was official approval of the complete four-year program by the University. Because the new program was to be about 30% elective, much of the material originally included in team syllabi (especially for the second and third years) had to be restudied and reduced.

At the same time a plan for coordinating the teaching of the various teams was devised. After considerable deliberation, it was decided that a block approach would be most suitable; that is, each system would be taught in a concentrated time period. With only two or three systems taught any quarter, it was decided that grouping of systems within quarters would be done first on the basis of their being closely related functionally, and second on the basis of the amount of time required, faculty overlap and other practical considerations. Figure 15 shows the distribution of Common Medical Principles (CMP) teams, organ system teams, core clinical experience and other core courses as well as times for elective offerings:
<table>
<thead>
<tr>
<th>YEAR 1</th>
<th>YEAR 2</th>
<th>YEAR 3</th>
<th>YEAR 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>CMP I</td>
<td>NERVOUS</td>
<td>CORE CLINICS</td>
<td></td>
</tr>
<tr>
<td>CMP II</td>
<td>ENDOCRINE</td>
<td>CLINIC CONF.</td>
<td></td>
</tr>
<tr>
<td>CMP III</td>
<td>CMP IV</td>
<td>SURGICAL LABS</td>
<td></td>
</tr>
<tr>
<td>CMP IV</td>
<td>ELECTIVE</td>
<td>PREVENTIVE MED.</td>
<td>ELECTIVE</td>
</tr>
<tr>
<td>CMP VI</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**QTR 1**

| CMP II | REPRODUCTIVE | CORE CLINICS | 1/2 CLINICAL OR |
| CMP III | INTEGUMENTARY | CLINIC CONF. | APPLIED ELECTIVES |
| CMP V  | CMP VI  | SYSTEMS LABS | DIGESTIVE |
| CMP VI | ELECTIVE | ELECTIVE | 1/2 OTHER ELECTIVES |

**QTR 2**

| CARDIOVASCULAR | MUSCULO-SKELETAL | CORE CLINICS | CLINIC CONF. |
| RESPIRATORY    | HEMIC-LYMPHATIC  | SURGICAL LABS |        |
| URINARY        | CMP VI           | DIGESTIVE    | ELECTIVE |
| ELECTIVE       | ELECTIVE        |        |        |

**CMP = Common Medical Principles**

SEE APPENDIX C FOR DESCRIPTION OF COURSES

**FIGURE 15. Phasing of the New Veterinary Medical Curriculum**
An alternative approach to gross curriculum structure that was considered involved having each system team divide its material into three phases: normal structure, function and chemistry; pathobiology; and clinical applications. The first phase of all systems would have been taught first, thus permitting more teams to teach simultaneously and, hopefully, providing more opportunity for integration between systems. This plan was not adopted because, while it improved interteam integration, it greatly detracted from opportunities for intra-team integration. The latter was taken to be of higher priority because of the strong-problem-solving and disease oriented elements of the program's philosophy. Those elements, it was felt, required the close proximity of normal and abnormal biology as well as clinical medicine.

Returning to the chronology, the requirements for acceptance of the curriculum by the University were met during the 1969-70 school year, and University approval was given in June (see Appendix C). The task for summer 1970 has been to develop more explicit objectives for each team and as a result provide a basis for developing increasingly effective learning materials and test instruments. The initial development has, then, been taken over by the learning system, but curriculum tasks continue. Many of the decisions in the first development were made largely on the basis of intuition. Now that the program is operating those decisions can be reexamined and supported or modified on the basis of better evidence. Such modifications are being made first in those areas where feedback shows a need for curriculum change.
EVOLUTION OF THE CURRICULUM DEVELOPMENT SYNERGYSTM

The account of curriculum change in the Ohio State College of Veterinary Medicine is the story of a revolution that with proper guidance will become an accelerated evolution. A strong point for reversal of the periodic revolution as an approach to change in medical education was made in Chapter One. It is hoped that a systematic understanding of curriculum development functions, acts and roles will provide the basis for progressive evolution toward the ideal curriculum development synergystem. Evolution will begin with rudiments of the total system in operation, but because the goal exists in the thinking of a few agents of change the ultimate can be approached in time. Once operating, the synergystem is designed to be self evolving, but continues to require the wisdom and foresight of its constituents.

Nutritive Elements

How, then, might a curriculum development program build the momentum to become part of a innovative and evolutionary educational program? There are at least three nutritive elements from which it draws essential nourishment during the embryonic period. First there must be an inspirational nucleus, an individual or small group of individuals who make their primary goal revitalization of all aspects of the education program. It seems almost imperative that one of these individuals be the dean. Financial resources are required from the beginning and only through the dean can fiscal priorities be directed toward innovation. Presumably the dean is also a gatekeeper in other areas such as the college's image with the university
administration, other colleges, government agencies, alumni, and so forth. Positive understanding of the change effort by these groups will be essential especially in the early months and years before the program has established its own credibility.

The initial nucleus must have in mind some general goals and a rough plan for accomplishing them. For instance, if they feel that education at their institution is too rigidly structured to let any individual take advantage of his unique talents and to serve his unique interests, they might plan toward a flexible curriculum that allows students to progress at their own rates and to spend some of their time learning specialities of their own choice. If the nuclear members feel that students are made to relate many bits and pieces of curriculum on their own resulting in inconsistent and therefore inadequate understanding, they might resolve to explore various ways of integrating the curriculum for the student.

Other implications that must be considered at this early stage are summarized in these questions:

How must college budget and facility planning be altered to effect the change? Will some changes attract funds from private or government sources while others will not? How should faculty hiring practices be effected? What changes are being undertaken by faculty peers at other institutions?

The second nutritive element is the development of a climate for change. Faculty, students and administrators must feel that change is not only useful but necessary. They must begin to feel uneasy in a static environment, and must be motivated to question whatever has long been left unquestioned. This is a standard mode of operation
in the faculty's scientific pursuits, but they rarely make the application in their lives as educators.

A climate for change is developed through what has been referred to as diffusion. Diffusion in this case involves continual personal interaction of the nuclear members with their colleagues. Of particular importance in this process are faculty educational opinion leaders. These people, to whom many faculty members look for credible advice, should be among the first targets of diffusion. After initial interaction is established, more direct methods of diffusing a climate for change can be invoked. Speakers representing innovative medical programs or representing advanced concepts in educational thinking might be asked to participate in faculty meetings. Financial support could be given to individuals or departments that propose plans for innovative experimental programs. Recognition should be given to faculty for time spent in improving education. A reputation for making a success of even the largest undertaking should be established by the key leaders, and most importantly by the dean.

The third nutritive element is the beginning of an in-house resource of educational expertise. Most likely this will be single educational specialist at first, and most surely it will have to be someone with considerable educational flexibility. He must be conversant in the theoretical and practical implications of such disciplines as audiovisual learning methods, curriculum testing, change theory, educational systems and communication, because many immediate problems must be solved on the road to curriculum innovation. The major responsibilities of this person early in the program will be 1) to be sure that faculty have convenient ways of accomplishing routine
and innovative teaching efforts, 2) to assist in the study and to
guide the planning of the new program from a synergistic point of
view, 3) to guide administrative planning of other education related
projects (e.g. facilities, grants) and 4) to coordinate all these
activities in his own mind and in the minds of others by regular
reference to the system plan.

These activities seem like more than enough to occupy the full
time of several people, but at first faculty and administration
acceptance and use of this in-house education resource will be casual.
Although there will be a great variety of things to be done, volume
will be light until an appreciation for the potentially available
assistance begins to develop. When this begins to happen, the capa-
bility is expanded into an office housing several educational spec-
ialists of varied abilities.

A few additional characteristics of the first staff educator
should be mentioned. He should be experienced in working with pro-
fessional faculty and professional education programs, or he should
be young and flexible enough to discern and accept the practical
constraints of professional education. He should have proven leader-
ship qualities, and aspire to further leadership, because he must take
the initiative in helping to build a viable organization of educa-
tional specialists within the college. He should be thoroughly
committed to serve for several years, because he will sustain many
major concepts of program development in the early years, and will be
aware of many subtleties that would be difficult to communicate to
a successor.
Less vital, perhaps, than the above mentioned characteristics, but most useful are two others. The role of first staff educator will be greatly facilitated if he knows his way around your campus, including the administrative structure, budgeting procedures, university services, and particularly key personnel in education, medicine, administration, audiovisual materials production and distribution, and physical plant. Finally, it will help the program if he has had some educational background in a biomedical science at the college level.

**Embryonic Development**

Even with a good measure of the nutritive elements, full implementation of a curriculum development synergystem cannot be expected to come quickly to fruition. It is wise to except this and move toward an interim implementation approach. By so doing formally remote, theoretical questions become real problems to be solved as part of an ongoing program. Curiously enough, the author's experience indicates that the sequence of development events that actually happens in initial implementation tends to be opposite of the sequence of philosophy, outcomes, structure logically developed earlier. This is, in practice a form of structure is first achieved, then rudiments of outcomes in the form of content outlines are generated, and if someone has time the philosophy that is always implicit is made explicit. Synergistic support depends heavily upon the attention given it by educational specialists, but the beginnings of diffusion and commitment are essential early in the embryonic phase, and at least some formal communication is needed before parturition.
The new curriculum begun at the end of this embryonic development may appear to be only superficially changed, but a very real change will have taken place if the inertia that would arrest further change is overcome and the young program is allowed to continue its growth.

Six major steps can be identified as contributing toward the initial implementation of a revitalized curriculum, assuming the nutritive elements are present:

1. Orient and motivate faculty and students by an intensive period of study.
2. Culminate initial study with recommendations for further action, including a structural approach.
3. Continue with a study in depth of each aspect of the agree upon structure.
4. Culminate these studies with structured topic outlines.
5. Coordinate outlines within curriculum time available.
6. Finalize initial curriculum for official approval.

A few important considerations will be cited with relation to each of the above steps.

1. Orient and motivate faculty and students by an intensive period of study. It is essential that faculty and students become involved in the program as soon as possible, and that they participate actively in early developmental activities and decisions. This promotes their ongoing concern for program success, and it gives validity to the whole effort on the basis of broad representation. Development leaders should not impose their ideas of the direction
the change should take, but can give initial structure to the inquiry through suggestions of major discussion topics. Topics should be related to concerns of faculty and students and might be gleaned from one of a series of open meetings in which such concerns are expressed. Final selection of topics should reflect a broad spectrum of educational concepts. There should be enough topics and subtopics to involve most of the faculty in groups of about ten, with interested students participating as they wish. It is assumed that all faculty members and representative students are in on planning from the start.

It is probably advisable to assign faculty and students to groups rather than to let them choose a group to avoid clustering of like-thinking individuals. A nucleus of one or two group members should have particular interest and capability in the area under consideration, and the others should be assigned to assure 1) different professional interests, and 2) different department affiliations. Faculty who normally have little or no contact should be together.

The goal of these groups should be to gain relevant insight on the topic in question with the expectation of reporting to the rest of the faculty its potential for application to the new program. One approach is to 1) study the literature and existing programs thoroughly for understanding, 2) propose the most coherent and useful applications, 3) study the implications of implementation of the proposed innovation in the program.

A complete program of resources should be available to the groups to facilitate all avenues of inquiry. Useful resources include: services of the resident educator, funds for travel to examplar programs or for supporting consultants, bibliographic information,
typing assistance, release time, funds for purchase of materials, and so forth.

It should be understood from the beginning that after a period of time, a workshop will be held to bring together all the knowledge gained, to formulate a set of recommendations for structuring the curriculum, and to plan for further development. Regular group meetings are necessary to assure accomplishment of group work, and periodic interim reports to the faculty at large should be encouraged to promote inter-group communication. The staff educator can benefit greatly from attending group meetings by getting to know faculty and by gathering insights into the college program in many of its fine details.

2. **Culminate initial study with recommendations for further action, including a structural approach.** A concentrated period of interaction among all student and faculty participants is recommended to culminate the first study phase. A workshop such as the one described earlier in this chapter is a useful way to get faculty away from the demanding responsibilities for such an activity. A panel who will summarize the proceedings and formalize recommendations should be designated before the workshop, and made responsible for keeping a complete record.

To break faculty groups out of the frame of reference established during phase one studies, prominent experts in education and medical education should be asked to present stimulating and generative discussions of key curriculum development issues. Coming with already prepared preliminary reports, groups then have the opportunity to
try out their ideas face-to-face with their colleagues and the specialists. After this interaction, a final report is prepared and submitted at the workshop. Change agents responsible for this kind of activity should take care that discussions do not get bogged down in details of special interest or implementation problems. The ground rules at this point assume ideal budget, personnel and facilities situations.

A few other recommendations for effective operation of such a workshop follow. The formal schedule should not be overloaded because many significant ideas are generated in recreational time between sessions. Alternative programs, equipment, support personnel should be prepared so that nothing goes less than smoothly. Clerical and duplicating services should be available as well as a good collection of key references pertinent to medical education. Members of different teams, departments, professional groups should room together. Areas for scheduled and informal small group meetings should be provided. Fiscal support should be available for at least some of the specific recommendations that come out of the workshop.

Final conclusions of the initial study phase should be made after the workshop, as mentioned earlier. The document that is produced should be as free as possible of narrow interest biases; it should avoid terms with loaded connotations for some at the expense of more generally understood terms; it should not go into great detail, but should form a solid conceptual base that can be easily accepted by the faculty at large for further study and application. It should, however, specify directions for future action, and recommend a general curriculum structure from which further
action can be taken; it should be prepared for faculty approval as soon as reasonably possible after the workshop.

3. **Continue with a study of each aspect of the agreed upon structure.** The above recommendations for gross breakdown of subject matter make possible the formulation of teaching teams for further study. For example, in The Ohio State Veterinary curriculum the only specific structural decision was that teaching teams would be responsible for organ system teaching. Since the teams established here will maintain at least some continuity into the instructional phase, the choice of team leaders and members is critical and should be done by a knowledgeable, credible faculty group. Team leaders ideally should be actively interested in the organ system or other unit to be learned; they should be opinion leaders among faculty; and they should be capable of working with and motivating their teams.

A curriculum coordinating council (e.g. Council on Education) should be established to make decisions and promote communication for the new curriculum organization. The members of this group should be the leaders of subgroups. The choice of chairman of this council is perhaps the most crucial single choice of the entire development. He must be as highly credible as possible both as a basic scientist and as a clinician; he must have an unusual grasp of the continuity of curriculum development past, present and future; and he must be willing to sacrifice his other professional interests for several years to see the program take root. Obviously this is asking a great deal and requires strong and continuing support from
the dean and other administrative officers.

The first activity of the council (and a continuing one) can be to set milestones for accomplishment of certain team responsibilities. These schedules should be closely coordinated with the dean's office to avoid last minute notification of important university deadlines and other similar emergency situations.

At this point it is probably most realistic to ask the teams to work toward what they feel is a realistic program for teaching their subject area and to submit such programs simply as topic outlines. Asking them to think about outcomes, objectives, criteria and so forth when they are first trying to organize their thinking in a new way will probably invite resistance.

Simultaneously with the above team activity, the council will work toward more definitive agreements about structure. It might be an opportune time to initiate some semblance of the structural dynamics subsystem. Generally, the need is to design a structure or guidelines for structure between teams and within teams. As noted before, the within teams structure may vary, but should at least be coordinated with the council.

4. **Culminate these studies with structured topic outlines.**

The council chairman should coordinate the activity of pulling together all the individually prepared topic outlines. Topics and/or subtopics should be rated with regard to their absolute necessity in the curriculum on a scale such as: 1) essential, 2) important, 3) helpful, 4) useful for some, 5) ancillary. This rating process is particularly necessary if a core curriculum must be identified and developed for
for which there is limited student time available. Rating information along with best estimates of student class time, faculty class time, section sizes, etc. will also be needed for scheduling of faculty, students and facilities.

When preliminary topic outlines and principles of between and within groups integration have been developed they should be made available to faculty and students for critique and feedback to the council.

5. Coordinate outlines within curriculum time available.

Many important variables must be considered as the content outlines are fitted together to form a coherent program on which to base instruction. Working from the principles for between group integration, the placement of groups within the curriculum require study. Perhaps a group's topics should be spread over two years, taught in a single quarter block or given three or four concentrated periods in the space of four years.

Consideration must also be given to the way each group's learning depends upon the others. That is, is one group or part of one group requisite to part or all of another because of a simple-complex, inductive-deductive, or theory-practice relationship? Of course, the amount of time available for learning must be compared to the estimates given by each team. Finally, all material presented must be evaluated in light of the principles originally approved by the faculty.

This coordination phase should be undertaken by the council chairman in cooperation with educational advisors and team leaders.
as they are needed. Alternative feasible schemes should be
developed and discussed individually with team leaders to avoid
unnecessary inter-team competition for student times.

A crucial problem of this phase is the pruning of unnecessary
material from the team's topic outlines. Because the outlines were
developed by people close to the topic area who have vested interests
in it, they can be expected to include enough important material, but
not to eliminate enough unimportant material. The process of pruning
would be greatly simplified if good overarching and unit outcomes
were developed early in the development program. However assuming
that the climate was not ripe for early outcome development, the
criteria used here must depend upon the best intuitive sense of the
chairman and team leaders.

6. **Finalize initial curriculum for official approval.**

Agreements are concluded with each team regarding the content
to be taught, the most feasible scheduling for between group integra-
tion, prerequisite relationships and so forth. Formalities such as
assigning course numbers, completing appropriate forms, and writing
a complete program description are then prepared for critique by the
council and the dean. When final college approval is given, and the
program is accepted for implementation by the university, the
embryonic stage is complete, and the curriculum, with the rest of the
educational program is ready for its first contact with the real
world environment. It is functional, but not fully developed.
Post-Natal Development

It is likely that the only subsystem that will be recognizable as a system at the end of the embryonic period is structural dynamics. Studying the interrelationship of curriculum topics within a gross structure is something most medical faculty are familiar with and have participated in at one time or another. Formulation of outcomes and definition of useful philosophical positions are most often left implicit, and because they involve unfamiliar activities those subsystems take longer to evolve.

Soon after final acceptance of the embryonic curriculum, diffusion of concepts basic to the outcomes subsystem should begin. Teaching teams will at this point be faced with the reality of the upcoming instructional program, and will quickly recognize the need to answer the question: How will I know that the student has learned what I want him to learn at the end of my course? To answer that question the professor must ask: What acts do I want him to perform? And finally: After having taken this course, what traits should he exhibit as a knowledgeable functioning member of the profession? If these kinds of questions are suggested by educators participating in team activities, the beginning of an outcomes subsystem will soon develop.

Informal statements of values and philosophy are recorded in various reports throughout the embryonic period, and should be summarized by a staff educator for use as needed for the structural dynamics and outcomes subsystems. Formal development of a philosophy subsystem, however, will probably come only after the more immediate concerns relevant to instruction (i.e., structure and outcomes) have
become accepted parts of the education program.

Synergistic support must begin early in the embryonic phase as noted earlier. Like outcomes, it will most likely function informally until initiation of the curriculum. At that time, or as soon as sufficient staff time is available, a systematic program for synergistic support can be initiated by a team of educational specialists. Students and faculty are likely to perceive a structured program designed for diffusion, commitment and communication as propagandistic or even subversive. Therefore considerable credibility must be developed by educators before making this change function a formal part of the curriculum development synergystem. In fact, it is suggested as the last to involve student and faculty participation.

ORGANIZATION FOR IMPLEMENTATION OF CURRICULUM DEVELOPMENT

Beyond the organization of role incumbents given in Chapter Three, there are two aspects of organization that are related to curriculum development. The first has to do with the organizational confusion caused when an interdepartmental curriculum is adopted by a departmentally structured institution. The second relates to the organization necessary for the coordination of education support services.

Organization for an Interdepartmental Curriculum

A curriculum taught by interdepartmental teams of faculty poses some organizational problems because responsibilities and loyalties may become split. This usually happens when the demands for faculty time from the two areas become impossible to meet. One solution is to form large interdisciplinary departments such as Basic Medical
Science and Applied Medical Science. The tremendous inertia of the departmental structure, however, may be very difficult to overcome because of traditional loyalties, vested interests and facility design.

The approach taken by The Ohio State University College of Veterinary Medicine has been to leave the traditional departmental structure intact. Faculty appointments, offices, and graduate students remain with their traditional departments. Participation in interdisciplinary professional teaching teams is also regulated through the department by negotiations between the department chairman and the team leader. When a department is unable to supply the need for team members the deficiency is called to the attention of the college administration, and adjustments are made.

Organization for Educational Support (OVME)

The staff educational specialists that have been continuously referred to in this paper must be organized into a functioning service to support all faculty requirements in both curriculum development and learning. Willard reported in September 1955 that five medical schools had medical education offices and at least three more planned to add them (Willard, 1955, p. 481). Undoubtedly several more have done so since then. Two of the twenty-one medical schools surveyed by Riley had formal departments of medical education (Case Western Reserve and The University of Illinois). He reports: "These departments had no direct hand in curriculum development. What influence they had, and I suspect it may have been considerable, was indirect." (Riley, 1968, p. 31)
To the present author's knowledge, The Ohio State University College of Veterinary Medicine is the only veterinary medical school to have an office of medical education. Members of this office have participated directly in curriculum development throughout the embryonic phase, and participation is expected to increase during subsequent growth and maturity.

The objectives and functional organization of the Office of Veterinary Medical Education (OVME) are shown below. Note that the office integrates curriculum development ("program development") with learning system functions and assessment functions. Present staffing includes two doctoral candidates studying various aspects of communication, learning, research, organization, instruction and change in medical education; one doctoral student in industrial and educational psychology with emphasis on test and measurement aspects; one learning materials writer-designer; one computer coder, several professional students and two secretaries.

Rationale and Objectives

Three major questions must be asked continually of any educational program to insure its productive development and to take advantage of opportunities for innovation: 1) What is to be learned? 2) By what means is it learned? 3) Are students actually learning? Subheadings under each of these must deal with questions such as appropriateness, cost-effectiveness, organization, long-range planning, and feasibility of implementation.
The Office of Veterinary Medical Education (OVME) seeks practical answers to the above questions and above all serves faculty needs for educational support. The general objectives of the OVME are as follows:

1. To support efforts in the instruction of students of veterinary medicine by providing professional and paraprofessional educational services to do those jobs that can best be done by education specialists, photographers, illustrators and others thus assuring most efficient use of faculty time.

2. To assure optimal use of scarce educational resources through careful, insightful planning, appropriate application of commercially available materials and methods, centralization of college resources and thorough evaluation of the effectiveness of educational programs.

3. To provide professional leadership and expertise in the ongoing process of educational change, particularly in the areas of curriculum development, educational evaluation, and educational resource development, and to assist other administrative offices with educationally relevant problems.

Operation and Organization

Three major functional areas have been identified for the OVME. They are described briefly below, followed by a listing of more specific exemplary functions, most of which are performed to at least a limited extent under the Office's current level of operation.

1. Operational Support - daily support for the faculty to help them help students learn.
2. **Program planning, development, implementation and administration** - application of professional educational expertise to the preparation and operation of programs of curriculum and instruction; internal coordination of the OVMEd program; cooperative and state-of-the-art coordination with other programs.

3. **Program evaluation and applied research** - monitoring the effectiveness of curriculum and instructional programs and applying techniques of educational research toward the continued development of veterinary medical education.

**Operational Support**

1. Assistance in objectives development

2. Advice and assistance to departments and college administration

3. **Learning Resource Center (Centralized Services)**
   a. Materials production (Film, Slides, Drawings, Charts, Live TV, Videotape, Audio recordings, etc.)
   b. Materials distribution (Classroom, Carrels, Library, Laboratories, Clinic, Off Campus, etc.)
   c. Equipment utilization (Evaluation, Selection, Purchase, Maintenance, Setup, Operation)

4. Materials acquisition (Rent, Purchase, Cooperate—Films, Audiotape, Videotape, Slide-Tape, Programs, Microslides; 2x2 slides, Models, etc.)

5. Classroom achievement test construction

6. Scoring and item analysis service

7. Instructional materials planning and design (writing) (Slide-tape, Film, Computer TV, Audio-tutorial, etc.)

8. Application of learning principles
9. Application of new instructional methods
10. Workshops

Program, Planning, Development, Implementation, Administration

11. Grant preparation
12. 6-year planning (CVME)
13. Studies of existing similar programs
14. Implications of curricular and instructional change for fiscal planning
15. Professional educational assistance for all program development activities
16. Reporting
17. Coordination of educational purchases
18. Educational liaison with this and other institutions
19. Budgeting
20. Operations analysis

Program Evaluation and Applied Research

21. Entrance testing
22. Student observation program
23. Design of evaluation for new and existing programs
24. Design of evaluation for pilot projects
25. Follow-up studies of graduates
26. Studies to predict learning styles
27. Periodic review and summary of progress
28. Motivational and biographical studies

The CVME presently has three key personnel who coordinate the three functional areas outlined above. These individuals are responsible for functions rather than for individuals under them (with the
exception of the Associate Director, who has responsibility for the total program operation. However, staff positions have been listed under the area of most participation in Figure 16. The OVME Director represents the faculty in the administration of the area, but delegates the authority and responsibility for day-to-day operations to the Associate Director.

![Organization Chart]

**Figure 16. Organization of the OVME**
EVALUATION OF CURRICULUM DEVELOPMENT

Evaluation is an essential element throughout all phases of curriculum development to answer the fundamental questions, "Is curriculum development reaching the goals set for it?" and "Are those goals the best possible?" Mechanisms such as monitoring and recycling are built into subsystem operations to assure some basic evaluation activity. A branch of the OVME is provided to design and assist in the performance of these built-in system evaluations as well as independent objective evaluations. A paradigm that is useful to bring together all aspects of evaluation has been developed by Stufflebeam (1969).

Stufflebeam (1969) identifies four concerns of educational evaluation: Context, Input, Process, and Product (CIPP). He defines evaluation as the science of providing information for decision-making, and presents the classification scheme reproduced by permission in Figure 17.

Examination of Stufflebeam's four evaluation strategies indicates that they relate to the eleven system steps as follows:

<table>
<thead>
<tr>
<th>Context Evaluation</th>
<th>Perform Need Assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Define Goals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Input Evaluation</th>
<th>Identify Constraints</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Generate Alternative Solutions</td>
</tr>
<tr>
<td></td>
<td>Define Selection Criteria</td>
</tr>
<tr>
<td></td>
<td>Select from Alternatives</td>
</tr>
<tr>
<td></td>
<td>Organize Selected Solutions</td>
</tr>
<tr>
<td></td>
<td>Prepare Operational Model</td>
</tr>
</tbody>
</table>

| Process Evaluation | Assess Model Function |

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The CIPP Evaluation Model
A Classification Scheme of Strategies for Evaluating Educational Change

The Strategies

<table>
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<tr>
<th></th>
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<tbody>
<tr>
<td>To define the operation context, to identify and assess needs in the context, and to identify and delineate problems underlying the needs.</td>
<td>To identify and assess system capabilities, available input strategies, and designs for implementing the strategies.</td>
<td>To identify or predict, in process, defects in the procedural design or its implementation, and to maintain a record of procedural events and activities.</td>
<td>To relate outcome information to objectives and to context, input, and process information.</td>
</tr>
<tr>
<td>Objective</td>
<td>Method</td>
<td>Relation to Decision-Making in the Change Process</td>
<td></td>
</tr>
<tr>
<td>By describing individually and in relevant perspectives the major subsystems of the context; by comparing actual and intended inputs and outputs of the subsystems; and by analyzing possible causes of discrepancies between actualities and intentions.</td>
<td>By describing and analyzing available human and material resources, solution strategies, and procedural designs for relevance, feasibility and economy in the course of action to be taken.</td>
<td>By monitoring the activity’s potential procedural barriers and remaining alert to unanticipated ones.</td>
<td>By defining operationally and measuring criteria associated with the objectives, by comparing these measurements with predetermined standards or comparative bases, and by interpreting the outcome in terms of recorded input and process information.</td>
</tr>
<tr>
<td>For deciding upon the setting to be served, the goals associated with meeting needs and the objectives associated with solving problems, i.e., for planning needed changes.</td>
<td>For selecting sources of support, solution strategies, and procedural designs; i.e., for programming change activities.</td>
<td>For implementing and refining the program design and procedure, i.e., for effecting process control.</td>
<td>For deciding to continue, terminate, modify or refocus a change activity, and for linking the activity to other major phases of the change process, i.e., for evolving change activities.</td>
</tr>
</tbody>
</table>
Clearly, then, evaluation should be an integral part of the development process—providing information for decisions that are made throughout. Stufflebeam further summarizes four basic methodological functions and criteria for evaluating evaluation:

The methodology of evaluation includes four functions: collection, organization, analysis and reporting of information. Criteria for assessing the adequacy of evaluations include validity (is the information what the decision-maker needs?), reliability (is the information reproducible?), timeliness (is the information available when the decision-maker needs it?), pervasiveness (does the information reach all decision-makers who need it?), and credibility (is the information trusted by the decision-maker and those he must serve?).

A detailed analysis of evaluation tasks within all subsystems of the curriculum development synergystem is beyond the scope of this paper. However, Hock and others (1953) present a step-by-step analysis of the four strategies that will be useful for further application of the CIPP model to curriculum evaluation.

Some elements of evaluation have been mentioned throughout the synergystem analysis and synthesis, but a few specific examples should be given here as they relate to the context, input, process and/or product of curriculum development.

Role Monitoring

We have seen that every aspect of the synergystem depends on individuals engaging in specified acts, and that an individual's set of acts constitutes his role. Clearly, if any individual is not
able to sustain his role, the viability of the system, (its ability to fulfill system goals) is endangered. For this reason, one aspect of process evaluation support is to monitor the various roles with the hope that, by detecting and correcting role discrepancies, many major system reexaminations may be avoided.

Role monitoring may be of two types. First, actual performance of roles may be compared with intended performance, assuming acts are well grouped into roles. Second, the distribution or grouping of acts within roles may be examined to determine appropriateness for the personnel involved. In either case corrective action may enable the system to reach its goals without a complete reanalysis.

Educational Self-Study by Schools of Medicine

The work by Sanazaro (1957) cited earlier includes evaluation strategies in the four classes for curriculum and for learning. The titles that relate to curriculum are:

- The Medical Student
  Biographical Inventory
  Critical Thinking Appraisal
- The Institution
  Finances, Faculty and their Correlates
  Faculty Attitudes
  Communication
- The Instructional Program
  The Climate for Learning
  Curriculum
- Educational Outcomes
  In-school Criteria
  Immediate Criteria
  Intermediate Criteria

Admissions Testing

Admissions testing has become part of the curriculum context evaluation at The Ohio State University College of Veterinary Medicine.
In autumn 1969 all entering freshmen were given a battery of tests including: the Veterinary Aptitude Test, Henmon-Nelson tests of Mental Ability, Strong Vocational Interest Blank, Adjective Check List, California Psychological Inventory, Myers-Briggs Type Indicator, and the Guilford-Zimmerman Temperament survey. One hope is that a bank of these kinds of data will assist in the College's understanding of the nature and background of the students, and will thereby assist in the development of appropriate curricula.

**Peer Group Ratings**

A new usefulness for these data is being explored by Mr. Jack Smith, the OVME's applied psychological researcher. Mr. Smith's findings will be reported as a Master thesis during 1970, but the expectation is that he will be able to generate product information using pre-admission testing and in-course peer group ratings. That is, he expects to be able to predict success in the profession on the basis of multiple correlations between entrance characteristics and inter-student expectations for success after several months of personal contact in the academic environment.

**Student Observation Reporting**

One method of process evaluation that has been used quite successfully by the OVME is student observation and reporting. Five students from the first-year class who were learning under the new curriculum were chosen to complete a semi-structured observation report for each instructor in each teaching team each week. Figure 18 and 19 are facsimiles of the front and back of the report form. Students were asked to avoid comments that reflected personal personality conflicts.
STUDENT INSTRUCTIONAL PROGRAM OBSERVATION REPORT

Questions are to be answered specifically in reference to the team and instructor(s) shown below.

Name _____________________________ Instructor _____________________
Lecture ___ Lab ___ or Conference ___ Team ________ Date ________

1. Give a one-sentence summary of each of the main topics of the presentation. (Do not copy or paraphrase from syllabus.)

2. Did you feel you had enough background to understand the lecture or lab? (Was it over your head?) In what area(s) were you lacking? Be specific with respect to topics.

3. Were assignments helpful to you in preparing for class and did they correlate with the material presented in class? Comment.

4. Did you feel you had too much background; was it repetitious from other classes or previously learned material? Note which and comment.

FIGURE 18
5. What audio-visual aids were used? How were they helpful to you? If not used, how do you think they could have been helpful? Be specific in naming kind(s) of material that would have been helpful.

6. Amount of student participation: none at all _____, very little ___, about average ___, above average ___, or a great deal ____

7. Suggestions or comments.

8. Do you feel your comments reflect the consensus of the class as a whole? Yes ____ No ____ (Comment)
with instructors, but to be as thorough as possible in explaining elements of curriculum or learning that they felt were outstanding or lacking.

The reports were collected, summarized without student names and distributed to the instructor and his team leader each week. Early in the program there was some faculty resistance, but by spring quarter a delay in processing of the reports brought several inquiries from faculty who wanted to confirm or alter their instruction.

The front of the report form has given team leaders information for changing the part of curriculum assigned to their teams. It has pointed to areas in which students did not feel they had enough preparation as well as some to which the vast majority were exposed before entering veterinary college. It is important also when teaching a newly reintegrated curriculum to be able to detect duplication or gaps between teaching teams. The student observation report is a method for doing this in process so that changes can be made before too much time is lost. Representative observation reports are reproduced as Appendix D, along with examples of a similar report on tests and quizzes.

Medical Consultant-Observer

A final, and most unique evaluation method that was used successfully to launch the veterinary curriculum included some elements of all CIPP strategies but was primarily a process method paralleling the observation reports. The program was most fortunate to have the services of Dr. Walter R. Krill, an experienced veterinarian and Dean Emeritus of the college. Dr. Krill became the ninety-seventh member
of the ninety-six strong first-year class. He attended lectures and observed in labs on the same schedule as the students, and because of his credibility and empathetic attitude with students and faculty was able to offer many useful suggestions for improvement. His final report to the Council on Education entitled "Observation and Suggestions on Organ Systems Teaching in Veterinary Medicine" is reproduced as Appendix E.

GENERAL SUMMARY AND CONCLUSIONS

It is the author's contention that the reluctant-to-change medical curriculum has been a major factor in medicine's inability to keep pace with rapidly changing needs for health care delivery. The implication is that any new curriculum development approach must provide for continuing change that is sensitive not only to present needs but also prepared for future requirements.

The setting in which we find medical education today has been interpreted as heterogeneous and divisive. That is, many individuals have good ideas and proposals for the improvement of the medical curriculum, but few organizations are trying to solve curriculum problems by making systematic use of that available resource. It is suggested that a trained educational change agent, having a model of the ideal curriculum development process and having some tested hypotheses on how to practically implement the model, can become the catalyst for a curriculum development program in which the best efforts of all concerned are used with maximum effectiveness. This paper has taken a first step toward the needed model and hypotheses.
Understanding of the model involves an introduction to the four basic curriculum development elements: philosophy, synergistic support, outcomes, and structural dynamics. These become subsystems of the curriculum development system and are further analyzed into their major functional components. While functions are system components, roles are components of human organizations. Both functions and roles can be analyzed into acts, so acts become the common denominator or translation level for converting functions into roles.

Knowing functions, acts and roles of each subsystem as well as the interactions between subsystems, a model of curriculum development emerges for the change agent. He uses this model as a guide, not trying to superimpose its process on his program, but influencing the curriculum development to evolve toward the idealized pattern.

The major hypothesis for implementation of the curriculum development model is that implementation should be started prematurely on the basis of intuitive decisions. Trying to force maturity on an untried program will not foster the same participation and realization of need that will come from an operating program in continual change. This insight may have been shared by many medical curriculum developers in the past, but few avoided the trap of becoming quickly locked into a changed program, allowing for little continued systematic improvement.

Other hypotheses posit the need for certain nutritive elements, a period of embryonic development, and a continuing period of postnatal development after the initial implementation.

There is much more study to be done before many definite conclusions are reached. The true test of the author's model and hypotheses is just beginning at The Ohio State University College of Veterinary
Medicine, and if successful will not end as long as professional education is required to respond to a dynamically changing environment.
APPENDIX A

DIFFUSION OF CURRICULUM REVISION PROJECT
.(TO STRUCTURE OUR THINKING-FIRST DRAFT)

OVERALL STRATEGY: REBIRTH OF EXCELLENCE
Through Disease Oriented Organ Systems Approach.

VALUE Strategy:

What values can be stressed to the adopters (faculty), that will bear constant repeating?

Our professional colleagues are looking to us for new dimensions in leadership to meet spiraling needs, and to transcend "business as usual" pursuit of veterinary medical education goals.

Our students are entitled to dynamic learning experiences.

Our constituency expect to receive expanded quality services.

Tactics:

Gentle persistence in telling each point continuously repeated to faculty members. Will be said frequently in new ways using different types of data, and by leaders at all levels.

Reinforcement by dissemination of queries from the profession, from students and from community on their anticipation of forthcoming program.
RATIONAL Strategy: Our existing system has been working because we have worked to make it work. New workload requirements would overload this system, leading to degradation in quality of our graduates. We can expect the addition of an educational resources staff and a support services augmentation to help us help ourselves, but much more will be needed.

Our intended organ systems diseases approach is an opportunity to add student mindpower to our own for their progress to excellence. They can teach themselves and teach each other if we identify and prepare those elements in the curriculum that don't require immediate faculty intervention to insure learning. Faculty drive will now be less critical, as student drive will be enhanced. A greater number of minds and hands are joined in the learning responsibility.

Tactics: Gentle insistence in identifying predictable learning elements, and their preparation for student self-instruction and for student teaching student activities such as role playing or team problem solving.
Frequent periodic preview of materials available from outside sources by faculty members, and their evaluation for acceptance in programs.

**DIDACTIC Strategy:**
What is not clearly pictured and understood can never be materialized or reach fruition as a construct. What is fuzzy in concept will be amorphous in design, structure and process. A new system must not only transcend the system it is to replace, but to gain the impetus by which it will take its rightful place, it must be well-defined in the minds of those who will provide the impelling force. The degree of understanding of the concepts involved in the intended curriculum approach will likely only be achieved through a quality building block training program in which the faculty are involved.

**Tactics:** Organ systems teams meet as frequently as schedule permits to carry on tasks formulated by themselves and their leadership in achieving the curriculum rebuild. Leadership to be provided ideas that make each meeting effective in part for
orientation and training.

Workshops will be conducted for specific purposes such as preparing behavioral objectives, selection of learning methods and media, preparation of materials, evaluation and demonstration of proposals. These will be conducted to provide for maximum involvement of faculty and interacting staff personnel.

Confrontations will be arranged to provide faculty experiences in role playing, self-instruction, student teaching, student and programmed and computer-assisted instruction.

Assisting services will provide periodic demonstrations in types and uses of audio-visual aids and assistance in solving presentation problems.

Education staff will promote ways and means for in-service training that leads to faculty comprehension of meaningful learning experiences beyond those now regularly used.

The library will participate by obtaining and maintaining up-to-date data, and by regular dissemination of information on what is available.
Tactics: Faculty will be exposed to exemplar experiences when feasible.

Each call for assistance by faculty for consultation, service and troubleshooting will be on mutual terms.

Services will not be permitted to become personal in nature, however,

OTHER Strategies and Tactics: Inasmuch as all contingencies cannot be foreseen, and since some changes in plans will undoubtedly take place, a continuous review of strategies and tactics will be made, and indicated revisions proposed. For example, a psychological strategy, beyond day to day goodwill may become necessary to get past temporary roadblocks emotionally erected. An authority strategy, beyond that inherent in the Dean's interest in success of program, may be required in the case of full utilization of facilities, or to obtain maximum output of graduates.

APPENDIX E

REPORT

TASK FORCE GROUP LEADERS

COLLEGE OF VETERINARY MEDICINE

November 8, 1968
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REPORT

Task Force Group Leaders

College of Veterinary Medicine

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T. E. Powers, D.V.M.
W. G. Venzke, D.V.M.
C. C. Capen, D.V.M.
Milton Wyman, D.V.M.
A. A. Gabel, D.V.M.
R. L. Farrell, D.V.M.
J. A. Shadduck, D.V.M.
J. Bradford, B. S., M.A.
C. Tackett, B.S.
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3  Objectives

4  Program Design

10  Pattern of Faculty, Student, and Administration Participation

13  What Remains to be Accomplished

Opportunities for Action

Recommendations for Continued Progress

16  Appendix: Summary—Workshop on Veterinary Medical Education

Note: Details have purposely been omitted. Most have yet to be clearly identified. Their effective consideration must evolve as they are defined by further development.
INTRODUCTION

The culmination of combined efforts of the task force committees, resource consultants and faculty workshop has suggested a new philosophy for our college educational program. (Appendix I)

The continued explosive increase in knowledge of the principles and practices of education and veterinary medical science requires that the professional learning program be constantly reviewed and revised. These revisions should be based on the immediate and future needs of society and our profession.

All veterinarians require a body of knowledge and skills (core) which can serve as a starting point for diversification. In addition to this core of knowledge, the many applications of veterinary medicine require extension of knowledge and experience into identified individual segments of the profession.

The total curriculum must be flexible, individual, and offer freedom to pursue the academic needs and future career interests in the specialized areas of the profession. It should stimulate interests and develop attitudes, values, and leadership qualities characteristic of a scientist and
The ultimate goal is to develop self-reliant individuals capable of identifying and solving problems. For this reason emphasis shall be directed toward continued learning by problem-solving through scientific evaluation and judgement.

Our workshop groups in many of their recommendations suggest the emulation of successful elements of curricula in other professional colleges. In order to implement these recommendations, your task force leaders have compiled the following report:
The primary objective is to employ a new approach to comparative medical education which will stimulate and foster learning. The following guidelines may be helpful in the development of the proposed new curriculum.

1. **Develop a flexible curriculum** which permits acquisition and implementation of new knowledge in the curriculum to meet the present and future needs of the profession.

2. **Strengthen the students' basic scientific background** by correlation with applied medicine.

3. **Provide the adaptability to incorporate innovations** for motivation of students and faculty.

4. Enable the veterinary student to **select and pursue his specific area of interest** early in his education.

5. Provide for **efficient utilization of student and faculty time**.

6. Stimulate **closer interdisciplinary relationships** and cooperation.

7. **Develop concepts and habits for self-education and proficiency** on a continuing basis.

8. **Encourage and impart professionalism** and technical proficiency.
I. Principles of Professional Education

1. **Content should focus upon animal diseases.** Not more than 70% of the curricular experiences should be required for mastery of the minimal knowledge and skills needed to qualify for the D.V.M. degree (core program). Additional experiences should permit preparation for individual careers as veterinarians according to each student's interest and capabilities. Beginning guidelines have been developed in several Task Force Reports.

2. The curriculum should provide experience opportunities for achievement of curricular objectives described earlier in the report.

3. The core program must have Veterinary Medicine as its central theme. It shall be primarily concerned with how the prevention, diagnosis, and treatment of diseases is accomplished. Medical practices is always a problem-solving exercise. It commonly includes establishing history, physical examination, etiology, and pathophysiology, laboratory examination,
treatment on a physiologic basis (pharmacotherapeutics and surgery), and response evaluation. While attention is often first directed to the intact individual animal(s), it logically proceeds to the organ system, organ or tissue, cell, cell inclusions and biodynamic chemicals, and matrix. Progressively as thought processes are concerned with interrelationships, it becomes less rigid and to and fro movement or scanning occurs until a composite consideration of all components is attained. The ideal curriculum should not rigidly divide preclinical from clinical, organ system from organ system, tissue or organ from cell, or any component from veterinary medicine. Rather it should introduce the student to dynamic mechanical, chemical, electrical and thermal interrelationships as determinants of normal and abnormal function, and keep reintroducing them at progressively more complex levels.

4. The arrangement of curricular content should:

(1) allow for continuity or the vertical reiteration of major comparative medical concepts,
(2) provide for sequence or the progressive expansion of such concepts in breadth and depth and
(3) provide for integration or the unification of concepts and skills into ability to prevent, diagnose and treat animal diseases, or to seek and find better veterinary medicine.

5. Flexibility. The curriculum should insure that each student will acquire the essential knowledge and skills for a career in veterinary medicine in a way and at a rate more appropriate to his individual preparation, capabilities and interests.

II. Basic Design of the Growth Structure of the Learning Program.

How will our program be organized to obtain the best continuity, sequence, integration, flexibility and individualization of learning? What is it or what will it be like? No absolute detailed answers have evolved but basic ideas have crystalized to the point where skeleton organization is possible. It is realized that the best is always in the future. Any curriculum is a product of planning at all levels plus day to day use
by students and educators. Clarity of objectives, cooperation and communication are key elements for progress.

The suggested program consists of core and elective portions mixed in proportions to maximize learning. The core program provides learning opportunities for acquiring and mastering that knowledge and those concepts and skills the faculty defines as essential and minimal for beginning any career as a Doctor of Veterinary Medicine. The elective portion enhances motivation for learning, adds synergism and efficiency to the combined programs and provides the flexibility required for individualization of the curriculum.

The proposed growth structure for learning within the core is based upon a progressive expansion in breadth and depth of the principle concepts and skills of veterinary medicine by an interdisciplinary (anatomy, pathology, medicine, parasitology, surgery, microbiology, pharmacology, etc.) study of the organ systems. Each system program considers diseases as they relate to cells, organ systems and patients at times and with intensities deemed most appropriate for learning. Programs are coordinated to insure integrity of the
whole program and to avoid inefficient and undesirable repetition.
Pattern of Faculty, Student and Administration Participation in the Organization and Application of the New Curriculum.

I. Organizing Principles

1. The actual capabilities, the responsibility and the authority for the educational program development and use resides within the faculty.

2. Leadership for educational program development and application should be widely distributed among the faculty and students.

3. A special section with the college administration should be developed for assisting faculty in the development, application and evaluation of the educational program in a wise, scientific manner incorporating consideration of recognized facts and observations.

4. Faculty Involvement. Mechanisms using interdisciplinary teams or committees shall be instituted for (1) developing outlines of program content and experiences and their arrangement and application to subject matter areas identified by organ systems,
(2) coordinating the work of individual subject matter teams and ways of dealing with aspects of objectives common to the several subject matter areas, (3) continuing study of curricular objectives, defining the minimal requirements for granting the D.V.M. degree and for continuous evaluation of student status with reference to such standards, (4) cooperating with education research personnel in the development of procedures and technology for increasing independent student participation in learning, improving learning efficiency and accommodating the variety of ways students go about learning, and (5) for coordinating the professional curriculum with pre- and post-doctoral educational programs.

5. Student involvement. A faculty-student committee system should be initiated for (1) incorporating student perspective into the curriculum, (2) counseling students about curricular choices and (3) the application of student capabilities to the instructional programs.
5. Administrative involvement. An administrative section shall be developed including capabilities for engaging in educational research. A dean of academic affairs shall be responsible for coordinating the college educational programs. He shall work with a central instructional council which shall continuously study curricular objectives, identify problems of common concern and suggest ways for their solution.

II. Schematic Representation

```
    Dean
     |       |
     |       |
Office of Academic Affairs     Professional Curriculum Coordinating Committee
     |       |
     |       |
Student-Faculty Committees Core Program Teaching Teams Elective Program Committee
```
What Remains to be Accomplished

I. Opportunities for Action

1. Faculty approval in principle of the development and application of a core program concept incorporating the best judgement of the faculty as expressed in their committee reports and summarized above.

2. Faculty approval and initiations of mechanisms necessary for completion of the development of a core program and its application at the earliest possible date.

3. Administrative support for supplying the inspiration, faculty time, resources and facilities necessary for successfully achieving a major curriculum revision.

II. Immediate Recommendations for Continued Progress in Curricular Development.

1. Acceptance in principle of this report.

2. Approval of the formation of the following system teaching teams.

   a. Cardiovascular-Respiratory System
b. Digestive System  
c. Endocrine System  
d. Hematopoietic System  
e. Integumentary System  
f. Musculoskeletal System  
g. Nervous System  
h. Reproductive System  
i. Urinary System

3. Approval of a committee to plan the electives curriculum including approval of the task force committee report on a combined D.V.M.-Ph.D. program. The latter suggested acceleration of the Ph.D. program by (1) implementing the already approved dual program, and (2) seeking approval of courses for both professional and graduate credit.
   a. Electives program committee

4. Approval of a "Committee on Patient Studies". The committee should concern itself with development of animal patients studies using the organ system approach and assisting faculty in the use of patients, on and off campus, in their instructional
5. Continued development of administrative support in the form of appropriate additional faculty and staff time. Continued planning and development of facilities for recommended learning and educational technology and of a division of academic affairs.
Summary: Workshop on Veterinary Medical Education

Section 1. General Recommendations.

Every part of the curriculum shall encompass these common goals:

..To develop interests, attitudes, values and appreciations characteristic of a scientist and scholar, a professional person and a leader (affective domain).

..The curriculum should serve to intensify and project the desire and ability to succeed at being a scholar and scientist. Rewards must be evident. An attitude of open-mindedness, to know how to investigate correctly rather than proceed in a manner which would deliver the "right" answer.

..To develop an appreciation for responsibility and the capability and responses for its assumption.

..To learn that work is rewarding, inaction eroding, and ignorance tragic.

..This is the real futuristic component of the curriculum, one cannot teach what is not known, one can only prepare for it.
Section 2. Objectives.

It is recommended that the study of veterinary medical education address itself to:

.. The discovery of the best methods for educating veterinarians.

.. The elimination of unnecessary duplication in the curriculum.

.. The establishment of a workable concept of core curriculum and elective time for veterinary medicine.

.. The establishment of patterns for horizontal and vertical integration of the veterinary medical curriculum.

.. The education of veterinarians who can go into any area of practice.

.. The provision of a basis for developing the ability for making a rational diagnosis followed by rational therapy of the many diseases in a wide variety of species.

.. The determination of a core curriculum consisting of only "what the graduate veterinarian needs to know".

Section 3. Organizational Recommendations.

The following recommendations are made relating to the organization of the veterinary medical curriculum:
That the core curriculum be based on organ systems but allow for species differences.

That subject committees be appointed to implement the curriculum.

That basic material on cell biology be taught early in the curriculum.

That definitive criteria be established to determine what content will be included within the core curriculum.

That electives include studies in depth in any area of veterinary medical science, often leading toward a career goal.

That internships in veterinary medical education be considered.

That the departmental structure of the College be retained for research and graduate teaching.

That the core curriculum be divided into the following three segments:

1) an introductory segment including cell biology and general principles of veterinary medicine.

2) the integration of normal and abnormal structure chemistry and function including some clinical examples in the early phases of the core.
3) the last phase of the core be applied veterinary medicine.

Phases 2 and 3 to be considered by organ systems.

That the hospital must function with professional and technical staff without dependence on student participation in order to allow students freedom of choice in learning without performing menial tasks which have no educational value.

That there be a general introduction to etiologic prototypes before detailed consideration of diseases by system.

That the college continues to provide a complete professional veterinary service to agri-business clientele in order to insure an adequate supply of educational materials.

That all applied off-campus activities should be closely coordinated to avoid unnecessary duplication and to make better use of student and faculty time, and that this close coordination be accomplished through administrative restructuring.

That more time be available to the applied veterinary medical faculty for professional self-education, research
and teaching preparation.

That an outlying farm be acquired for the use of the College of Veterinary Medicine for teaching and research.

That inter-collegiate cooperation be encouraged in the exchange of students, instructional materials, etc.

That a student committee be encouraged to make recommendations to the Dean of Academic Affairs on innovations in veterinary medical education.

That a program of dual enrollment (D.V.M.-Ph.D.) be initiated up to a maximum of 45 credit hours.

That the graduate committee of the department in which the D.V.M.-Ph.D. student ultimately performs his graduate program would decide what training in addition to 45 hours of dual enrollment would be required.

That at least 30 additional hours of study beyond the dual enrollment courses be required for the Master of Science degree and that a minimum of 90 hours beyond the dual enrollment courses be required for the Ph.D. degree.

That a program which has recently been approved for guidance counselors for pre-veterinary student be fully implemented.
Section 4. Methodology.

In the area of methodology it is recommended:

..That because learners learn differently many methods of learning be investigated and the best offered to the students.

..That the integrated curriculum be taught by teaching teams made up of representatives from various disciplines.

..That the students have early exposure to clinical entities to stimulate student motivation.

..That self-teaching methods be carefully studied in relation to all areas of the curriculum and a glossary of terms be developed either in dictionary form or programmed form.

..That pre-tests be considered to determine areas of knowledge in which incoming students are deficient.

..That these deficiencies be eliminated either through courses available in the summer before the first year or in the material of Phase 1 of the curriculum.

..That an extensive and continuing program of research and development in educational materials be supported to include program devices, audio-visual aids, mobile television, motion pictures, student response systems, etc.
That early developments in programmed teaching be made in areas which are particularly difficult or time consuming.

That the College of Veterinary Medicine utilize the resources of the College of Education in the development of theories, techniques, and materials of education.

That channels of internal communication be developed so that successful innovations in teaching may be made known to the entire faculty.

That changes in content and method of instruction be predicated on measures of student output as related to course objectives.

Section 5. Content.

In the realm of content it is recommended:

That species and/or systems oriented disease courses be offered in the senior year as electives.
APPENDIX C

NEW VETERINARY MEDICAL CURRICULUM

JUNE 1970
PRINCIPLES AND OBJECTIVES OF NEW CURRICULUM

Recognizing the vital need for more veterinarians to serve society in the many fields of practice, and further motivated by the tremendous increases in biomedical knowledge and the resulting requirement for more effective and efficient instruction, the faculty of the College of Veterinary Medicine initiated a highly innovative professional curriculum with the first-year class of 1969-70. The curriculum was given faculty approval after exhaustive study by faculty in consultation with educational experts. The result is a curriculum designed to assure each student the basic knowledge, skills and attitudes requisite to entering the profession of veterinary medicine, as well as some training in a speciality area of his choice.

Five general GUIDELINES directed the development of the new
program:

1. The ultimate goal of the curriculum is to develop self-reliant individuals who are capable of identifying and solving problems in veterinary medicine.

2. The most important persons in the College are the students. Their discoveries about veterinary medicine determine the success of the College.

3. The focus of the curriculum is on animal disease, the way it differs from the normal state, its diagnosis, treatment and prevention.

4. The curriculum is designed to conserve faculty and student time, and to allow maximum flexibility to meet individual needs and interests.
5. The curriculum must be constantly evaluated and revised. Evolutionary change is dictated by continued dynamic change in all areas of biomedicine.

Three ORGANIZATIONAL PRINCIPLES were cited by the faculty as central to definition of the new curriculum:

1. A curriculum consisting of a blend of core and elective portions was decided upon to provide each student with a strong grounding in the fundamentals of veterinary medicine as well as an opportunity to begin development in a specialty area of choice.

2. Organ Systems are the foci around which core content is organized. The veterinarian never sees an isolated organ system and because many basic medical principles are common to all organ systems, parts of the core bring together common principles and emphasize the whole animal. The first two quarters of the curriculum are devoted to Common Medical Principles courses. Throughout the remainder of the curriculum, whole animal implications are stressed by organ system teams, and student clinical experiences are emphasized.

3. Team Teaching meets the need for interdepartmental cooperation in teaching organ systems. Faculty teams that teach in the curriculum also had major responsibility for shaping it into its present form. Team leaders together with a representative of the Student Curriculum Advisory Committee and educational specialists comprise the Council on Education. This group oversees and directs ongoing educational change.

Several EDUCATIONAL PRINCIPLES were also adopted by the faculty to complete their conceptualization of the curriculum:
1. **It is essential to have clear objectives**, and to communicate these to the student at the beginning of any learning experience.

2. **The most useful knowledge for the student is generative knowledge**: The most important experiences in the curriculum are those that stimulate the student to discover new knowledge.

3. **Principles, skills and attitudes rather than facts should be the focus of learning**: facts are necessary to support the other learning domains.

4. **Concepts should be progressively developed in breadth and depth throughout the curriculum**; literal repetition should be avoided.

**DESCRIPTION OF VETERINARY MEDICAL CURRICULUM**

Because veterinary medical services are delivered by general veterinary practitioners and specialists in many areas - for example, the farm animal practitioner, the bovine practitioner, the veterinary research scientists, the public health veterinarian, the equine practitioner, the pet animal practitioner, the veterinary radiologists, the veterinary surgeon, the veterinary ophthalmologist, the laboratory animal practitioner, and others - it was decided that the curriculum should be more flexible. This is accomplished via core and elective portions of the curriculum.

**Basic veterinary medical knowledge is the central theme in the Core.** The Core encompasses all that each student must master while earning the D.V.M. degree. It requires approximately 67 percent of 12 academic quarters. One aim in cutting down the content of required courses by integration and avoiding unnecessary duplication was to provide the time for students to obtain full benefit from attending a university.
Students will be encouraged to mix with other students and faculties in other colleges in order to become familiar with developments in animal science, biological science, bioengineering and other related medical and environmental sciences.

The Core program is largely presented on an organ system basis. It begins, however, with a portion called Common Medical Principles (CMP). The common medical principles include that scientific knowledge and those intellectual and technical skills necessary for a student to launch an intensive study of animal disease on an organ system basis. Following CMP is the study of animal diseases through programs identified as 1) the cardiovascular system, 2) the respiratory system, 3) the urinary system, 4) the nervous system, 5) the endocrine system, 6) the reproductive system, 7) the integumentary system, 8) the musculoskeletal system, 9) the hemic-lymphatic system and 10) the digestive system. Each of the ten organ systems is interdisciplinary and focuses upon the particular anatomic, physiologic, pharmacologic, pathologic, microbiologic, parasitologic, and clinical science necessary for the students' understanding of normal and abnormal structure, function and chemistry as it relates to basic treatment and prevention of diseases of that system. In addition to the common medical principles and organ system approach to animal diseases, the Core curriculum includes in the third year, clinical experiences in various areas of the veterinary hospital, together with integrated laboratories conducted by the organ system teams. The fourth year is designed for students to explore their individual interests in more detail as they prepare for a career in one of the various aspects of veterinary medicine.
Our faculty recognize that knowledge personally acquired by individual effort has the greatest value and the most permanence. Throughout his career, the veterinarian teaches himself. Within college, the things learned best are self taught. As the College faculty and students develop more learning materials and procedures individual learning in the laboratories, library and hospital will become the principal way of life of the veterinary student. Student participation in the continued development of the educational program is encouraged, solicited and vital to a program of study as dynamic as modern veterinary medical science.

**CURRICULUM IN VETERINARY MEDICINE**

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FOURTH YEAR

During the three quarters of the fourth year, students are expected to elect two quarters of clinical or applied elective packages (600 or 700 course numbers) which total a minimum of 30 credit hours. An additional 31 credit hours of elective courses are required for graduation. As many as 25 of these electives may be taken during the first nine quarters of study. It is expected that each student will select an additional 12-15 elective credit hours during the fourth year. The elective program for the fourth year will be determined in consultation...
with a faculty advisor.

The total required credit hours for graduation with the degree Doctor of Veterinary Medicine will remain unchanged (228 credit hours).

DESCRIPTION OF REQUIRED CORE COURSES

COMMON MEDICAL PRINCIPLE COURSES

COURSE NOS: Veterinary Medicine (College of) 510, 520, 521, 530, 531, 540, 550, 560-564.

NAME: Common Veterinary Medical Principles I - VI

DESCRIPTION: The practice of veterinary medicine is dependent upon advances in science. Every method of prevention, diagnosis and treatment of disease is the outgrowth of scientific research. The Common Medical Principles section of the curriculum familiarizes the student with the language, work, concepts and skills of basic comparative medical science. The subjects of anatomy, physiology, pathology, microbiology, parasitology and biochemistry are integrated into a broad interdisciplinary introduction to veterinary medicine. The program emphasizes those common elements indispensable for study of animal diseases on an organ system basis. There exists a vast scope of knowledge in the sciences relevant to the practice of veterinary medicine. The application of wise discrimination has resulted in the presentation of only a minor fraction of all that is known.

The Common Medical Principles section is subdivided into 6 units. The titles of components of Common
Medical Principles are: CMP I - Animals and Their Environment, CMP II - Comparative Topographic Anatomy, CMP III - Comparative Structure and Function of Tissues, CMP IV - Comparative Cellular Biology, CMP V - Comparative Biology of Animal Disease and CMP VI - Basic Elements of Veterinary Medical Practice and Hospital Orientation.

CMP I - (Veterinary Medicine - College of - 510) Animals and Their Environment includes acconsideration of 1) the composition of the whole animal body and sizes of the main body compartments from a medical viewpoint, 2) the external and internal environments and the concepts of homeostasis, biological variation and measurement and 3) animal behavior. The whole organism is considered as an indivisible anatomic and functional unit.

CMP II - (Veterinary Medicine - College of - 520, 521) Comparative Topographic Anatomy deals with the form, relationship and mechanical functioning of component parts of the body. The course incorporates a study of living as well as embalmed animal bodies and employs techniques of the surgeon, radiologist and internist for the acquisition of useful anatomical concepts and ideas. Anatomical science is viewed as a dynamic, significant and constantly useful source of knowledge pertinent to modern veterinary medicine.
CMP III - (Veterinary Medicine - College of - 530, 531)
Comparative Structure and Function of Tissues deals with early development and its control and the structure of four functionally distinct tissues. It is interdisciplinary in nature combining embryology, histology, endocrinology and physiology.

CMP IV - (Veterinary Medicine - College of - 540)
Comparative Cellular Biology deals with interrelationships between function, and structure at the cellular level. Hydrogen ion control, enzymes, energetics and regulations of metabolism and growth are placed in perspective for students of comparative medical science. Subjects treated summarily will be expanded and intensified at other appropriate loci in the curriculum.

CMP V - (Veterinary Medicine - College of - 550)
Comparative Biology of Animal Disease is an integrated presentation of general pharmacology, pathology, pathophysiology, parasitology and microbiology. It aims to establish concepts necessary for understanding the interactions between disease producing agents, body systems, tissue cells and subcellular units and drugs which modify tissue response and/or body history of disease producing agents.

CMP VI - (Veterinary Medicine - College of - 560-564)
Basic Elements of Veterinary Medical Practice and Hospital Orientation. An introduction to the importance of medical histories, physical examination, and handling
of small and large animals in disease recognition is offered. In addition, methodology of special laboratory procedures are introduced to assist in arriving at a specific diagnosis. Therapy both medical and surgical is discussed. This includes operating room technique, and pre and post-operative patient care. Student participation in laboratory and clinical exercises is included. The diagnostic process and therapeutic procedure as applied to animal patients are the central theme of the learning program.

ORGAN SYSTEM COURSES

COURSE NO: Veterinary Medicine (College of) 600
NAME: The Cardiovascular System
DESCRIPTION: General considerations of the importance of the CV System to body function and a comparison of disease states in man and animals will be followed by specific anatomic and physiologic details of the heart and vascular system. This information will precede considerations of arrhythmias, reactions of the heart to abnormal flow, syndromes of circulatory failure, and congenital heart disease. Pathologic states affecting the various portions of the heart and the blood and lymphatic vessels will be presented from the standpoint of etiologic agents, physiologic alterations, diagnostic methods and therapeutic approaches.

COURSE NO: Veterinary Medicine (College of) 601
NAME: The Respiratory System
DESCRIPTION: The significance of respiration to body function and the comparative importance of diseases of the respiratory system will precede a detailed anatomic and physiologic consideration of the respiratory passages and lungs. The study of pathological changes in respiratory disease will include a detailed consideration of causes of disease (including hereditary and congenital, parasitic, allergic, poisonous, physical, circulatory, metabolic and nutritional, neoplastic and infectious) and will be integrated with discussions of the diagnosis and therapy of respiratory disease.

COURSE NO: Veterinary Medicine (College of) 602
NAME: The Urinary System
DESCRIPTION: Structure and function of the kidney and urinary passages will precede a general discussion of the role of the kidney in regulating homeostasis. Etiologic agents producing disease states and a detailed discussion of structural changes produced by these agents will be followed by the chemical changes which result in altered homeostasis and the diagnostic methods employed in diseases of the urinary system. The treatment of disease and the alteration in homeostasis will be given special attention and clinical patients will be used to exemplify the importance of kidney disease and proper renal function.

COURSE NO: Veterinary Medicine (College of) 603
NAME: The Nervous System
DESCRIPTION: The development, structure and function of the central and peripheral nervous system and of the organs of special sense will be presented and followed by the reactions of these organs to injury. Neurologic alterations will be evaluated by neurologic examination, radiography, myelography, ventriculography and electroencephalography. Etiologic agents causing important diseases of the nervous system together with the pathogenesis, pathophysiology, diagnosis, prevention and treatment of these diseases will be discussed and illustrated. Examples of neurologic disease in clinical patients will be used for clinical discussion periods.

COURSE NO: Veterinary Medicine (College of) 604

NAME: The Endocrine System

DESCRIPTION: General concepts of endocrinology and an introduction to endocrine and metabolic diseases will precede the presentation of structure and function of the endocrine organs and neuroendocrine system. The important disease problems which involve the endocrine system of domestic and laboratory animals will be discussed from etiologic, pathogenic, pathophysiologic and therapeutic aspects. The concept of stress and the pharmacodynamics of hormone therapy will be discussed. Each endocrine organ (hypophysis, adrenal, thyroid, parathyroid, pancreas and pineal) will be considered in detail from the standpoint of specific disease problems and how
these perturbations interrupt normal homeostatic mechanisms.

COURSE NO: Veterinary Medicine (College of) 605
NAME: The Reproductive System
DESCRIPTION: Sequenced immediately following the endocrine system (Veterinary Medicine - College of - 604) hormone regulation within the body will be completed by studying the structure and function of the ovaries and testicles together with the associated sex organs. The obstetrical portion of this system will be concerned with conception, embryology, variations in placentae, gestation periods and maternal behavior in the various species as well as inherited defects in the different species. The gynecologic considerations will consist of diseases of the two sexes which prevent oogenesis, spermatogenesis, conception, embryogenesis or birth of the fetus. Etiologic, pathogenic, pathophysiologic, therapeutic and preventive aspects of these disease will be presented. Clinical patients and herd problems will be used to illustrate the disease conditions.

COURSE NO: Veterinary Medicine (College of) 606
NAME: The Integumentary System
DESCRIPTION: The structure and function of skin, primarily as it relates to protection, will be presented. The important diseases of skin and adnexae, particularly the infectious and parasitic diseases and the manifestations of hormonal imbalance will be presented in detail from the
etologic, pathogenic, pathophysiologic and therapeutic aspects. Species variations in susceptibility to disease producing agents will be discussed. Clinical patients will be used in laboratories to illustrate the disease states.

**COURSE NO:** Veterinary Medicine (College of) 607  
**NAME:** The Musculoskeletal System  
**DESCRIPTION:** The structural and functional interrelationships of muscles and bones as they pertain to support, protection and locomotion will be presented. Congenital and acquired diseases from the standpoint of etologic, pathogenic, pathophysiologic, diagnostic and therapeutic approaches will be discussed. Special attention will be directed to traumatic diseases of the skeleton, relying heavily on radiographic interpretation and therapeutic approaches. Clinical patients will be used to illustrate the disease conditions affecting these two tissues.

**COURSE NO:** Veterinary Medicine (College of) 608  
**NAME:** The Hemic-Lymphatic System  
**DESCRIPTION:** The structure and function of hemic and lymphatic tissues will be followed by a consideration of hemopoiesis and lymphopoiesis. The diseases which alter both formation and function of these tissues together with reaction of these tissues to disease states affecting primarily other organ systems will be presented from the etologic, pathogenic, pathophysiologic,
diagnostic and therapeutic approach to diseases of the hemic-lymphatic system. Special attention will be directed toward immunologic diseases.

**COURSES NO:** Veterinary Medicine (College of) 609, 610

**NAME:** The Digestive System

**DESCRIPTION:** The major emphasis of the program is a thorough consideration of selected principles of comparative gastroenterology. Appropriate interdisciplinary study of relevant physiology, pathology, pharmacology, microbiology, parasitology, medicine, surgery and preventive medicine is applied. In general, the diseases are divided according to the principal way they are managed clinically, i.e. as surgical, medical or those which are treated mainly as preventive diseases.

**MISCELLANEOUS REQUIRED CORE COURSES**

**COURSE NO:** Veterinary Medicine (College of) 640

**NAME:** Organ System Laboratories

**DESCRIPTION:** An opportunity is available in the second quarter of the third year for the ten organ system teams to re-emphasize some of the more important diseases pertaining to their system, with clinical cases material, correlating the information pertinent to their system with alterations which affect the other organ systems. It will provide the teams with an opportunity to put their organ system in perspective with the body as a whole. There will be a total of one 2-hour laboratory per student for each team during the quarter.
Veterinary Preventive Medicine 609

Preventive Medicine and Public Health

Regulations concerning food handling based on scientific principles and requirements for compliance with regulations by food processing plants and food establishments will be presented. The epidemiologic approach to animal health problems will be emphasized including government regulations, control programs and eradication procedures.

Veterinary Clinical Sciences 601, 602, 603

Clinical Conference

A three-quarter sequence, two hours each week, when organ system teams or clinical disciplines will be responsible for sponsoring a comprehensive conference utilizing both faculty and students to further illustrate the importance of considering the entire organism when diagnosing or treating disease conditions. These times are provided to present the best of selected clinical case material to the entire third year veterinary class, other veterinary students and faculty in order that they might benefit from the in-depth discussion of the patient which should include consideration of all organ systems as well as species variations.

Veterinary Clinical Sciences 610, 620, 630

Core Clinical Experience

Third year veterinary students will receive clinical instruction in different areas of the veterinary
hospital as part of the Core Curriculum. These areas are divided by species and discipline, rather than organ system. It is understood that the areas may be divided into organ system approaches to medicine or surgery as specialty programs evolve. The students will devote approximately one month, in one block of time, in each of the following nine areas:
1) Small animal receiving and outpatient clinical experience
2) Small animal medicine
3) Small animal surgery
4) Radiology
5) Large animal surgery
6) Large animal medicine
7) Ambulatory clinical experience
8) Preventive medicine and public health
9) Applied pathology

COURSE NO: Veterinary Clinical Sciences 650, 651
NAME: Surgical Laboratory
DESCRIPTION: Application of the principles and techniques of anesthesia and aseptic surgery will be emphasized in a sequence of surgical exercises over two non-consecutive quarters. The use of prepared specimens and representative species of animals will provide a variety of surgical experiences for each surgical team. The student will have opportunity to develop technique and judgment in surgery and patient management which will prepare
him for more active participation in clinical surgery.

SENIOR CLINIC - ELECTIVE PROGRAM

The fourth year in the veterinary medical curriculum has been designed to maximize opportunity for students to concentrate on primary areas of interest. A faculty advisor compatible with the students' principal areas of interest will be assigned by the College Office of Academic Affairs. Together, student and advisor, will select an appropriate elective program for the year.

The elective programs are coherent programs of study designed to best prepare a student for beginning a career in general veterinary medical practice, veterinary public health, or comparative medical science. The electives are grouped into quarterly packages which reflect the nature of the specialty area, the specific needs of the student, and which together insure a meaningful study of animal patients. After declaring a major, each student will spend at least two quarters of the senior year in a program of appropriate packaged electives. Students electing a given major will be pursuing common courses of study in the veterinary hospital, although an appropriate amount of the time may be spent in other college approved courses related to the major program.

One quarter will be available for students, in consultation with their advisor, to pursue studies in any department in the university.
### PHASING OF THE NEW VETERINARY MEDICAL CURRICULUM

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
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### DISTRIBUTION OF CORE AND ELECTIVE TIME

<table>
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<tr>
<th>Year 1</th>
<th>Year 2</th>
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<tr>
<td>Elective 35%</td>
<td>Elective 37%</td>
<td>Elective 33%</td>
<td>Clinical or Applied Electives 50%</td>
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<tr>
<td>Core 65%</td>
<td>Core 63%</td>
<td>Core 67%</td>
<td>Other Electives 50%</td>
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<tr>
<td>Elective 22%</td>
<td>Elective 32%</td>
<td>Elective 35%</td>
<td>Clinical or Applied Electives 50%</td>
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<tr>
<td>Core 78%</td>
<td>Core 68%</td>
<td>Core 65%</td>
<td>Other Electives 50%</td>
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<tr>
<td>Elective 47%</td>
<td>Elective 35%</td>
<td>Elective 33%</td>
<td>Clinical or Applied Electives 50%</td>
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<td>Core 53%</td>
<td>Core 65%</td>
<td>Core 67%</td>
<td>Other Electives 50%</td>
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The required core curriculum includes:

Common Medical Principles (CMP), Organ Systems, Preventive Medicine, Core Clinical Experience, Surgical Laboratories, Systems Laboratories

In addition to core courses, 61 hours of elective courses are required.
APPENDIX D

STUDENT INSTRUCTIONAL PROGRAM OBSERVATION REPORTS

STUDENT TEST OR QUIZ EVALUATION REPORT
STUDENT INSTRUCTIONAL PROGRAM OBSERVATION REPORT

Questions are to be answered specifically in reference to the exact area you are commenting on or about.

Name ___________________ Summary ______ Instructor __________________
Lecture X  Lab X or Conference X  Team CMP-V  Date Jan. 19-23

1. Give a one-sentence summary of each of the main topics of the presentation. (Do not copy or paraphrase from syllabus)

   Bovine mastitis: causative organisms; methods of culturing and staining.

2. Did you feel you had enough background to understand the lecture or lab? (Was it over your head?) In what area(s) were you lacking? Be specific with respect to topics.

   Some who had not had micro were lost on some terminology (e.g. staph = staphlococcus). The conference periods were helpful in clearing up these problems, and the instructors always willing to explain. Of those who had micro, some felt that the material was much too remedial.

3. Were assignments helpful to you in preparing for class and did they correlate with the material presented in class? Comment.

   No definite assignments given.

4. Did you feel you had too much background; was it repetitious from other classes or previously learned material? Note which and comment.

   Those who had 6C7 said emphatically, yes.
5. What audio-visual aids were used? How were they helpful to you? If not used, how do you think they could have been helpful? Be specific in naming kind(s) of material that would have been helpful.

6. Amount of student participation: none at all __, very little __, about average, __, above average, __, or a great deal __.

7. Suggestions or comments.
   Terminology requires standardizing among lectures. Abbreviations need additional review. Students who have had microbiology experience find labs repetitious. Can more material or new material be presented to experienced students? Laboratories were well presented. Lectures much improved. Can course be more clinically oriented?

8. Do you feel your comments reflect the consensus of the class as a whole? Yes____ o____ (Comment)
1. Give a one-sentence summary of each of the main topics of the presentation. (Do not copy or paraphrase from syllabus.)

Viral causes of cancer

2. Did you feel you had enough background to understand the lecture or lab? (Was it over your head?) In what area(s) were you lacking? Be specific with respect to topics.

Some students felt that there must have been things they missed. They described jumping from things they understood to being totally lost.

3. Were assignments helpful to you in preparing for class and did they correlate with the material presented in class? Comment.

The long list of reference was used little by the students because it was given so close to the test date and because there was no indication of which might be most useful.

4. Did you feel you had too much background; was it repetitious from other classes or previously learned material? Note which and comment.

No, but review of viruses at the beginning was good to refresh material.
5. What audio-visual aids were used? How were they helpful to you? If not used, how do you think they could have been helpful? Be specific in naming kind(s) of material that would have been helpful.

It was good to have list of properties, facts and examples on slides, but this prompted too fast a presentation for students to follow. Handout materials are suggested.

6. Amount of student participation: none at all, very little, about average, above average, or a great deal, average X

7. Suggestions or comments.

8. Do you feel your comments reflect the consensus of the class as a whole? Yes X No (Comment)
STUDENT INSTRUCTIONAL PROGRAM OBSERVATION REPORT

Questions are to be answered specifically in reference to the exact area you are commenting on or about.

<table>
<thead>
<tr>
<th>Name</th>
<th>Summary</th>
<th>Instructors</th>
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<tbody>
<tr>
<td>Lecture X</td>
<td>Lab X or Conference</td>
<td>Team CMP-VI Date 4-20 to 4-24-70</td>
</tr>
</tbody>
</table>

1. Give a one-sentence summary of each of the main topics of the presentation. (Do not copy or paraphrase from syllabus)

   Special diagnosis by contrast radiography of urinary CNS, GI and CV-R.

2. Did you feel you had enough background to understand the lecture or lab? (Was it over your head?) In what area(s) were you lacking? Be specific with respect to topics.

   The handout was essential; perhaps a better understanding of the physics underlying radiography would help some.

3. Were assignments helpful to you in preparing for class and did they correlate with the material presented in class? Comment.

   Students didn't have time, or for some other reason didn't read suggested references.

4. Did you feel you had too much background; was it repetitious from other classes or previously learned material? Note which and comment.

   No
5. What audio-visual aids were used? How were they helpful to you? If not used, how do you think they could have been helpful? Be specific in naming kind(s) of material that would have been helpful.

The handout was very helpful.

The slides used in the special diagnostic lab were "excellent" in helping the students understand the material. The radiograph demonstration, too, was "excellent" (a student reporting) to illustrate the important anatomical landmarks and the equipment used for radiology.

6. Amount of student participation: None at all____, very little ____ above average ___ or a great deal ____

7. Suggestions or comments.

A number of students noted the problem of travel between the Clinic and Sisson Hall or Goss for adjacent classes. The question has again been put before the administration.

8. Do you feel your comments reflect the concensus of the class as a whole? Yes ___ No ___ (Comment)
STUDENT INSTRUCTIONAL PROGRAM OBSERVATION REPORT

Questions are to be answered specifically in reference to the exact area you are commenting on or about.

Name          Summary                                      Instructor
Lecture X, Lab X, or Conference Team CV-R Date Jan. 6-10, 1970

1. Give a one-sentence summary of each of the main topics of the presentation. (Do not copy or paraphrase from syllabus.)

   Gross anatomy and histology of mammalian respiratory system.

2. Did you feel you had enough background to understand the lecture or lab? (Was it over your head?) In what area(s) were you lacking? Be specific with respect to topics.

   Needed a little more background in epithelial tissue. Course was well prepared so that it was not hard to follow.

3. Were assignments helpful to you in preparing for class and did they correlate with the material presented in class? Comment.

   Needed a handout sheet of structure of nasal cavity as it was presented in this course. No outside assignments given.

   Notes helped greatly.

4. Did you feel you had too much background; was it repetitious from other classes or previously learned material? Note which and comment.

   No.
5. What audio-visual aids were used? How were they helpful to you? If not used, how do you think they could have been helpful? Be specific in naming kind(s) of material that would have been helpful.

1. Blackboard drawings were of high quality; students requested writing and lines to be drawn heavier and labels to be spelled out. Copying drawings was difficult except for those who were in front rows and who knew abbreviations. Drawings on handouts were requested by many students as being of possibly greater help.

2. Students asked about projection 2x2 for study of micro work. They also indicated that more time was needed for this viewing of slides.

6. Amount of student participation: none at all, very little, about average, above average, or a great deal

7. Suggestions or comments.

1. Until a sound system for audio is made available, voice is somewhat obscured by other sounds in room. Especially when facing the blackboard or at end of sentences.
2. Students remarked that they appreciate the apparent extent of planning and the approach of the professor, especially since becoming familiar with his style and accent.
3. Check on 2 versus 3 lobes of lung (3 given in other classes.)
4. Clarify laboratory versus lecture time; some students may not understand that some lecture work is to be done in what is scheduled as laboratory.

8. Do your comments reflect the consensus of the class as a whole? Yes No Comment N/A
STUDENT INSTRUCTIONAL PROGRAM OBSERVATION REPORT

Questions are to be answered specifically in reference to the exact area you are commenting on or about.

Name Summary Instructors
Lecture ✗, Lab ✗, or Conference ✗, Team CV-R Date 4-22/4-24-70

1. Give a one-sentence summary of each of the main topics of the presentation. (Do not copy or paraphrase from syllabus)

Drug therapy

Distemper

2. Did you feel you had enough background to understand the lecture or lab? (Was it over your head?) In what area(s) were you lacking? Be specific with respect to topics.

Some students have difficulty with rate of coverage—not necessarily difficulty of material presented. Maybe a few anecdotes interspersed to reduce rate of concentration content delivery.

3. Were assignments helpful to you in preparing for class and did they correlate with the material presented in class? Comment.

Outlines are particularly helpful. Reading in advance might also help some students, if assignments were specific in text, but the handout is best option for most students.

4. Did you feel you had too much background; was it repetitious from other classes or previously learned material? Note which and comment.

No
5. What audio-visual aids were used? How were they helpful to you? If not used, how do you think they could have been helpful? Be specific in naming kind(s) of material that would have been helpful.

Summary slides of printed material liked. Handouts superior. Spelling is correct instead of misspelled scribblings. Blackboards in Goss were welcomed by students.

6. Amount of student participation: None at all __, very little__, above average__, great deal__, average__

7. Suggestions or comments.

Lab was viewed as a conference by some students.

8. Do you feel your comments reflect the concensus of the class as a whole? Yes X No (Comment)
STUDENT TEST OR QUIZ EVALUATION REPORT

Name: 
Test or Quiz: 
Team: CV-R
Instructor: 
(Lecture X, Lab Conference X
Date: 4-24-70

1. Did you feel that the questions covered the content (random sampling of questions) of the course?

   All said yes
   "Covered very well"
   "As well as one can cover 4 weeks of lectures with 40 questions"

2. Were they at an appropriate level of difficulty in your opinion?

   Again all said yes
   "The questions were tricky and difficult but were of the type that teach you something even if you miss them."

3. Was time allowed to finish? Nearly finish?

   Yes, plenty of time

4. Facts and principles x, problem solving _, or application x
   If exam was a combination of the above mark all appropriate boxes.
5. Ambiguity of questions.

Most were very clear, with a few tricky questions but the students said you explained these.

"Some, but professor warned class of these questions and was present to answer questions."

"---- no problem if the question was read properly."

"You have to read question #20 to see the ambiguity in the double negative."

6. Type of test:

a. true-false
b. multiple choice X
c. short answer essay
d. essay
e. identification
f. matching
g. other

Comment: I may not have done too well but I thought the exam was fair.

In all a good test as perceived by the students.

Note: Change of one point of one student would have virtually no effect on the item analysis.
APPENDIX E

Observation and Suggestions on Systems Teaching in Veterinary Medicine

To begin with after almost 3 quarters participation in the teaching and learning program as initiated last fall quarter, I am absolutely convinced that the program is basically sound, and any reservations I may have had at the start have been removed.

This does not mean that the program does not have some real problems to overcome, before it reaches its maximum potential, but these deficiencies are largely human and personnel problems which can only be overcome by time along with adequate financial support. This type of program will require constant scrutiny to meet changing conditions and to maintain the teaching of professional students on a level which meets the needs of a professional graduate, and not incorporate too much information which of necessity, must be left, for graduate or specialty training.

With the vast amount of new knowledge appearing in the literature it is impossible to expect our veterinary students to memorize all the knowledge covering the wide variety of animals and the broad field of service veterinarians are expected to render at the time of graduation. If we can confine the material presented to the basic scientific principles in the broad field of veterinary medicine, while at the same time
stimulate within these students a genuine thirst for more information and a dedication to provide the best information and service to their clients or whatever field in which they decide to direct their efforts, we can be assured that the best interests of society will be served.

Our best graduates are not necessarily those who make the best grades due to a keen ability to memorize over a lifetime; the veterinarian who is sincere, who learns by using knowledge, and is dedicated to seeking the answer to unfamiliar problems, will continue to grow and develop in this respective field of endeavor. It therefore becomes important that the teaching program include some problem solving situations with student participation, using the knowledge already presented in resolving a solution. Teaching by systems offers an ideal opportunity for this type of teaching and I can truthfully say, some areas are making excellent use of it.

Another very important consideration in this program is the team participants, and particularly the team leader. This program is perhaps the most important project the college has undertaken in many years. Its impact could have real significance on the future of our profession. The future lives of many students are at stake and the college cannot afford to shortchange their education. Coordinating the teaching in any one system requires a great deal of time and the leader must consider his position as one of real responsibility which requires a great amount of time and in return he should be recognized and compensated equally as the staff member who devotes his time to research and publication. During the formative periods of the program the team leader should attend most of the sessions taught by his section in the interest of evaluation, coordination, avoiding duplication and establishing uniform
nomenclature; as frequently as possible other members of the team should attend sessions taught by their sections especially when subjects closely related to their area of contribution are to be covered. Furthermore, meetings of the team leader and his staff should be held weekly to discuss mutual problems and areas needing change. The systems in which most effective teaching have been done this past year, followed the above suggestions most closely. The big problem in most areas however is a deficiency in personnel and time to give the program the time needed.

Another factor which should be considered in the selection of the team leader is his proven teaching ability and his past experience which would make him knowledgeable as to the needs of students at the professional level. This also applies to a lesser degree to all members of the teaching team. Teaching only that which comes from books or out of a laboratory is a poor substitute for knowledge derived from actual experience in solving the problems under field conditions. In several areas it was my observation that too much time was spent on controversial points of view and detail which, while important from a graduate level, contributed nothing to the basic concept so necessary for the solution of problems as encountered by the professional man. It was quite obvious in certain areas where the teachers had little or no experience in veterinary medicine and were not veterinary medicine oriented, the teaching lacked applicability and in turn student response was negative.

The use of visual aids for projection as a supplement to lectures is a very important need in a program of this kind. Many instructors recognize the need and have material on the drawing boards which will be available next year. In other areas the common complaint is lack
of teaching personnel in many departments to afford the participating teacher the time to devote the time necessary to prepare the material. In addition to the projection material, it was quite obvious that the instructors who did the best job, had mimeographed handouts covering the material to be presented, which were given to each student, so that students could devote their time to listening and asking questions rather than writing at an exhaustive speed trying to copy all that was being said. The latter is not my idea of learning and unfortunately in too many cases this was the only recourse for the students. The mimeographed material makes it possible for the student to familiarize himself with new terminology and concepts prior to the presentation of the subject and in turn he can concentrate on what is being discussed.

In numerous instances the instructor stated that there was no textbook available which adequately covered the subject and will give reading assignments from texts in the library. Unfortunately, with the limited free hours the students have from classroom assignments, the students were confronted with an impossible situation.

In my opinion, the immediate goal should be:

1. That each team member prepare copies of the material to be presented in his lectures as his contribution to the system teaching.
2. Reference material and suggested outside reading should be included.
3. The lecture material from each team member should be assembled in the chronological order in which it is to be presented.
4. Enough copies should be made so that each student could
4. Enough copies should be made so that each student could be presented a copy covering the entire system at the beginning of each system study. This would be of value to the team members as well as the students. The team members would be better able to evaluate their efforts and correct any deficiencies.

The students could review material for the following days assignment. Would be relieved from exhaustive note taking knowing that the important material would be available for quick review when desired both while in school and after graduation.

Since teaching by systems is a relatively new concept in teaching, it seems very important that in the best interest of learning and reference, the best knowledge available presented by knowledgeable people in all the participating discipline should be assembled in one packet for the students convenience and ready reference.

Here again, the big obstacle is time and sufficient teaching personnel to assemble these packets: The worry on the part of those willing to undertake such a venture as to whether their efforts will be appreciated and recognized and whether they will be properly compensated and rewarded for their efforts. I know of no other one thing which could make a greater contribution to the success of this teaching program than the assembling in packet form of all material to be covered in each system, which the student could use throughout his college and professional career.

One problem for which I have no answer is the educational background of students entering veterinary medicine. This varies all the way from students having the minimum 2 year college requirements to those
having Master of Science degree and occasionally a Ph.D. degree. Some are biology, chemistry, or general science majors. In the old system, credit could be given for some courses where the department involved felt the training was adequate. Under the present program, every student follows the same pattern, to some the matter presented is boring and considered repetitious. This is particularly true in such courses as embryology, histology, chemistry and some areas of physiology; on the other extreme, some students, even those having completed the basic requirements for admission, feel inadequately prepared and the material presented is "over their heads".

Another valid complaint of some instructors is that the present system with the limited time for contact with students they do not have the opportunity to get to know the students as they did under the old system where they met the class regularly over a period of one or more quarters. Naturally this problem will increase as the student enrollment increases and I have no suggestions as to how this might be corrected.

In summary may I say, that the program is improving each quarter. Time and experience will correct many of the inadequacies as well as the resistance to change attitude evidenced by some staff members. Departmental barriers are becoming less resistant and most important student enthusiasm and acceptance of the program is definitely better than during the fall quarter. I am sure all realize that many changes are needed in the fall quarter program, such as delaying the introduction to statistics, delaying the teaching of immunology until students had first had some basic training in microbiology and reducing the student classroom hours during this first quarter to allow for more time for
the learning of a whole new terminology and adjustment to a different educational experience.

To accomplish the maximum potential of the program, the team leaders and participants must be given ample time (and this program is time consuming for the instructors) to prepare the coordinate their material, ample resources to prepare the visual material needed, and be given assurance that their teaching efforts will be recognized and they will be compensated accordingly.

This latter cannot be overemphasized. To supply the time added personnel is badly needed in most departments and other departmental services are not neglected. This problem will become greater as the enrollment increases.

To be a great teaching institution, we must never forget the student and the personal contact between the student and teacher. In the training of professional students particularly, the most important lessons taught which establish the future image of the profession and the service which it renders mankind are not learned from textbooks, but from personal student-teacher relationship. The image which the teacher portrays and the enthusiasm which he engenders, will leave a lasting imprint on the students professional career and in turn, the public image of the profession.

Walter R. Krill
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