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THE DEVELOPMENT OF AN UNDERGRADUATE MEDICAL CURRICULUM FOLLOWING A CORE OF BEHAVIORS APPROACH: A STUDY IN PHILOSOPHY OF EDUCATION

The Ohio State University

Ph.D. 1985

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THE DEVELOPMENT OF AN UNDERGRADUATE MEDICAL CURRICULUM FOLLOWING A CORE OF BEHAVIORS APPROACH: A STUDY IN PHILOSOPHY OF EDUCATION

DISSERTATION

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

by

Miguel A. Bedolla, B.A., M.D.

*****

The Ohio State University 1985

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ABSTRACT

THE DEVELOPMENT OF AN UNDERGRADUATE MEDICAL CURRICULUM FOLLOWING A CORE OF BEHAVIORS APPROACH: A STUDY IN PHILOSOPHY OF EDUCATION

Miguel A. Bedolla, B.A., M.D.

This dissertation presents an argument in favor of a curriculum for undergraduate medical education developed with a Core of Behaviors approach such as that suggested by L. Weed.

To construct the argument, the history of medical education since the School of Salerno to the present is analyzed in order to present the Core of Behaviors approach to medical curriculum development as the solution to a real problem in the education of medical students. However, it is argued that the Core of Behaviors proposed by L. Weed himself is not adequately grounded nor has it been shown to be complete.

In order to discover this ground and identify completely the behaviors that must be included in the Core the dissertation pursues a clue taken from the writings of Bernard Lonergan. This clue is related to a definition of who is a physician and what he does. Thereby, his Core of Behaviors is identified.

The behaviors in this Core are then related to the logic of medical thinking in order to show that they contain it. Then it is argued that they make up a method which is isomorphic with those of Science. Next, the behaviors are embedded in the horizon of the doctor-patient relation. It is only after this that the Core of Behaviors of the physician are expressed as the Core from which a medical curriculum may be developed.

A strategy that would permit to learn these objectives at the level of mastery is described, along with the method to evaluate the learning. The last chapter attempts a critique of the dissertation.
ACKNOWLEDGEMENTS

In the summer of 1973 I visited the School of Human Medicine at Michigan State University in Lansing. It was there that I met someone whose name I do not remember, who said "a dissertation is a chance to think a thought a book long." At that moment I discovered that, although I was already having some intense and important experiences in medical educational development, nothing could substitute the doctoral graduate student's experience.

However, I would have never been able to become a "real doctor", as someone said, if Roble had not been my companion in the journey to become one, if Fr. Lonergan had not insisted, the only time that I talked to him, "get your credentials and then do whatever you want to," and if Bro. John Totten had gone to West Point instead of becoming a monk. And, I above all, if Don Sanders had not allowed me to pursue my insights into medical education and had not waited patiently for me to develop them into this dissertation.
Finally, I must acknowledge the support of the Consejo Nacional de Ciencia y Tecnología, The Mexican Council of Science and Technology, who awarded the Fellowship that permitted me to study at The Ohio State University. Thanks to the Council's support I feel a debt to Mexico. Thanks to the University I feel a debt to the people of the State that has come to be like a second home to me.

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INTRODUCTION: AN OUTLINE OF THE DISSERTATION

This dissertation presents an argument in favor of a medical curriculum which is developed following a Core of Behaviors approach. Such an approach was first suggested by Dr. Lawrence Weed in a number of publications, some of which have been used as references for this dissertation. The argument with which the Core of Behaviors is defined and the curriculum developed is a philosophical one; it is totally based upon Bernard Lonergan's Philosophy of Mind as it appears in "Insight" and other of his publications, which have been referenced. But the argument also relies upon the findings of others, such as Jean Piaget, Lain-Entralgo and Patrick Heelan. Some support for the argument is also obtained from the work of empirical researchers such as Elstein and Barrows.
In order to fulfill its objective the dissertation contains eleven chapters. The first chapter is a brief exploration of the history of medical education which intends to demonstrate that intelligence has been at work in the education of physicians, at least since the School of Salerno; and that because of this, medical education has been progressing toward more appropriate ways to educate better physicians. But this exploration also intends to show that there are some critical problems with the ways physicians are presently being educated, and then moves on to the statement of these problems insofar as they are pertinent to this dissertation. Having defined the problem, the chapter then defines the objective of the dissertation and the method that will be used to reach the objective.

The second chapter begins with a definition of who is a physician and moves toward the definition of a rule that may operate in the mind of the physician, a rule such that leads him to understand as physicians understand. To do this the operations of the mind of the physician are analyzed and found to be the working of a dynamic structure that passes through a set of levels of awareness. From this analysis is obtained the rule that was being searched.
The third chapter moves from the rule that was previously identified toward a first and then a second approximation to the Core of Behaviors of the physician, behaviors that arise from the operations of the dynamic structure of his mind.

The third chapter relates the behaviors postulated to be the elements of the Core with the logic of medical thinking as it has been identified. This is done in order to argue that the behaviors which are included in the core identified in the previous chapter do include the logical structure of the thinking of the clinician.

The fourth chapter relates the behaviors postulated to be elements of the Core with the Methods and the Canons of Empirical Science. This is done in order to argue that beyond the logic of clinical thinking the behaviors in the Core identified also contain the methods and canons that characterize contemporary scientific activity. However, it is argued that the relation between the methods of the physician and scientific methods is only one of isomorphism.

Having related the behaviors in the Core to the logic of medical thinking and to the methods and canons of empirical Science, the fifth chapter moves toward the insertion of these behaviors in a context: the doctor-patient relation
which implies two horizons: that of the physician and that of the patient.

All of the above leads to the definition of the objectives of medical education as a Core of Behaviors which is presented in the seventh chapter. These objectives are written following the syntax of present educational practice.

Chapter eight defines a strategy to reach the objectives of medical education that were defined previously. It blends into chapter nine which is a further elaboration of the strategy to reach them. In this last chapter a distinction is made between teaching clinical skills and teaching the Basic Science which is necessary for the practice of medicine.

Chapter ten defines a method with which the learning of medicine in a curriculum based in a Core of Behaviors could be evaluated. Such an evaluation is argued to be of a pass-fail nature, decision which is made using all data available about the performance of the student in clinical situations be these real or simulated. And it is argued that the appropriate evaluation of the learning of basic sciences is the efficiency with which the student searches within their space for the scientific image of the situation, real or simulated, in which he is located.
Finally, chapter eleven attempts a critique of the dissertation in terms of its validity, its desirability for medical education and practice and its relation to Flexnerian medical education. It is here argued that the dissertation presents a philosophical rather than a scientific study of the problem of developing a medical curriculum. Some of the empirical consequences that would have to be studied if the curriculum were implemented are, also, described briefly. With that the dissertation is brought to its conclusion.
CHAPTER I
THE PROBLEM, THE OBJECTIVE, THE METHOD

1.0 The Problem.
2.0 The Objective.
3.0 The Method.
CHAPTER ONE

1.0 THE PROBLEM

1.1 Introduction.

It has been said that the mission of a university is the communication of intellectual development. (1) From this premise it would follow that the mission of a medical school is the communication of the intellectual development of medicine. And, a medical school should communicate this development in such a way that the physicians it graduates provide their patients with the best available care. Yet, the best care presently available to the average patient does not represent the theoretical best. The existence of this gap may be explained, at least partially by the way physicians are educated. (2)

If the theoretical best is to become the best care actually available it is necessary to introduce changes in medical education that will correct the deficiencies in patient care attributable to it. This task is not easy to accomplish. The medical educational environment is very
conservative. (3) Insights which lead to innovations for the better take long to be accepted; in no small part this is due to the fact that few medical educational innovators understand the history and the determinants of the process that they are attempting to improve. (4)

Medical education has a very long history, but it is not continuous. The history of medical education may be divided into several periods. The Classical Period may have begun with Hippocrates and Alcmeon around the year 400 B.C. and ended some 800 years later with the disorganization of the Roman Empire. After the Roman Empire there was little formal medical education until the Tenth century A.D. From that century onwards a continuous series of events led to the medical education of the present. Among these events were the rediscovery of logic in Western Europe, the redefinition of the classical ideal of education, the rise of universities and their medical schools, the rise of modern science linked, as it was, to modern dualism and atomism, the insights of medical educators like Paracelsus, Montanus, Boerhaave and Pinel about the way physicians should be educated, the rise of the modern university hospital and the appearance of the full-time professor.
1.2 The Rediscovery of Logic.

In the background of the rebirth of formal medical education is what some have called "The Awakening of Western Europe," (4) a phenomenon strikingly similar to "The Greek Discovery of Mind" of Classical Antiquity. (5) This awakening was characterized by the rediscovery of logic, "The Revival of Dialectic," (6) which gave a new power to the minds of Western Europe. From this revival logic rapidly emerged "...as a critical agent and the centre of a programme of education and debate..." (7) This is obvious by the time of Fulbert of Chartres, who lived around the year 1000 A.D. Though "...he never tired of asserting that the human mind when unable of its own power to discuss the causes of the divine arrangement of things, should close its eyes in reverence..." he used the new tool at every opportunity. (8) The widespread use of logic among intellectuals developed into an until then unknown confidence on the power of human reason an eventually into the affirmation of its supremacy over other faculties. This was held by the outstanding teachers of the period, such as Aquinas, who "...specifically asserted that the appropriate pedagogical sequence places logical topics first, since logic teaches the method for all philosophy and scientific inquiry." (9) For the men of the period "there seemed to be no limits to the field which the human mind
could master, and all arguments that were not strictly logical and formal seemed worthless." (11)

1.3 The Redefinition of the Classical Ideal of Education.

The rediscovery of logic was not sufficient to reorganize medical education, disorganized as it was since the last days of the Roman Empire. The ideals of education itself had to be redefined. In the last century of the Roman Republic Varro (116-27 B.C.) "the most learned of romans" had described the nine liberal arts which would serve as the foundation of medieval education. These arts included: grammar, logic, rhetoric, geometry, arithmetic, astronomy, music, medicine and architecture. (11) However, Varro's thinking was taken up and modified by Martianus Capella, who wrote an encyclopedia of education which would be highly influential. For Capella there were only seven liberal arts: Varro's nine less medicine and architecture which were now considered to be not arts, but professional subjects. For the first time since Classical Antiquity it was possible to be a cultured man and not know medicine.

Such a state of affairs began to change toward the XII century. In 1106 A.D., Rabbi Moses of Huesca, later known as Petrus Alphonsi, wrote a book called "Disciplina Clericales," in which medicine was, once again, counted among the
arts, now considered to include: dialectics, arithmetic, geometry, music and astronomy. Having assimilated the rediscovery of logic into his thought, Moses proposed that the arts have it as their foundation, much as Aquinas will do a century later. (12) He also proposed that among the arts medicine occupies a special place, since it is "... wholly indispensable and of great usefulness to all living beings in this world." (13) It is the science that "... allows the conservation of health and the computations of the length of a life." (14)

For Moses medicine was not only an art, it was one that must be supported by a theory provided by the other arts, particularly arithmetic and astronomy. Arithmetic allows the physician to select, "... with their relations classes and stages, the weights of medications and identify diseases, days, weeks, degrees of fever and other things of importance." (15) While astronomy permits the physician to identify the moment of opportunity to apply the diverse therapies, cauterizing, bleeding, etc., at his disposal. And "... besides it regulates the administration or taking of medications, establishes the day and hour of a cycle of fever, and many useful things with which medicine is related." (16)
Somewhat later than Moses of Huesca, but still in the Twelfth century, Roger of Hereford first differentiated what would eventually become the independent sciences of astronomy and physics. The two disciplines constitute what he called "res naturae investigare." (17) To them lead the other arts: arithmetic, music and geometry. And, in a proposal similar to that of Moses of Huesca, Roger advanced that the "res naturae investigare" should serve as the theory upon which the practice of medicine should be based. It must be "... the content of all medical thought and action: the physician must include in his therapeutic plan the course of the stars as well as the composition of all terrestrial and corporeal substances." (18)

Thus, at this time medicine, until now a trade, was being transformed into a practice based upon a scientific theory and thereby into a discipline worthy of being studied in the higher centers of learning. Around the teachers of medicine that came together at these centers the new medical schools were organized; they became a part of the rising universities. The graduates of these medical schools were the first scientific physicians that Western Europe had in many centuries.
1.4 The Rise of the Medical Schools.

Europe had two medical schools before it had a university: the schools of Salerno and Montpellier. The beginnings of the School of Salerno are obscure. By the Tenth and Eleventh centuries existed there a medical community that called itself "Collegium Hippocraticum." One of its early teachers was Sabbatai ben Abraham, known as "Donnolo", who wrote prescriptions that were used for many years. Sometime after "Donnolo", Alphanus, the bishop of the city also taught there and gained a reputation as an excellent physician; he wrote at least two books: "Natura hominis" and "Summa pulsum." (19)

Alphanus was a friend of the abbot of the nearby Monastery of Monte Cassino, where many of the writings of antiquity were preserved. Yet, the man who gave the School of Salerno a modern flavor was Constantinus, an African; he was crucial in the establishment there of what for the time was a true scientific spirit.

Constantinus was born in Carthage about the year 1010 A.D. and traveled several decades in Syria, India, Egypt and Ethiopia, learning medicine and accumulating medical manuscripts. He was versed in Greek, Arabic and Hebrew, and translated into Latin the medical texts available to the
Islamic world, which included both those written during classical antiquity as well as those written more recently. These translations aided in the consolidation of the medical school of Salerno.

However, Constantinus did more than translate what was available in other languages; he also structured medical knowledge. In a book called the "Liber pantegni" he established a distinction between "Teorica" and "Practica." "Teorica is the highest science, which includes all those things that can be grasped only by the intellect." (20) And, "Practica is "...knowledge acquired through the senses and the operation of the hands..." (21)

The contents of the "Liber pantegni" are organized into Anatomy, Physiology and General Pathology which represent "Teorica" and into Diagnostic Process, Special Pathology and Surgery which represent "Practica". In such organization are found the essential contents of the medical curriculum that prevails today. However, the school did not have a formal curriculum until the edition of the "Articella" the book through which salernitan medicine would be communicated to the rest of Europe. The "Articella" included works by all of the great physicians of history.
The origins of the medical school at Montpellier are as obscure as those of Salerno. Like Salerno, it is not surprising that a medical school should be found there, "A flourishing commercial city with shops owned by Arabic merchants, famous for the scientific activity of its wise Jews." (22) It is known that before there was a medical school in the city medicine was taught in its synagogues. By the year 1180 Count William VIII had granted the school the privileges that assured everyone of its teachers freedom to teach. It was given a charter in the year 1220, its statutes in the year 1242 and a Bull issued in 1289 by Pope Nicholas IV created the University when it added to the school of medicine those of Philosophy and Laws. (23)

The University of Paris was founded sometime after that at Montpellier. Gilles de Corbeil, who had studied medicine at Salerno was one of the first to teach at its medical school; through his influence the salernitan curriculum was followed. Through Paris this curriculum spread to other parts of Europe. (24)

1.5 The Legitimation of the Role of the Medical Schools. The first European medical schools rose spontaneously. As their graduates began to practice, civil authorities began to require a license for it in order to protect their citizens
from "imperitia medicorum:" inexpertness of physicians. The first regulations were issued in relation with the school of Salerno by Roger the Norman, King of Sicily in 1140. According to them, whoever wished to practice medicine had to present himself before the officials and examiners of the King in order to pass their judgement. Anyone who disregarded the King was liable to be imprisoned and to the confiscation of his entire property. "In this way we are taking care that our subjects are not endangered by the inexpertise of physicians." The teachers of the School of Salerno were named the officials and examiners of the King. (25)

Sometime after Roger, Frederick II of The Holy Roman Empire published a body of laws in which he regulated the activities of physicians in great detail. These regulations defined a curriculum which included three years of study of the humanities followed by five years of study of medicine proper, at the end of which the student would be examined. But before being able to practice independently, the student had to do one more year of practical work under the guidance of his teachers. (26)

As the laws and regulations of Roger and Frederick in fact canonized the salernitan curriculum, the School exerted a
definitive influence over the rest of Europe, an influence that continued to be felt even after its decline. As Salerno declined it was Montpellier that rose to prominence, and when it declined leadership in medical education moved first to Bologna and then to Padua.

In these schools medicine was taught following what has been called the Scholastic Method. Of it we have no better description than that left to us by a teacher of law at the University of Bologna, who told his students: "First, I shall give you summaries of each chapter; secondly I shall give you a clear statement of each law included in the chapter;thirdly I shall read the text with a view to correcting it;fourthly I shall briefly repeat the content of each law;fifthly I shall resolve apparent contradictions, adding any general principles of law." (28) The Method would seem to prepare the students to speak about medicine and not for the practice of it.

The University of Padua was founded in 1222 within the Venetian Empire; its life was guaranteed by substantial subsidies which it received from the Doge. Its statutes were so flexible that after the Reformation its enrollment was maintained open for catholics and protestants. It became the most important center for medical education in the
Sixteenth century when one of its teachers, Montanus, went beyond Scholastic Method and revived the bedside teaching of medicine. It was at this time that Baglivi published a book called "Praxis Medica" in which he said that "the cadavers of those who have died from disease must be dissected by the physician who must stain his hands in order to find the seat and the cause of the disease." (29)

As Padua declined the medical school at the University of Leyden rose to prominence. The paduan method of teaching medicine was brought there by Van Heurne and Schrevelius. To the paduan method of teaching medicine at the bedside of the patient, Boerhaave added that the student should study the bodies of his dead patients and attempt to correlate this data with that obtained from the living patient. (30) As the graduates of Salerno once spread its influence so now did the graduates of Leyden. To three students of Boerhaave can be attributed the development of three excellent medical schools: at Gottingen under Albrecht von Haller; at Vienna, the "Old" medical school under Gerhard Van Swieten; at Edinburgh under Alexander Monro. These last two, Vienna and Edinburgh were the most prominent when Leyden declined. (31)
The Scottish Faculty of medicine was founded in 1726. From its beginning it had a strong university base, and, "... was the cradle of clinical teaching for the English-speaking world..." (32) A number of American physicians studied there, including John Morgan, who was the first teacher of the first medical school in the United States. This school opened its doors in Philadelphia in 1765. (33)

Toward the end of the XVIII century there were twenty-four medical schools in France, but medical education was dominated by four of them: Montpellier, Paris, Toulouse, and Strasbourg. The medical educational situation in the rest of Europe was heterogeneous; some countries had many medical schools, others had few. In Russia there were few physicians trained in western medicine, and it was not until after the Russo-Polish war that Czar Alexander Mihailovich (1645-1676) ordered the opening of the first medical school. (34)

At this time in England the education of physicians was in the hands of individuals, mostly surgeons, "... who had their own private schools which dealt principally with anatomy and surgery until other subjects were added later. (35) Some of these private teachers were very conscientious and imparted excellent clinical education, but the students "received their clinical education by walking around the
wards and observing the leaders of the great institutions of London." (35)

The situation in Scotland was entirely different from the one that prevailed in England. Since the time of Monro there had been a continuous tradition of bedside instruction and formal courses of study.

By the XVIII century the standards and requirements for the medical degree varied, in Europe, from country to country. "Degrees from Leiden which could be bought after a brief visit of few weeks were nevertheless honored at Cambridge." (36) While in France three different medical degrees were offered: the baccalaureate, the license and the doctorate, (37) A reform was needed.

The first country to attempt a reform was France. The new program of French medical education centered itself in the hospitals, particularly those of the City of Paris. It emphasized the study of the patient at the bedside and the correlation of the autopsy with the clinical findings. This, which is not different from the way in which Boerhaave had taught at Leyden a century earlier, made Paris the center of medical education and created a model which greatly influenced medical education in Latin America. (36)
During the early part of the XIX century more uniform educational and licensure requirements were established throughout Europe. It was during this century that "the King of Prussia determined that his state should seek intellectual as well as military prowess." (39) This decision led to the construction of research institutes that emphasized training in the sciences: physiology, embriology, experimental pathology and so on. These institutes were based at universities; they made Germany the leader in medical education. In these institutes appeared for the first time, a new kind of professor. "In contrast to the busy clinical practitioners who led the French medical schools and had little concern for science, the German professors were full-time and totally dedicated to research." (40)

A similar development in England, that of physiology at the universities of London, Cambridge and Oxford, permitted it to move ahead of Scotland in medical education. Meanwhile the hospital based medical schools had developed a clinical clerkship system which strongly emphasized the study of the patient at the bedside and had become exemplars in medical education. (41)

The medical school in Vienna continued to attract many students. It was based at the Allgemeines Krankenhaus, the
first general hospital built. It had a regulation which made many bodies available for autopsy. It also offered an excellent training in medicine and surgery. (42)

Early in the twentieth century American medical education had undergone a thorough reform from which it emerged as the synthesis of the best that German and English medical education offered: a strong training in the sciences followed by a clinical clerkship in a hospital. Its influence was soon felt abroad, particularly at the University of the Philippines and the American University of Beirut. (43)

Thus, toward the middle of the XX century four major systems of medical education had developed and could be clearly distinguished. The British system followed in Great Britain and its former colonies. The German system which was also followed by Japan. The French system which was also followed throughout Latin America. And, the American system, whose influence was on the increase. (44)

1.6 The Rise of Modern Science

In parallel of the early development of what eventually became the major systems of medical education there was a growing awareness, among medical educators, of the need to go beyond the viewpoint that placed logic first in the medical
curriculum toward a viewpoint that demanded that assertions be not only logically obtained, but also empirically verifiable. It seems that from 1200 A.D. onwards many thinkers began to move toward new methods of research and new concepts to be researched. Their cumulative efforts and results would change science entirely after 1500. (45)

The Renaissance, whose foundations seem to have been laid in Toledo around the year 1000 A.D. with Alhazen's work on the nature of vision, brought with it a great insistence on observation. (46) Even earlier, there were people like Mondino di Luzzi who dissected cadavers and wrote a treatise on anatomy in the early part of the Fourteenth century. (47) Somewhat later Antonio Beniveni (1440-1502) "... systematically carried out autopsies on his patients in order to discover the causes of their illnesses and their deaths." (48) In Beniveni an entirely new viewpoint was manifesting itself, his autopsies are not the "... ritual dissections carried out in the medical schools, where the cutting up of corpses had no other end than to corroborate and illustrate the anatomical teachings of Galen;" it is not the didactic viewpoint, but the viewpoint of scientific research. (49) It seems that Beniveni's work, published when "... syphilis was becoming endemic stimulated physicians from all over Italy to embark on wholesale autopsies in search of the
source of the scourge." (50) At this time, Alessandro Achillini wrote a book, product of his own experience "... in which he corrected Galen on several points..." (51) All of these men were observing what had always been observed with an entirely new attitude: that of the empirical scientist; their labours transformed anatomy into the first empirical science to be included in the medical curriculum. They were followed by Vesalius, "...the genuine kind of pioneer, who carried out dissections himself, invented new instruments for the purpose or borrowed them from other fields..." (52) After him anatomy progressed rapidly as it can be deduced from the dates in which anatomical theaters were constructed: Padua, 1549; Montpellier, 1551; Basel, 1558; Paris, 1604. (52)

There was not only greater insistence on observation, but Empirical Science began to differentiate from Philosophy and to focus upon those questions that can be settled, not by logical argument as in previous centuries, but by evidence gathered through experimentation and the senses. Scientific questions were to be settled by appealing, not to logic, but to sensible data.

All of these developments transformed medical education beyond the incorporation of anatomy as an empirical science.
into the curriculum. Its contents and the strategy with which they were taught and learned began to be modified and updated. This process started symbolically when Paracelsus in 1527 publicly burned the books which had been studied for centuries, such as the "Canon" of Avicenna, and taught in the vernacular tongue what he had learned from his own experience. The invitation to attend his lectures at the University of Basel read: "The art of medicine has decayed, but we will free it from its worst errors. Not by following what we were taught by the ancients, but by our own observation of nature, confirmed by an broad practice and a lengthy experience." (53) It is a contemporary of Paracelsus, Montanus already mentioned, that revived the teaching of medicine at the bedside of the patient in the University of Padua. (54)

Simultaneously with the development of anatomy, medieval alchemy began to be transformed into modern Chemistry. By 1606 Andreas Libavius had published plans for a chemical laboratory. (55) Meanwhile the development of Experimental Physics with Galileo and his followers influenced medicine with the introduction of precise measurements. Sanctus Sanctorius adapted the thermometer for clinical purposes, measured the pulse with an instrument invented by Galileo, studied the physics of the circulation and made weighing
experiments. (56) Sanctorius' younger contemporary, Borelli applied the science of Mechanics to study of the living organism. (57)

The progress produced by these men was so rapid that "...by the second half of the seventeenth century the students of nature were beginning to acquire tools for investigation and experimentation." (58)

During the Eighteenth century, laboratories of chemistry continued to develop at the universities, particularly those of Germany. But while anatomy is a science based on the senses, "chemical studies, however, gave data often at variance with ordinary sense expectation, data that to be meaningful seemed to require a new conceptual framework." (59) The eventual construction of this framework produced a true scientific revolution. (60)

The Nineteenth century began with great promise. Bichat published a work in 1801 in which he identified "...the seat of disease not in the organs, but in the tissues or fabrics of which they were composed, which gave great impetus to the investigation of pathological changes." (61) It was also during this century that the structure of the clinical record, which registers the observations of physicians at the
bedside of their patients, was given a formal structure and turned into a true scientific instrument. (62) This record was used for the first time in the sixteenth century by Van Heurne, the physician who studied at Padua with Montanus and with Schrevelius introduced bedside teaching into the University of Leyden.

It was during the Nineteenth century that laboratories for students were introduced into the medical schools, first in Glasgow, then at Rensselaer Polytechnic Institute, then at Giessen. The first laboratory of physiology appeared at Breslau in 1839. The first laboratory of pharmacology was established at Dorpat in 1849. And in 1856 was organized the first laboratory for teaching practical pathology. (63)

Yet, it may be said that in spite of all of these developments in medical education something had not changed since the time of Constantinus at the School of Salerno: the division of the study of medicine into "Teorica" and "Practica." "Teorica" was now studied in the student laboratories and "Practica" was learned at the bedside of the patient and validated at the autopsy. But there had been a very important change: the place occupied by the study of logic in the early medical curricula is now occupied by the study of scientific method.
As medicine and medical education have been influenced by the developing scientific viewpoint, so they have been influenced by developments in philosophy. After the Renaissance medical thought was embedded into a form of philosophical dualism that seems to have been an element of western thought at least since the time of Plato. (64) Once so embedded, it was linked to a form of atomism very similar to that of Democritus. (65)

The dualism in which medical thought was embedded arose from a certain analysis of the relation between mind and body. The thinker who gave it its best expression was Descartes. "Now, on the one hand I see that nothing belongs to my essence as affirmed in the 'cogito ergo sum,' except that I am a thinking unextended thing...and it follows that this I (that is to say, my soul by which I am what I am) is entirely and absolutely distinct from my body and can exist without it. (66)

His existence as a thinking thing did not demonstrate Descartes the existence of his body or other bodies, but he found in himself certain faculties and activities, such as changing position and movement, which in a very clear way implied the existence of his body. From these faculties and activities he went on to establish the existence of bodies
and eventually was led into an argument which concluded that "...the human being consists of two separate substances and that the relation between mind and body is analogous to that of the pilot in the ship." (67)

The viewpoint expressed by Descartes was in sharp contrast with the Aristotelianism that prevailed until then, which considered the human being as a unity in which the relation between soul and body was one of form to matter. For Aristotelians the soul was not reducible to mind, but was regarded as the principle of life. Body and soul together formed one complete substance, whereas for Descartes the substance of self is mind and in this case the soul is simply lodged in the body. (68)

The dualism expressed by Descartes seems to have facilitated, thanks to its radical separation of soul from body, the scientific study of the later. Thus, for Borelli, the body and its operations "... are understood in terms of motion, and body and motion are the subject of mathematics." (69) For him, "animal functions take place through mechanical causes - the balance, the lever, the pulley, the wheel, the wedge - and the knowledge of these is wholly mathematical. (70) Cartesian dualism made it possible to understand the body through the laws of mechanics, as a set of parts
mechanically linked, and originated a school of medical thought called "iatromechanism." (71) But it also set off the search for the ultimate bodies from which all others are constructed thereby making medical thought amenable to the acceptance of "Corpuscular Philosophy," as Atomism was called then. The association of medicine and Corpuscular philosophy gave rise to a school of thought called Iatrochemistry. (72)

It is from the embedding of medical thought into these viewpoints that arose what at present is called the "Biomedical Model" which undergirds the theory and practice of medicine and medical education. (73) Guided by the logic of this model, in the following centuries physicians learned to think of disease as a mechanically caused phenomenon that occurred within the bodies of their patients and produced definite and unique changes in their structure, each disease resulting in changes which are characteristic of it. Through the identification of these changes may be revealed the nature of the disease. Thus the interest in correlating the clinical findings with the findings at the autopsy.
1.7 The Insights of Medical Educators.

Medical education has been transformed greatly since the days of the School of Salerno. There has occurred the development of an insight whose intention is to discover the most fitting way to educate physicians. This insight in its present stage of development is the product of the efforts of many minds; yet some of these minds have created ideas which served as a pivot. It is these pivots that have been identified in the text above; by the end of the Eighteenth century their cumulative product was expressed by Pinel, a French physician, as follows: the students,

"... will proceed to the methodical examination of the patient in his present state, according to the general program used at the famous medical school (Edinburgh) just mentioned. Thus,

I. before beginning therapy, one must:
1. establish the exact name and nature of the illness.
2. conjecture, albeit tentatively, on its probable outcome.
3. outline the general therapeutic strategy that present conditions seem to require, allowing for modification or change.
4. propose an alternative plan in the event that the first one fails.

II. After therapy is ended one should proceed to a factual review of the simultaneous and successive symptoms and recall:
1. the initial opinions, before treatment, about this particular case.
2. the duration of the proposed strategy.
3. the changes in therapy that unforeseen pathologic events demanded.
4. the actual and apparent effect of specific drugs.

III. Unique and important cases require particular considerations; these must serve for the instruction of the students and for the progress of medicine. They demand:
1) "Remarks on their history"
a) reflections on the analysis of the symptoms in the case record;
b) discussion of the specific developments that these symptoms seem to indicate.
c) comparison with analogous or similar aspects of other known diseases.

2) "Remarks on theory
a) observation on remote causes;
b) attempts to ascertain immediate causes;
c) likely explanation of some of the main symptoms;
d) a review of the arguments on which the prognosis was based throughout the illness.

3) "Remarks on practice
a) a discussion of the general therapeutic plan reviewing successively what is called
   aa) "indicantia"
   bb) indications
   cc) "indicata"
   b) a discussion of the medications prescribed, with
      aa) their usual action and their prescribed efficacy;
      bb) observations regarding their actual effects;
      cc) remarks on the expected changes and the evolution of the illness." (74)

1.8 The Rise of the University Hospital.
The ideas of the medical educators mentioned in previous sections accumulated and resulted in a strategy for the education of the student physician that was very different from that of the medieval medical school. But the strategy needed a stage in which to be implemented. Such a stage was provided by the creation of general hospitals devoted to teaching. That such hospitals were necessary was argued by Pinel at the end of the Eighteenth century: "the healing art should be only taught in hospitals: this assertion needs no proof. Only in the hospital can one follow the evolution and progress of several illnesses at the same time and study variations of the same disease in a number of patients." (75)
For him this was the only way to understand the true history of diseases. "In these shelters for suffering humanity, young students can analyse the influence of the seasons and of each year's medical constitution." (75) In the hospital the physician can be certain "... that patients receive the specific diet and medication that he prescribes, and that nascent symptoms are carefully observed." (76)

The first of these teaching hospitals seems to have been the "Allgemeines Krankenhaus" constructed in Vienna for its medical school in 1784. With it, "... Vienna set a model for all Europe of a hospital devoted not only to teaching but also to care of the underprivileged." (77) Pinel describes the manner in which the activities of teaching were held there:

"In the morning Stoll made grand Rounds in the General Hospital. In the presence of the students, he questioned the patients, examined them carefully and prescribed suitable regimes and medications. Every student was free to ask questions and the professor conscientiously gave clear and precise answers.

Then came the visit of the teaching wards where the students themselves examined the patient under the professor's supervision. To render this examination more careful and precise, M. Stoll chose the outstanding students and entrusted the supervision of one patient to each of them. The student gathered information about a newly admitted patient's health and determined the character of the illness precisely, by asking intelligent questions and examining the symptoms with care. Thus, the young supervisor studied the patient and wrote the case history. In order to preclude any accident, the professor subsequently reviewed the medication prescribed. During his visit, M. Stoll would ask the student assigned to each sickbed for his clinical opinion." (78)
It was in institutions like this that the student was first effectively transformed into a "student physician," with the simultaneous responsibilities of learning medicine and delivering care. It is also in these institutions that the reform in the method of observation introduced into medicine by the scientific ideals and philosophies of the Renaissance and the periods that followed was carried out to its logical conclusion; in them the patient was, at last, definitely transformed into "scientifically knowable object" to be studied with all the observational skill and the conceptual advances that have accumulated since the time of Mondino di Luzzi. It was also in these institutions that the physician was transformed into the "physician-scientist" who would establish the foundation of the modern medical specialties.

When in due time American medical education was reformed and emerged as a synthesis of the best that the European medical schools had to offer, it was based at a university hospital very similar to the "Allgemeines."

1.9 The American Viewpoint on Medical Education.

The first medical schools that existed in the United States were affiliated to universities like Columbia, Harvard and Dartmouth. But the schools that came later were not, they
were commercial ventures meant to make profit for their owners. More than 450 of them were opened between 1810 and 1910. (79)

Colonial United States developed its own way of educating physicians through an apprentice system tutored by practicing physicians. Upon completion of their individual service most apprentices called themselves physicians and undertook the practice of medicine." (80)

This situation began to change toward the middle of the Nineteenth century. In 1859 the University of Lind, presently Northwestern University in Chicago, upgraded its academic standards and lengthened its school year to five months. In this it was alone until 1871, when Harvard thoroughly revised its medical school "... and instituted a 3-year graded course, a nine-month academic year, and written and oral examinations." (81)

Harvard experienced an immediate drop in its enrollment but it persisted and within a few years it was being followed by a number of universities including Pennsylvania, Syracuse and Michigan. (82)
The next major advance in American medical education came with the establishment of the medical school of the Johns Hopkins University in 1893. In it was assembled a number of extraordinary professors, William H. Welch and William Osler among them. With them, "... Hopkins drastically reshaped American medical education and set a pattern which persists today." (83) Hopkins required a college degree for entrance, provided a four year curriculum, used laboratories extensively for teaching its students, "... and integrated the hospital and college facilities to provide clinical training to advanced students." (84)

Hopkins flourished and soon its former students, like the graduates of Leyden, or Padua, or Salerno of previous centuries, were spreading the Hopkins style of education to all parts of the country.

1.10 The Flexner Report.

The reform movement received support from the American Medical Association, which established a permanent committee, presently The Council on Medical Education. However, "publication by the Carnegie Foundation for the Advancement of Teaching in 1910 of Abraham Flexner's now classic study, 'Medical Education in the United States and Canada' is commonly cited as the beginning of the modern era..." (85)
For Flexner there was an urgent need to substitute scientific method for the empiricism which dominated medical education and practice. This was the essence of the reform.

For Flexner medical practice is wholly compatible with science.

"The main intellectual tool of the investigator is the working hypothesis. The scientist is confronted by a definite situation, he observes it for the purpose of taking in all the facts. These suggest to him a line of action. He constructs an hypothesis. Upon this he acts, and the practical outcome of his procedure refutes, confirms or modifies his theory. Between theory and fact his mind flies like a shuttle; and theory is helpful and important just to the degree in which it enables him to understand, relate and control phenomena. This is essentially the technique of research: wherein is it irrelevant to bedside practice? The physician, too, is confronted with a definite situation. He must seize its details, and only powers of observation trained in actual experimentation will enable him to do so. The patient's history, condition, symptoms form his data. Thereupon he too frames his working hypotheses, now called diagnosis. It suggests a line of action. Is he right or wrong? Has he actually amassed all the significant facts? Does his working hypotheses properly put them together? The sick man's progress is nature's comment and criticism. The professional competence of the physician is in proportion to his ability to heed the response which nature makes to his ministrations. The progress of science and scientific and intelligent practice of medicine employ, therefore exactly the same technique. To use it whether in investigation or in practice, the student must be trained in the positive exercise of his faculties. ... A professional habit definitely formed upon scientific method will convert every detail of his practicing experience into an additional factor in his effective education." (85)

From his recommendations emerged a model of medical education which consisted of a premedical period characterized by the study of physics, chemistry and biology. This would be followed by the medical period of fours years which, "for
purposes of convenience . . . may be divided into two parts, according as the work is carried on mainly in laboratories or mainly in a hospital." (86) However, the distinction between these two parts is superficial, since the hospital is a laboratory in the fullest sense of the word. The first two years of the medical curriculum are "... devoted mainly to laboratory sciences,-anatomy, physiology, pharmacology, pathology;" (87) whereas the last two years are devoted "... to clinical work in medicine, surgery and obstetrics." (88) During his two clinical years the student will learn medicine "... under the guidance and supervision of a knowledgeable physician responsible both for the care of the patient and the education of the student." (89)

During the first part of the medical curriculum the student will learn about normal and abnormal phenomena. During the second part the student will learn the practical treatment of these phenomena as manifested in disease. The laboratory sciences "... furnish indeed, the essential instrumental basis of medical education..." (90) but they are not sufficient for adequate medical practice: "... the instrumental minimum can hardly serve as the permanent professional minimum. It is even instrumentally inadequate." (91) This is because the medical practitioner deals with facts of two different categories. The laboratory sciences
prepare him to apprehend the data in one of these categories; but, "...he needs a different apperceptive and appreciative apparatus to deal with the other, more subtle elements. (95) Specific preparation for this apparatus is much more difficult than preparation to apprehend the data in the first category, "...one must rely on the requisite insight and sympathy, on a varied and enlarged cultural experience. (96)

1.11 Medical Education after the Flexner Report.

It seems that it could be justly said that the model of medical education propounded by Flexner synthesizes all the relevant insights since the time of Salerno, and, at least implicitly, it considers inadequate for the education of the physician the biomedical model associated with dualism.

In the decades that followed the publication of Flexner's report medical education in the United States and Canada and wherever their influence was felt, was redesigned following his suggestions. However, at present medical education in these countries faces a number of critical problems: 1. medical education has paid no attention to the self-learning process, exemplified by Paracelsus, "...which ultimately must become a leading objective of any educational programme." (97) The medical student has been given little chance to define the objectives
of his own education and pace himself toward their achievement. Instead, he has been forced to strive for the objectives defined by a committee and reach them within a prescribed timetable.

2. Medical schools have accepted to be dominated by an extremely restricted concept of science, particularly during the early years and this, "... has created a massive disillusionment both in many doctors and even in a large number of their patients." (98)

3. Medical schools have transformed what for Flexner was a superficial distinction, that between the laboratory sciences and the clinic, into a rigid scheme that forces the student to master before he begins his bedside training, "... a mass of fine detail which turns out to be, in the event, of depressingly little value." (99)

4. Medical curricula have failed to address the fact that "... the most fundamental question in medicine is why disease occurs rather than how it operates after it has occurred." Thus, in clinical teaching the focus is upon investigation of the disease, its pathogenesis, the way it is diagnosed, its clinical manifestation and treatment. While questions like: "... why is this patient ill? how effective is the treatment and what risks are associated with it? What advice and care are
needed by the patient and his family...?" are left unanswered. (100)

5. there has been a flagrant neglect toward providing the future physician with effective skills for interviewing. And, the student is allowed to graduate without the medical school having "... any knowledge at all about whether he is capable of establishing rapport and communication with human beings in physical and mental distress." (101) Such a capacity may be absent even in the clinical teachers. During the course of an investigation it was observed that "senior physicians" did not emphasize the approach to the patient or established with him an adequate relationship; they paid very little attention to "... individual and personal aspects of patients." (102) Most of the time that these physicians were observed was dedicated to the discussion of the patient's laboratory findings.

6. there has been no attempt to promote in the student the development of attitudes appropriate for medical practice. "Little if any emphasis is placed on the importance of an attitude of caring, both in medical students and medical graduates ... " (103) Some have insisted that curricula crush the idealism of many medical students and turn them into cynics. (104)
7. Medical schools have been concerned with teaching the student an enormous amount of fine details but have failed to teach him to use them effectively. "The end result is that the gap is progressively widening between the best that medicine can offer and what is actually available..." (105)

8. Medical education has neglected to teach students about the risks involved in treatments and about the effectiveness of these treatments. In general, these topics are infrequently discussed critically, "... and doctors complete their education with only vague ideas about the credentials of many of the tools they are expected to apply." (106)

9. Medical education has focused upon the ills of a minority of the people that are sick at any given time, and has not prepared physicians to deal with the health problems of the majority. "Probably the most serious deficiency in clinical teaching is in respect of the care needed by patients after completion of investigation and treatment. ... " (107) Among the patients that are neglected are all those who "... are not considered to provide scope for active measures and so are never seen in teaching hospitals." (108)
There are more problems than those listed above; However, if the ideas of Flexner are contrasted with them it seems obvious that "... the medical profession still has a long way to go before it evolves a system of education adequate to its social and scientific responsibilities." (109) But such an evolution will not come about if medical educators do not recognize and take into consideration the deficiencies of the Biomedical Model and take the time and make the effort to develop a more suitable foundation, one that appropriates the substantial unity of the human person and opens medical education toward its psychological and social dimensions. It may be that such a foundation can be provided by what has been called "Generalized Empirical Method." (110)

To be sure, medical educators are intelligent and have been aware of the deficiencies in their curricula and its graduates. Thus they have experimented and introduced many innovations into their schools; some of the outstanding are:

a. integrated curricula which attempt to bridge the chasm that has been constructed between the laboratory sciences and the clinic and lead the students into insight about the phenomena of life, health and disease from multiple perspectives and from different levels of organization. (111)
b. multidiscipline laboratories which break down the barriers that have been constructed between disciplines and permit the student to have experiences from the viewpoint of several of them simultaneously. (112)

c. early clinical experiences which permit the student to have contact with patients from the very beginning of their medical education. (113)

d. instructional modules which permit the school to adapt itself to different types of students, and permits them to proceed in different manners and at their own pace. (114)

e. the incorporation of a preventive viewpoint, related to the concept of the "Natural History of Disease" which makes it applicable at several levels. (115)

f. the incorporation of the social scientist and the social sciences into the design and implementation of the curriculum. (116)

During the incorporation of these innovations medical educators appropriated some of the resources developed in other areas of education. One of the most widely used is the definition of the objectives of the educational process in behavioral terms. "The need to state educational objectives came to be seen as necessary for proper education during the sixties." (117) An objective, in this sense, specifies the
intended outcome of the process in term of the student's behavior. It was soon accepted that "... only when educational objectives are specified is it possible to select the appropriate teaching methods and devise the relevant examinations and other assessment procedures." (118) It seems to be widely accepted that when such objectives are available students always know what is expected of them while, the faculty can always determine what they are expected to help the student to achieve. Also, it is always possible to evaluate the quality of the aims of the process and the appropriateness of the procedures being implemented to reach them. (119)

However, a number of problems have been associated with the definition of the objectives of medical curricula in behavioral terms. After an experience at their definition two educators published a report in which they state that the process is time consuming and expensive, while the product was not always understandable by the student, and "often the obvious has been belaboured and embellished to the point that relatively simple tasks become lost in complex descriptions." (120) In some cases the delineations are so extensive that many pages are required to describe the competencies which the student is expected to have acquired at the time of his graduation.
Another problem associated with the methods used in the definition of educational objectives is represented by their theoretical foundation. They are based upon a philosophical anthropology that conceives the human person to possess the faculty to develop competencies within three domains: cognitive, affective and psychomotor. But no arguments seem to have been advanced to support that these are in fact the domains in which the competencies of the students have to develop, nor has it been defended that the list of domains is exhaustive. (121)

As they are, one of the domains for which objectives must be defined has proved to be unwieldy. "A fourth area relating to the attitudes necessary for giving good patient care has been a difficult one for which to develop specific objectives. . . " (122) This was so although the curriculum committee felt that "... attitudes for effective and compassionate care are essential." (123)

As large as the problems in medical education are, new have arisen before the old ones were solved. One of these is the extraordinary increase in the number of research articles being published. Someone calculated that one new article appeared every 26 seconds. It is estimated that medical information doubles every ten years. (124) This situation
has created at least the following problems:

1. there is not a mechanism that assures that every discovery of worth is communicated as soon as possible to the entire medical community, above any language and geographical barriers.

2. there elapses a long time from the occurrence of a discovery to its incorporation into medical practice.

3. there is no absolute criterion to identify what, of all this information, should be taught to the student.

Medical educators have attempted to solve the last of these problems through the "Core Content Approach." Of this there seems to be no explicit definition, but it seems to refer to that part of medical information which is essential for sound medical practice. When guided by this concept the task of a curriculum committee would be as follows:

First. Identify the core content of medicine or of the discipline to be learned.

Second. State the core content in behavioral terms and make these the objectives of the learning process.

Third. Define the strategies to teach the objectives.

Fourth. Identify the resources necessary to execute the strategies.

Fifth. Define the process for the evaluation of learning.

(125)
However, this approach has not been free of controversy. "Claims of content irrelevancy, content overload, and even total uselessness are commonly directed . . . " (126) at those in charge of medical education.

In order to go beyond this controversy a technique for determining what students should learn was described. Known as the "Consensus Method" it is based on the assumption that in order to achieve a balanced and appropriate view of what the student should learn many individuals representing multiple backgrounds and viewpoints should participate in the process of curriculum definition. These individuals should include the appropriate specialists, general practitioners, medical educators, students, and "... even intelligent laymen." (127)

The Consensus Method has been used to define the core content of medical curricula, but there are at least three objections against its use:

a. it is time consuming. One group of educators who used it took one year to define the objectives of an internship program. (128)

b. there are no explicit criteria for identifying the contents that must be included in the core, even though they are implicit in the participant's choices.
c. the core content, though relevant at the moment that it is chosen, may become irrelevant rapidly, because of the research being published and ultimately lead to an outdated education unless it is kept under constant revision.

1.12 The Approach of Lawrence Weed.

Dr. L. Weed has taken the fundamental insight expressed in the Core Content Approach and developed it into a "Core of Behaviors." (129) In his article "A New Paradigm for Medical Education," in the section devoted to the new premises for it he states: "Old premise: A core of knowledge should be taught. New premise: A core of behaviors should be elicited. (130) The core consists of four behaviors which a physician is expected to demonstrate under any circumstances and independently of the changes that research and development may introduce into medical practice. They are: thoroughness, reliability, efficiency and sound analytical sense. When he relates his new premise to the structure of the medical curriculum he states that "the structure of the curriculum in which the student is educated should be representative and lead naturally to the structure in which he will eventually perform." (131)
Dr. Weed believes that if a student learns to perform the four behaviors in the core "... in 25 cases (for example), then with reasonable certainty, he will perform in this same competent manner in the 26th case, even though 26th case concerns a new and different content." (132) For him the fundamental goal of any educational program is to enable the student to become a lifelong learner. And the student can begin understanding medicine if he is provided the problems and the resources to solve them. "In so doing he is forced to pass from particular to general." (133)

Dr. Weed also believes that the educational system must not be dependent on memory. Thus, he suggests that "... time must be the variable between students of unequal background and abilities." (134) So, it seems that Dr. Weed considers that the core of behaviors can be mastered through a problem-based approach which would allow the student to proceed independently of his differences with the rest of the students and which would transform him into a lifelong learner.

Dr. Weed suggests, also, that the process toward mastery of the core of behaviors should allow the student to "... to see the whole of medicine before he begins to examine any of its parts." (135) And, when he has learned the details of
one of the parts the student "...must always make an attempt
to see the relations of this part to the whole." (135)

In his progress toward mastery of the core of behaviors with such a problem-based strategy the student will frequently be exposed to information "...which is not yet coupled to the whole of medicine." (136) This should always be clearly stated to him. In any case, "the students themselves are fantastic coupling agents." (137) Thus, if a curriculum were designed and implemented along the lines proposed by Dr. Weed the student would always know when he is learning something which has not yet been incorporated to the practice of medicine and the needs of society. However, it is probable that the student himself will accomplish the incorporation. If so, this would solve at least partially the problem created for medical education by the amount of research being published.

The Core of Behaviors proposed by Dr. Weed can easily be coupled to the Problem Oriented Medical Record, (POMR) a clinical information management system developed by Dr. Weed himself, which has rapidly gained widespread acceptance.(138)

Dr. Weed's proposal for a medical education based on premises that are new and different from the old does seem to
open the possibility of solving some of the problems encountered by present day medical education. The Core of Behaviors concept appears to be very powerful. However it is here argued that before it can be fully exploited it needs to be refined considering that:

1. No rule has been defined by Weed that would permit us to accept or reject as elements of the set Core of Behaviors any other behaviors than those proposed by him.

2. Although the behaviors included in the Core appear to be complete, no argument has been advanced to demonstrate that in fact the core is complete.

3. The thinking of a physician has a certain logical structure and the core has not been demonstrated to contain it.

4. To date no more than naive arguments have been advanced to demonstrate that the four behaviors in the core in fact result in a scientific medical practice.

5. The behaviors in the core have not been expressed in the grammar of current educational practice so that their achievement may be verified and evaluated.

6. The behaviors in the core have not been rigorously related to a teaching strategy.

7. The argument about how the behaviors in the Core could be taught and evaluated could be strengthened.
2. THE OBJECTIVE OF THE DISSERTATION.

The objective of this dissertation is to exploit Dr. Weed's Core of Behaviors insight; it has as its background the development of medical education from Salerno to Johns Hopkins and Flexner.

Specifically, the objective of the dissertation is to develop the general structure of an undergraduate medical curriculum following a Core of Behaviors approach. First, a rule to obtain the behaviors in the core will be identified. Second, the list of the behaviors in the core will be produced by the application of the rule. Third, it will be argued that the list of behaviors and therefore, the core, is complete. Fourth, it will be argued that the behaviors in the core defined with the rule contain the entire logic of medical thinking. Fifth, an argument will be advanced with the intention of defending that in fact the behaviors identified by the application of the rule are isomorphic with scientific method and lead to scientific medical practice. Sixth, the behaviors in the core will be expressed in the grammar of current educational practice. Seventh, the manner in which they can be taught and evaluated will be discussed. Eighth and finally, it will be discussed the scientific validity and desireability of such curricula to medical education and practice, and to flexnerian education.
3. THE METHOD TO REACH THE OBJECTIVE OF THE DISSERTATION.

In the introduction to his book "Insight: a study of human understanding," Lonergan stated:

"Thoroughly understand what it is to understand and not only will you understand the broad lines of all there is to be understood but also you will possess a fixed base, an invariant pattern opening upon all further developments of understanding." (139)

This could be restated as follows:

thoroughly understand what it is to understand as a physician, and not only will you understand the broad lines of all there is to be understood in medicine but also you will possess a fixed base, an invariant pattern of operations which are the operations of the mind of the physician, opening upon all further developments in medicine.

In order to reach its objective this dissertation will:

1. Explore a definition of "physician" in order to move toward the discovery of the basic operations of his mind, the operations through which he understands as a physician.

2. Obtain from the operations of the mind of the physician the rule or rules that will permit, through their application, the identification of the core of behaviors that must be taught to and learned by the
medical student; then obtain, with the rule or rules, a first approximation to the core.

3. Develop the definition of the basic operations of the mind of the physician, then obtain a second approximation to the core.

4. Explore the logic of the operations of the mind of the physician, and argue that the behaviors in the core obtained contain all of the logic.

5. Relate the operations of the mind of the physician to scientific method, and argue that the behaviors in the core lead to scientific medical practice.

6. Insert the operations of the mind of the physician into the horizon of modern medicine and the structure of the human good in order to have the elements necessary to express the educational objectives.

7. Express the operations of the mind of the physician in accordance with current educational practice.

8. Describe the strategies for teaching and learning the Core of Behaviors, and the resources necessary for these activities.

9. Describe the strategy that may be used to evaluate the learning of the behaviors in the Core.

10. Critique the curriculum developed following the Core of Behaviors approach in terms of the theory upon which it is constructed, its validity, its desirability for
education and practice.

11. relate the curriculum developed to the essentials of flexnerian medical education.

12. describe, briefly, some of the investigations that would have to be made if the curriculum proposed were implemented.
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CHAPTER II

THE RULE THAT OPERATES IN THE MIND OF THE PHYSICIAN

2.1 The Definition.
2.2 The Doctor-Patient Relation.
2.3 Arriving at the Diagnosis.
2.4 Discovering the Person-inside-the-object.
2.5 Toward the Rule.
2.6 The operations of the Mind of the Physician.
2.7 The Mind as a Dynamic Structure.
2.8 The Mind and the Patterns of Experience.
2.9 The Rule that Operates in the Mind of the Physician.
CHAPTER TWO

THE RULE THAT OPERATES IN THE MIND OF THE PHYSICIAN

2.1 The Definition.

According to Dr. Phillip Tumulty,

a clinician is one whose prime function is to manage a sick person with the purpose of alleviating the total impact of his illness. The multifocal character of the impact of the illness upon the patient and his family is stressed. Clinical evidence is the material with which the physician works, and a meticulous history and physical examination are paramount. The availability of specific forms of therapy requires a physician to be more of a scientist and, at the same time, more expert in clinical methods. Ability to listen and to talk, so that valid clinical evidence is gathered, anxieties are dissipated, and understanding and motivation are instilled are the clinician's greatest assets. (1)

If the word "physician" substitutes the word "clinician" in Tumulty's definition, and to the definition is added the preventive viewpoint, as it has been included in his model by Smilkstein, for example (2), the following is obtained:

A physician is one whose prime function is the management of a person and the health resources available to him with the purpose of preventing disease, and when disease presents itself, alleviating its total impact. The multicausality and its multifocal impact upon the person and his family are stressed...

If now the four behaviors in the Core defined by Dr. Weed are added to the definition, the following is the result:

A physician is one whose prime function is the efficient management of a person and the health resources available
to him with the purpose of preventing disease, and when
disease presents itself, alleviating its total impact. The
multicausality of disease and its multifocal impact upon
the person and his family are stressed. Clinical evidence
is the material with which the physician works, and a
thorough and reliable history and physical examination are
paramount. The availability of specific forms of
prevention at the different levels that this can be done
requires a physician to be more a scientist and to use
sound analytical sense and to be reliable in the methods
that he uses. Ability to listen and to talk, so that valid
evidence is gathered, anxieties dissipated and
understanding and motivation are instilled are the
physician's greatest assets. (3)

2.2 The Doctor-Patient Relation.

The physician that attempts to fulfill his prime function
as defined above has to establish a relation with his patient
that is both dual and helping.

Because of its intention, form and content, a human
relation may adopt any of an indefinite number of modalities;
at the limit it may be either an objectivizing relation or an
interpersonal relation. (4) "... an objectivizing relation
is one in which one of the two humans bound by it tries to
transform the other into a pure object; even more so when it
is both of them that treat each other with such intention." (5) An interpersonal relation exists between two humans when
"... he and I consider and treat each other as beings to
whose individual realities belong life, intimacy,
intelligence and the capacity to appropriate." (6)
A personal relation may be either full of love or full of hate. When the two persons are bound by hate, either one or both pretends to dominate the other "... and in the ultimate to destroy from its very roots the freedom of the other." (7) But when the two are bound by love they move toward each other with acts of giving, acts of growth. These two have become a dyad. (8)

The dyad is contrasted with the duo. The duo is made up of two persons who are bound by an objectivizing relation in order to attain a goal which is accidental and external to both of them. (10)

However, the relation between the physician and his patient can neither be dual nor dyadic. It cannot be dual because its prime function is to prevent and alleviate the total impact of illness, possible or actual. For in doing so the physician helps the patient to maintain or regain his health, a status which seems to be a condition for the exercise of his freedom and his intimacy. But the relation cannot be dyadic because in order to gather the clinical evidence in which he will discover the nature of the illness, the physician objectivizes the patient. "The medical relation is a quasi-dyadic helping cooperation ordered toward the attainment of the psychosomatic status we call health." (11)
It is called quasi-dyadic because it pivots between the dual and the dyadic. The physician studies an object through the interrogation, physical examination and the laboratory in order to arrive at a diagnosis. He has to manipulate and order the object around in order to administer the treatment. But, in the ideal case, the physician discovers the person inside the object, and he also discovers its family and motivates them and leads them toward understanding, and obtains their collaboration so that together they may work toward the success of the prescribed treatment.

In fact, since classical antiquity it was recognized that the good physician was bound to his patient by philia iatrike: the love proper to the physician which is as the love of one friend to another. Ever since then, "when the medical relation is what it has to be, love is the bond that unites the healer and the person," (12)

2.3 Arriving at the Diagnosis.

When the physician has arrived at the diagnosis of the illness, probable or actual, that afflicts the patient, he has identified a problem whose nature varies with the medical specialty that he practices. In general practice, for instance, the person visits the physician usually early in the development of the problem, when it is latent or indifferentiated; the person may be of any age or sex. In a
person like this the general practitioner encounters a "macroworld" in which the number of illnesses that could be dealt with are enormous. Nevertheless in a very short time the physician reduces the possibilities to a very small number. (13)

The physician accomplishes this feat in spite of the fact that his memory is finite, its computation capacity limited, that in the medical literature it is unusual that the frequency with which certain signs and symptoms appear together as a manifestation of a given entity be published, and the fact that medical information is organized around diseases whereas the patient presents him with data organized around the subjective appreciation of his problems. (14)

This task is accomplished by the physician following a strategy that is comparative and deductive. (15) In it a very important role is played by the early emergence of vague hypotheses, the identification of signs and symptoms that function as a "pivot," and the intentional search for data that confirm or invalidate the hypotheses. (16) The hypotheses are thought of well before the physician has gathered all of the data about the patient. "Rather than progressively and systematically converging on a formulation
of a problem through a series of constraining questions, the experienced physician appears to go directly to a small number of provisional hypotheses very early in the encounter with the patient. These provisional hypotheses are created as a function of the physician's "...background knowledge of medicine, including his range of specific experiences, in conjunction with the problematic elements which he recognized in the early stages of the encounter with the patient. (17)

2.4 Discovering the Person-inside-the-Object.

Through the diagnostic process the physician discovers an object, but it is an object within his own horizon. But when the physician discovers the person-inside-the-object, the patients as a subject, the physician enters an horizon entirely different from his. He begins to grasp the present state of development of the patient and his family, and the possibilities that it holds; the feelings that move them to concrete action, the values that the feelings reveal; the beliefs that they hold; the habitual understandings that they have. And he grasps the capacity of the patient and his family to move toward new feelings, values, beliefs, understandings.

Thus, the physician that has established a quasi-dyadic relation with the patient not only knows the nature of the
disease to be prevented or treated; he also knows the feelings which the illness has aroused in the patient and his family, the manner in which these feelings are related to his seeking and accepting medical assistance; knows what the patient and his family value and its relation to the illness; knows what the patient and his family believe about his illness and the treatment being administered; and knows about the capacity that the patient and his family have to change their behaviors, feelings, values, and understandings, so that the physician's intervention may be successful.

2.5 Toward the Rule that operates in the Mind of the Physician.

If the description above is correct, it seems that the physician will fulfill his prime function only if he:

1. attends to all of the data available to him about the person whom he will provide care, the family of the person and the specific forms of prevention and treatment.

2. understands all of the data available about the person his family and the specific forms of prevention and treatment. And in this understanding the multicausality of the disease and its multifocal impact are included.
3. judges his understanding to be correct only after critically analyzing the relationship between the data available and the particular manner in which the data have been understood, and deciding that his understanding can be verified in the data.

4. acts responsibly, that is, in congruence with the judgement that he has made about the correctness of his understanding and uses efficiently the resources available.

5. acts in a loving, quasi-dyadic manner, so that anxiety about possible or actual illness and its multifocal impact are dissipated from the person and his family, and understanding and motivation are instilled into them.

But a person who attends to all the data available is being attentive; and if he understands it all he is being intelligent; and if he judges critically upon the correctness of his understanding and decides that his understanding can be verified in the data available is being rational; and if he acts efficiently and in congruence with what he has understood correctly he is being responsible; and if he is acting concerned with preventing and alleviating the impact of an illness in a quasi-dyadic manner he is being in love. Thus, it may be concluded that what the physician does in
order to fulfill his prime function is ruled by the following imperatives: be attentive, be intelligent, be rational, be responsible, be in love.

The origin of this rule, that is the origin of the imperatives, is to be found in the self-organizing structure of the interiority of any human being. The study of this structure has been one of the central concerns of modern philosophers, Kant, Hegel, Dilthey amongst them, and more recently, Lonergan. (19) It is proposed in this dissertation that these five imperatives are the rule that will permit us to identify the behaviors in the Core that must be taught to the medical student. And in line with this, it is also proposed that the four behaviors in the Core advanced by Dr. Weed: thoroughness, efficiency, reliability and sound analytical sense, can be substituted by the noun associated with the five imperatives: attentiveness, intelligence, rationality, responsibility and love.

2.6 The Operations of the Mind of the Physician.

A physician is able to act attentively, intelligently, rationally, responsibly and lovingly only because he can see, hear, touch, smell, taste, inquire, imagine, understand, conceive, reflect, marshal and weigh evidence, judge, deliberate, evaluate, decide, speak, write, manipulate. But
these operations, as has been stated by Lonergan, are those of a formally dynamic structure (20).

The physician as a formally dynamic structure is open toward the universe of medicine and his patients. All of the operations of his mind are transitive in a grammatical and a psychological sense. Through them the physician becomes aware of an object, of the person-inside-the-object, and of the family of the object. Behind them is the intention to know the object about which data are attended, the data understood, the understanding judged, the action decided, all while being in love.

The formally and dynamically structured interiority of the person is the operator that produces the operations called attentiveness, intelligence, rationality, responsibility and love. The operator, the physician in this case, is named the subject. He is the subject of the operations in a grammatical and in a psychological sense, for his operations are conscious. Through them the physician is aware of himself operating and of the intention of each operation. The awareness of himself changes with each operation. None of the operations can be performed in dreamless sleep or in coma.
The quality of the consciousness of the operating physician moves through different levels:

1. There is an empirical level in which the physician senses, perceives, imagines about the patient, speaks to him, writes about him, manipulates him.

2. There is an intelligent level in which the physician inquires, understands and follows through his ideas about the possible illnesses that may affect his patient, their multicausal and multifocal impact, and their prevention and treatment to their logical conclusion.

3. There is a rational level in which the physician who has understood now wants to understand correctly. Thus he reflects upon his understanding about the patient and his illnesses, their multicausal and multifocal impact and how their impact may be prevented or treated. So, he marshalls and weighs the evidence for his concrete understanding in the data available to him, only to pass judgement upon its correctness.

4. There is a responsible level in which the physician is concerned about the possible courses of action through which he may prevent or alleviate the multifocal impact of the illness upon the patient and his family. Thus, he deliberates, evaluates and decides upon one of them.
5. there is a level of love in which the physician knows when to talk, when to listen, what to say and what to do in order to dissipate all anxieties and instill understanding and motivation in the patient and his family. (21)

Each of the levels of consciousness of the mind of the physician, as the levels of the mind of any human being, has its own intention. (22) The intention of the mind at the empirical level is the data about the patient, his family, the resources for preventing and alleviating the total impact of the illness. The intention of the mind at the level of intelligence is the understanding of the data available. The intention of the mind at the rational level is the judgement on the correctness of the understanding of the data. The intention of the mind at the level of responsibility is the decision to act congruently with correct understanding. The intention of the mind of the physician at the level of love is the establishment of the appropriate, quasi-dyadic relation with the patient.

2.7 The Mind of the Physician as a Formally Dynamic Structure.

The structure of the mind of the physician as the operator which moves through the levels of consciousness that have
been identified is called "formally dynamic" because it is self assembling, self constituting. It puts itself together, one part summoning the next, until the whole is reached. And this occurs not with the blindness of natural process, but consciously, intelligently, rationally. Experience stimulates inquiry, and inquiry is intelligence bringing itself to act; it leads from experience through imagination to insight, and from insight to the concepts that combine in single objects both what has been grasped by insight and what in experience or imagination is relevant to the insight. In turn concepts stimulate reflection, and reflection is the conscious exigence of rationality; it marshalls the evidence and weighs it either to judge or else to doubt and so renew the inquiry." (23)

The judgement brings forth the need to be congruent with oneself and to act as one has judged. Thus the physician is moved to make the responsible decision. And, as the responsible decision is to act for the patient as person, the physician is in love.

So, the experience of encountering the patient and his family stimulate the physician to inquire about illnesses, possible or actual, and the specific forms through which its impact may be prevented or alleviated; experience calls into act the intelligence of the physician. And, intelligence in act is led from the experience through imagination to insight about specific illnesses, possible or actual, and specific forms of prevention; and from such insight it is led into the concepts, diagnoses and treatments that combine in a single object what has been grasped by insight and what in the data of the encounter or in the imagination of the physician is
relevant to the insight. In turn, concepts stimulate reflection, and reflection is the conscious emergence of the rationality of the physician which will be satisfied only with the arrival at the correct diagnoses or the appropriate measures of prevention or treatment; and which continues inquiring and searching for correct understanding until it is encountered. So, rationality marshalls and weighs the evidence and judges on the correctness of the diagnosis and treatment. And the judgement moves the physician to the appropriate action, the action that is responsible, and in this case it is responsible to relate to the patient in a quasi dyadic manner, so the physician is moved to philia iatrike, to love and be concerned about the patient and his family.

2.8 The Mind of the Physician and the Patterns of Experience.

   The subject is not only a formally dynamic structure, who executes operations that correspond to different levels of consciousness, and each level of consciousness has its unique intention. The subject also is certain concerns that pattern his experience. (24)

   When the subject is concerned with mere survival and reproduction, he will consider as relevant the experiences
that produce the data necessary to have the understandings that are appropriate, the judgements upon those understandings and the actions that are congruent with them. This concern patterns his experience biologically.

After survival has been assured, the subject may amuse himself, or play, or even search for beauty. Now he is in the esthetic pattern of experience, and the relevant data, understandings, judgements, decisions are those that permit him to play, to amuse himself, to find beauty.

Beyond survival and play the subject discovers that he wants to know the universe as it is, and himself as he is. When under this concern the subject will consider as relevant all data, insights, judgements and decisions that put things in relation to each other, not to self; that permit him to construct theories about how things might be. This concern results in an intellectual pattern of experience.

Ultimately, beyond survival, play, theory, the subject becomes concerned about how he is to orient himself in his world, about what he is to make with himself, about what he is to do with his life. This relates him to the values that he wants to incarnate and will consider as relevant all data, understandings, judgements and decisions that will permit him
this incarnation. This concern results in a dramatic pattern of experience.

But the mind of the physician, as it deals with the patient, does not confine itself to any single pattern of awareness. The physician may be concerned about the fees with which he will assure his income, biologic pattern of experience, or may be concerned with the extraordinary amusement provided by the search for a cause unknown, aesthetic pattern of experience, but in the ideal case, the physician is in the intellectual and the dramatic patterns of experience. The mind of the physician is in the intellectual pattern of experience in so far as he is relating to an object from which data are to be gathered, understood, judged. The mind of the physician is in the dramatic pattern of experience in so far as he wants to be a good physician for his patient, a physician truly concerned with the good of his patient.

2.9 The Rule that Operates in the Mind of the Physician.

The first step in the method to reach the objective of this dissertation has been taken. Beginning with a definition of "physician" a rule has been discovered which when applied
will permit the identification of the behaviors in the Core of Behaviors that would be taught to medical students in order to exploit fully the concept of Dr. Weed.

The rule has been defined heuristically: it is that which spontaneously makes the physician the exigence to be attentive, be intelligent, be rational, be responsible, be in love.
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CHAPTER III

THE CORE OF BEHAVIORS OF THE PHYSICIAN

3.1 The First Approximation to the Core.

3.2 The Second Approximation to the Core.

3.3 Summary.
CHAPTER TWO

3.1 The First Approximation to the Core of Behaviors.

In the previous chapter it was argued that a physician will not fulfill his prime function unless he:

a. attends to all the data available to him about the patient to whom he will provide care, the family of the patient and the specific forms of prevention and treatment. In making this data available to him a paramount role is played by the history and the physical examination; they must be thorough and reliable.

b. understands all of the data available about the patient and his family, and about the specific forms of prevention and treatment. In this understanding the multicausal and multifocal impact of the illness are included.

c. judges his understanding to be correct only after critically analysing the relation between the data available and his understanding to assure himself that his understanding is verifiable in the data.
d. acts responsibly, that is, in congruence with his correct understanding, and uses efficiently the resources available to him to prevent and treat the multifocal impact of the illness upon the person and his family.

e. acts in a loving, quasi-dyadic manner, so that anxiety about the illness, possible or actual, may be dissipated from the patient and his family, and understanding and motivation are instilled into them.

It was said, also, that these behaviors are the result of the operation of a rule, and that the operator is a cognitional, formally dynamic structure. The rule manifests itself through the imperatives be attentive, be intelligent, be rational, be responsible, be in love, that spontaneously emerge in the mind of the physician. Each of the imperatives represents a level of awareness that has its unique intention. And the consciousness itself is patterned by the concerns of the physician.

The entire argument rests on the Cognitional Theory developed by B. Lonergan. It must be said that Lonergan believes that his theory is empirically grounded. Yet, it is necessary to see if the argument has empirical support other than the one provided by him.
Barrows et al. have published a number of extensive papers whose synthesis is that the physician uses his clinical skills for interrogation and the physical diagnosis of the patient, and thereby produces information from which a set of problems is distilled. The problems distilled from the data are fed back upon the clinical skills which now are used upon the patient to produce more information. From this new information further problems are distilled, and the feedback continues until there is an adequate formulation of the problem and this is followed by the management of the patient. (2, 3, 4)

If the findings of Barrows et al. are related to the argument that was based on Lonergan's Cognitional Theory, it would seem that the production of information corresponds to the level of attentiveness. The process of problem distillation corresponds to the level of intelligence. The process of problem formulation corresponds to the level of rationality. And the process of patient management corresponds to the level of responsibility. The only level of awareness which is not easy to find is love. Yet, Lonergan himself did not mention it until his later lectures without having had time to make a formal publication about it.
The ideas of Barrows and coworkers seem to be in agreement with those of other investigators. Thus, Elstein et al. found that the patient work up used by physicians "... has features designed to reduce the likelihood of premature incorrect commitments." (5) The performance of these standard procedures assures the physician "... that he will not inadvertently ask only those questions that tend to confirm a favorite hypothesis." (6) He will, in fact, "... ask a series of questions which afford a fair and adequate opportunity to disconfirm a favorite hypothesis." (7) These questions that are asked toward the later part of the interview "... provide an opportunity for facts to emerge which could lead to hypothesis other than the preliminary ones." (8) In all of these operations it seems that the physician is not only being loyal to the imperatives, but implicit in them is the fact that one may not rationally judge to know the truth if one has not thought the different alternatives to be so affirmed; and one does not think of all the alternatives that could be affirmed if one does not have all the relevant data.

Eddy and Clanton analyzed "... the psychological process by which physicians solve complicated diagnostic problems." (9) Their findings suggest that "... the following six steps are taken to arrive at a diagnosis: aggregation of
groups of findings into patterns, selection of a 'pivot' or key finding, generation of a cause list, pruning the cause list, selection of the diagnosis, and validation of the diagnosis." (10) It seems that in this description, too, is to be found the process from attentiveness, aggregation of findings into patterns, to intelligence, generation of a cause list and pruning it to select the diagnosis, and from intelligence to rationality, selection of a diagnosis and its validation. In their study there was no possibility to observe the movement from rationality to responsibility since their material consisted of the dialogues of physicians as they were solving clinicopathological exercises.

It must be mentioned that the work of the investigators cited above also seems to be congruent with and supported by the work of others, like Simon and Newell, who have studied human problem solving. (11)

The work of all of these researchers supports the occurrence of what have been called levels of consciousness. That there exists such a thing as the Cognition Formally Dynamic structure that is the operator of these levels of awareness in physicians seems to be supported by the work of Rimoldi who found "the existence of patterns of performance that become sharper as levels of experience and training
increase, and that seem to transcend local differences in medical schools." (12) Performance would not be patterned, nor would these patterns transcend differences in medical schools if behind them there were not an operating structure.

Yet, before attempting a second approximation to the definition of the behaviors in the Core it seems prudent to analyze some of the publications quoted above in greater detail.

Barrows, Norman, Newfeld and Feightner made a study in which the subjects that participated consisted of eighteen family physicians and nineteen general internists. The participants were chosen at random from an academy of medicine and were asked to examine one of four randomly assigned patients which were presented to them by a patient simulator that had been trained carefully, so that his presentation would be invariant. The encounter with this simulated patient took place in an examination room which allowed for one way observation and videotaping. The cases simulated were taken from actual patient histories. The encounter was observed by two persons, one of them a clinician who was asked to write his ideas as to what the physician solving the simulation may be thinking. The observations of this clinician were later compared with those
to the subject about his own thinking. The second observer recorded the interpersonal relationship behaviors between the physician and the simulated patient. (13)

At the end of the encounter the consulting physician was asked to register the patient record. Immediately afterward this physician reviewed the videotape of the encounter, while being asked questions about his thinking process by the observing clinician. When he expressed diagnostic hypotheses he was asked to rank them and whether they had changed during the encounter. The videotape was stopped whenever it seemed appropriate. The significant points brought out by the playback were dictated by the second observer. A third observer dictated the actions of the physician on history and physical examination as they were seen in the videotape. All of the observations were coordinated with a timer, and transcribed. The transcription was given to the physician within 48 hours of the encounter and he was asked to rate the effect that the information gathered from the patient had in supporting the various hypotheses he was considering about the patient's problems. The physician was also asked to decide whether each question and physical examination maneuver was routinely performed on every patient or was performed in this particular patient in order to distill the hypotheses. (14)
When Barrows et al. analyzed their data they discovered that physicians spent 57% of the time of the encounter with the patient in taking the history, 12% in the physical examination and 21% in activity that combines history taking and physical examination. The remaining 10% of the time with the patient was spent in activities related to the education of the patient and to the discussion of the plans for treatment and management. (15)

They also discovered that multiple hypotheses are "... a central feature of the physician's thinking. The first hypothesis is advanced, on the average, within 28 seconds ..." (16) And, while describing what they call "The Anatomy of the Encounter," they say: "In the initial quarter of the interview the physician has created nearly all of his hypotheses about the patient's problem. Halfway into the encounter he has asked sixty-seven percent of his questions and elicited seventy-four percent of the significant findings. The last half is devoted to the physical examination, management concerns and improving patient rapport." (17)

When Barrows et al. discuss their findings they conclude that "at the very beginning of the encounter with a patient, the physician is sensitive to verbal and non-verbal cues from
the patient." (18) He is obviously very attentive in order to
gather all the data about the patient for whom he will
provide care. That he is in fact attending to all of the data
seems to be confirmed by the following statement: "In some
cases he is influenced by prior information such as referral
notes or comments from the office nurse." (19)

The fact that the first hypothesis about the nature of the
problem of the patient appears very early in the encounter is
very striking. "... it would appear that this generation
results from a pattern recognition process in which the
initial clues from the patient are matched with similar
instances from the physician's prior knowledge and
experience." (20)

However, not only does the first hypothesis appear very
early in the encounter, an hypothesis which signals the shift
into the intellectual level of awareness, but after the first
comes a multitude, "... to explain or encompass the
possibilities suggested by his concept of the patient problem
that was synthesized from the initial cues." (21) This
multitude seems to "... prevent the clinician from
prematurely closing on an acceptable but possibly incorrect
diagnostic conclusion." (22) This maintains the physician
in track toward the shift from the intelligent into the
rational level of awareness. It prevents him from irrationally accepting a diagnosis which cannot yet be supported by the available data.

Elstein et al. found that after generating this multitude of hypotheses, a physician ranks them according with several criteria: probability, seriousness, treatability and novelty. (23)

When a physician ranks the hypotheses that he is entertaining according with their probability he makes an estimate about the likelihood that a particular disease may be the cause of the problem presented by the patient. When he ranks the hypotheses according with their seriousness, those diseases which are life-threatening or incapacitating are placed higher than those which are not. When he ranks the hypotheses according to their treatability he places higher those diseases that are treatable although they may be as equally serious as the ones placed lower. And when he ranks the hypotheses according to their novelty he seems to be protecting himself from the "... premature closure on a more generally probable hypothesis which in a particular case might be in error." (24)

The hypotheses of the experienced clinician are found to be vague and non-specific. The vagueness and non-specificity
work similarly to the "novelty" principle when rank-ordering the hypotheses. They allow the physician to "... capture data that would not be seen as relevant to more specific or focused hypotheses." (25) Using these vague and non-specific hypotheses the physician gathers more data than he would if his hypotheses were clear and specific. Barrows et al found that "... each question that he asks usually relates to at least 2 or 3 hypotheses in his attempt to verify, refine or rank their likelihood or priority." (26)

As the physician continues the search for all of the available data, he uses non-routine questions related to his hypotheses and routine questions when he wants "... to scan for more cues that may produce new hypotheses,..." (27) because his search is now unproductive. These routine questions basically review the systems and gather the patient's background data. These questions have a low utility for the actual problem solving process, but "... are also used to give the physician time to ponder about the patient's problems and his next moves..." (28)

Yet, as already mentioned, at least 10% of the time of the encounter is devoted to educating the patient, discussing the treatment with him and increasing rapport. Thus, the physicians studied by Barrows et al. were also being
responsible and moving toward a quasi-dyadic relation with the simulated patient: moving toward the level of love.

It is also interesting to review in greater detail the publication of Eddy and Clanton already cited. As mentioned, they discovered that when a physician is solving a clinicopathological exercise he aggregates groups of findings into patterns, selects a "pivot" or key finding, generates a cause list, prunes the cause list, selects a diagnosis and validates the diagnosis. (29)

Aggregation is one of the "... most important cognitive steps taken to arrive at a differential diagnosis." (30) It reveals how the physician has integrated the elementary findings and condensed the data available into a manageable volume. A discussant studied by them integrated into the following aggregation of findings a 1500 word description with more than 200 elementary findings: "This 60-year-old woman with a history of heavy smoking had respiratory failure 10 days after the onset of symptoms of a respiratory infection. Severe hypoxia was associated with a dry cough and patchy bilateral pulmonary infiltrates and was followed by obtundation, clinical and laboratory evidence of a coagulopathy and additional organ system complications." (31)
Aggregation is possible because there is a hierarchical structure to the facts of any medical case. "By focusing on higher and higher levels of abstraction through aggregation, the physician captures the important features of the case with fewer and fewer labels." (32) The facts that have been aggregated usually involve a clinical pattern for which a definite and unambiguous explanation will be apparent.

After the physician has aggregated the facts he has to select the diseases that explain the aggregates and the remaining elementary findings. The physician now moves to a list of causes. To identify the causes in the list most discussants used a simple heuristic device: they selected one or two clinical findings, focused on it, and temporarily ignored the rest. "We call this the selection of a pivot." (33) One of the discussants said: "One of the most striking features of the radiologic findings is the prominence of the central pulmonary arteries, which brings up a differential diagnosis that merits consideration." (34) The selection of the pivot simplifies the task the physician is trying to accomplish because instead of "... trying to remember and analyze all the aggregate findings of the case, the physician need only think about one-one that the physician has personally chosen" (35)
After selecting the pivot the physician ignores all other data temporarily and "... concentrates on compiling a list of diseases that could have caused the pivot." (36) This seems to be a relatively simple task, "... equivalent to listing the differential diagnosis of an uncomplicated sign or symptom that the discussant knows well." (37) Thus, one discussant that had selected a pulmonary density on an x-ray film as the pivot then said: "The differential diagnosis involves consideration of five categories of pulmonary densities—those of traumatic origin, congenital lesions, tumors, malignant or benign, areas of infarction and infections." (38) Thus, by the use of the pivot the physician does not have to explain all of the aggregate findings. "This heuristic device also obviates the need for explicit probabilistic reasoning; the discussant is not concerned with the probability of any disease on the list, only with the fact that it could have caused the pivot." (39)

The next step that the physician takes is the pruning of the cause list. What he does is "... to inspect the diseases on the cause list one at a time and measure them against the findings of the case, noting both the presence and absence of critical findings." (40) Because of the role that the pivot has played in the definition of the list of causes, most diseases will not be likely explanations of the
case. In the case with the pulmonary density that was mentioned above, a congenital lesion was included in the cause list because of the pivot selected, but then it was immediately rejected: "I shall rule out traumatic and congenital lesions on the basis of the history and the normal x-ray films a short time before this illness." (41) The task of pruning the list is relatively simple. "The physician focuses on one possible diagnosis at a time, comparing one by one the patient's findings with the signs and symptoms that characterize the diseases, again taking advantage of the fact that most medical knowledge is stored according to disease." (42)

The manner in which the physician prunes the cause list allows him to bypass the problem of estimating probabilities. While pruning the cause list the physician is searching for the most probable diagnosis. "But rather than try to estimate the probability that the patient has a particular disease, the physician merely has to determine whether the pattern of findings in the case could have been caused by the disease under consideration." (43) What the physician is doing at this moment "... is a comparison rather than a calculation, and it uses knowledge of the characteristics of diseases instead of requiring estimation of the probabilities of a disease, given the findings." (44)
When the physician has finished pruning the list he has to select a clinical diagnosis. In order to make this selection, at least during the clinicopathological exercise, what he does is "... to take the diseases two at a time and compare the ability of each to explain the case. The diagnosis with the characteristic features that most closely match the patient's findings is retained, whereas the other is eliminated. A discussant said: "... the enlarging lymph nodes and spleen suggest the diagnosis of lymphoma and not leukemia." (45)

Eddy and Clanton argue that the heuristic devise of comparing diseases, two at a time, is theoretically correct. "If one always chooses the more likely of two diseases in these comparisons, the winner will inevitably be the most probable disease." (46) This approach is beautiful and powerful since it allows the selection of the most probable disease without requiring the physician to calculate a single probability. And the discussant chooses the most probable cause without having to think about more than two diseases at the time. "And each comparison is performed by matching the characteristics of diseases, which is the way most medical information is learned." (47)

The pruning of the cause list and the selection of a clinical diagnosis have excluded any unlikely candidates to
the final diagnosis. Now the physician must consider whether the final diagnosis can explain all the findings of the case. Having derived the diagnosis that was selected solely from the pivot it is possible that it may not explain all of the findings. "This final step provides a review of the selected diagnosis for completeness." (48) Thus, one discussant said: "Before accepting that diagnosis I must ask two questions. Are there atypical features or discordant facts? Should other diagnoses be considered? (49) When the final diagnosis does not explain all the important facts, the discussant "... may then repeat the entire process, using one of the unexplained findings as a new pivot to identify a second or third diagnosis." (50) And when none of the unexplained findings can be used satisfactorily as a pivot an attempt is made to dismiss it. "The events during laparotomy... are puzzling but do not contradict the diagnosis of a dissecting aneurysm." (51)

Again, in these findings reported by Eddy and Clanton seems to be evident the movement of the physicians mind from attentiveness, to intelligence, to rationality. This movement is accomplished through a strategy in which the problem to be solved is recast in a form that uses one of the most effective mental skills of the physician: that of comparing patterns. The comparison of patterns together with the fact,
reported elsewhere, that the physician, early in the interview recalls similar patterns that he has encountered before make for an extraordinarily powerful technique. (52) Since similar patterns are similarly understood, a pattern which the physician discovers in the case before him cannot but be understood similarly to the similar case that he has just recalled. In their investigation, as already mentioned, it was not possible to capture the physician moving toward responsibility and love.

3.2 The second approximation to the core of behaviors. The literature reviewed above seems to confirm that attentiveness, intelligence, rationality, responsibility and love are, in fact, empirically verified behaviors of physicians. Thus, the argument that they be considered the behaviors in the Core of Behaviors that should be taught to medical students has a twofold basis: the Cognition Theory of Bernard Lonergan, which is verifiable through a self attentive methodology, and in the findings of experiments that use methodologies closer to the habitual.

However, it seems that attentiveness, intelligence, rationality, responsibility and love, the behaviors identified in the first approximation to the Core can be refined, thus resulting in a second approximation.
If the discrete behaviors of the physician which are evident in the literature mentioned are arranged in a sequence that resembles that in which they would be displayed during the encounter with the patient the result would be as follows: the physician,

1. meets the patient.
2. establishes and maintains rapport.
3. obtains the initial data.
4. imagines that a problem exists.
5. decides that a problem exists.
6. recalls similar situations and recognizes patterns.
7. develops initial problem statements.
8. identifies data that are necessary to verify or falsify the hypotheses he is entertaining.
9. searches intentionally for the data necessary to verify or falsify the hypotheses.
10. decides if the diagnoses have been verified or falsified.
11. decides if new diagnoses must be considered.
12. identifies data necessary for the verification of any of the hypotheses but that has not yet been obtained.
13. scan-searches for new data.
14. decides which problems have been verified in the data.
15. decides if all of the relevant data have been obtained.
16. decides if all the relevant problems have been diagnosed.
17. completes the list of diagnoses.
18. decides if the diagnoses explain all of the data available.
19. decides if the diagnoses need to be supported by data not yet available.
20. arranges the diagnoses as a function of some criterion.
21. decides if the final ordering of the hypotheses has been reached.
22. identifies possible management measures for each of the final diagnoses.
23. selects the management measures that are appropriate.
24. identifies the resources to implement the measures.
25. obtains the resources to execute the measures selected.
26. implements the measures selected.
27. identifies the results of implementation.
28. decides if each of the problems diagnosed has been solved.
29. judges upon the prognosis of the patient.
30. decides if the diagnoses treated were correct.
31. decides if the management is being executed correctly.
32. makes the appropriate corrections if necessary.
33. records the encounter in the appropriate format.
34. terminates the encounter with the patient.
It is now necessary to relate each of these discrete behaviors to one of the five behaviors that make up the Core previously proposed as a first approximation.

The first behavior in the Core is: the physician attends to all the data available to him about the patient, his family and the specific form of prevention and treatment. In making this data available to him a paramount role is played by the history and the physical examination which must be thorough and reliable. But this first behavior is manifested only if the physician:

1. meets the patient.
2. obtains the initial data about the patient.
3. imagines that a problem exists.
4. recalls similar situations.
5. searches intentionally for the data that verify or falsify the hypotheses which he is entertaining.
6. scan-searches for the data that verify or falsify the hypotheses which he is entertaining.
7. identifies the results of the implementation of the management measures.
8. records the encounter with the patient in the proper format.
The second behavior in the Core proposed is: the physician understands all of the data available about the patient and his family, the specific forms of prevention and treatment. And in this understanding the multicausal nature of the disease and its multifocal impact are included.

But this behavior can be manifested only if the physician:
1. develops initial problem statements.
2. completes the list of diagnoses.
3. identifies the management measures possible for each of the diagnoses.
4. identifies the resources necessary to implement the management measures.

The third behavior in the core proposed was: the physician judges his understanding to be correct only after soundly analyzing the relationship between the data available and the manner in which the data have been understood.

But this behavior is manifested only if the physician:
1. decides that in fact a problem exists.
2. identifies data that are necessary to verify or falsify the hypotheses that he is entertaining.
3. decides if the diagnoses have been verified or falsified.
4. decides if new diagnoses must be considered.
5. identifies data necessary but not yet obtained.
6. decides which problems have been verified.
7. decides if all the relevant data have been obtained.
8. decides if all the relevant problems have been diagnosed.
9. decides if the diagnoses explain all of the data available.
10. decides if the diagnoses need to be supported by data not yet available.
11. arranges the diagnoses as a function of some criterion.
12. decides if the final ordering of the hypotheses has been reached.
13. judges upon the prognosis of the patient.
14. decides if the treatment is being administered correctly.
15. decides if the diagnoses treated were correct.

The fourth behavior in the core proposed is: the physician acts responsibly, that is, efficiently and in congruence with his correct understanding uses the resources available to alleviate the multifocal impact of the disease upon the person and his family. But this behavior is manifested only if the physician:

1. selects the measures that are appropriate to the final list of problems diagnosed.
2. obtains the resources needed.
3. executes the measures selected.
4. makes the appropriate corrections if necessary.

The fifth behavior in the Core proposed is: the physician acts in a loving quasi-dyadic manner so that anxiety about the illness, possible or actual, is dissipated from the person and his family, and understanding and motivation are instilled into them. But this behavior is manifested only if the physician:

1. meets the patient.
2. maintains rapport with the patient.
3. terminates the encounter with the patient at the appropriate moment.

Thus, since everyone of the 34 discrete behaviors listed above is related to one of the five behaviors defined in the first approximation to the Core, they may be considered to be an expansion of this Core and this expansion may be called the Second Approximation.
3.3 Summary.

This chapter began with the statement of the First Approximation to the Core of behaviors that should be taught to the medical student. Then it was stated that the behaviors in the Core had been obtained from Lonergan's Cognitional Theory, and was added that it was necessary to see if they could be supported by empirical studies using methods other than Lonergan's.

Some of the publications of these empirical studies were examined and it was discovered that at least they are congruent with the Core of Behaviors obtained from Lonergan's Cognitional Theory.

When the examination of these studies was finished the discrete behaviors of the physician that they evidenced were arranged as they would be displayed by a physician during an encounter with a patient. Then, each of these discrete behaviors was related to one of the behaviors identified in the first approximation to the Core. Then it was stated that the set of these discrete behaviors would be considered the second approximation to the Core.
In the next chapter the relation between the behaviors of the second approximation will be related to the logic of medical thinking.
LIST OF REFERENCES TO CHAPTER THREE


6. Ibid.

7. Ibid.

8. Ibid.


10. Ibid.


14-28. Ibid.


30-49 Ibid.
CHAPTER IV
THE CORE OF BEHAVIORS AND THE LOGIC OF MEDICAL METHOD

4.1 Introduction.
4.2 The Syllogisms.
4.3 The Syllogisms and the Behaviors.
4.4 Summary.
CHAPTER FOUR

1. Introduction.

In the previous chapter a second approximation to the behaviors in the Core that must be learned by medical students was made. In this chapter the logic behind these behaviors will be identified.

In an article published by Albert, he presented an argument that permitted him to reach the following conclusions:

1. The medical history is an answer to the question "with what medical problem is the patient currently afflicted?"

2. The answer to this question lies within the class of diseases implied by the patient's initial presenting symptom.

3. The selection of the diagnosis is guided by a strict logical format submerged under the History of the Presenting Illness; that is the HPI and its diagnosis are analogous to a logical argument and its conclusion.
4. under as many circumstances as possible a diagnosis should be established using a deductive type of argument rather than an inductive, probabilistic formulation. (1)

The inclination of the physician to think deductively rather than inductively has been documented at least since 1974, when Elstein et al. in a publication commented: "Much of the observable procedures and reasoning of the physician are efforts to test deductions derived from provisional hypotheses rather than attempts to generate new formulations. " (2)

That physicians are not thinking inductively when identifying the nature of the problems of their patients is also supported by the work of Eddy and Clanton. They studied the psychological processes by means of which physicians solve complicated diagnostic problems, such as those encountered in a clinicopathological exercise. According to them, "The challenge of the differential diagnosis is to select the most probable cause of a patient's condition, yet the size of the problem, the nature of medical information, and the notorious inability of human beings to manipulate probabilities in their heads all conspire against the diagnostician to make it virtually impossible to employ
Bayes' theorem in routine diagnosis." (3) Since physicians neither have available the desired probabilities with which to make the calculations, nor would they be able to estimate them, They "... recast the problem into a form that uses one of their most effective mental skills—that of comparing patterns." (4)

It would seem that physicians are able to use this hypothetico-deductive and pattern-recognition strategy because operating in their minds there is a set of at least five rational expectations.

1. physicians expect that similar sets of data produce similar understandings and that similarly patterned sets of data will produce similarly patterned understandings.

2. physicians expect to be able to give their patients the treatment which is correct only when the diseases that afflict them have been diagnosed correctly.

3. physicians expect that patients that are given the correct treatment for their diseases improve.

4. physicians expect that the correct treatment will improve the patient only if it is administered correctly.
5. Physicians consider their diagnoses verified by the improvement of their patient's condition if the correct treatment was administered correctly.

4.2 The syllogisms.

Based on these five rational expectations and following the general "Form of Inference" (5) it would follow that the entire logical structure of the physician's encounter with the patient is contained in the following syllogisms:

First Syllogism,

a) If the patient presents data \( \{D_a\} \) then he suffers the disease \( \{D_i\} \).

b) But in fact the patient presents data \( \{D_a\} \).

c) Then, the patient suffers from the disease \( \{D_i\} \).

Second Syllogism,

a) If the diagnosis \( \{D_i\} \) is correct then the correct treatment \( \{T_r\} \) may be given to the patient.

b) But in fact the diagnosis \( \{D_i\} \) is correct.

c) Then, the correct treatment \( \{T_r\} \) may be given to the patient.

Third Syllogism,

a) If the correct treatment \( \{T_r\} \) is given then most probably the patient will improve.

b) But in fact the correct treatment \( \{T_r\} \) is being given.

c) Then, most probably the patient will improve.
Fourth Syllogism,
a) If the patient improves after treatment \( (tr) \) then probably \( (tr) \) is the correct treatment \( (Tr) \).
b) But in fact the patient improved after the treatment \( (tr) \).
c) Then, probably the treatment \( (tr) \) is the correct treatment \( (Tr) \).

Fifth Syllogism,
a) If the treatment given to a patient was the correct treatment \( (Tr) \) for the correct diagnosis \( (Di) \) and the patient did not improve then either the correct treatment \( (Tr) \) is not being administered correctly, or \( (Di) \) is not the correct diagnosis.
b) But in fact the treatment given was the correct treatment \( (Tr) \) for the correct diagnosis \( (Di) \) and the patient did not improve.
c) Then, either the correct treatment \( (Tr) \) is not being administered correctly, or \( (Di) \) is not the correct diagnosis.

Sixth Syllogism,
a) If the patient did not improve and the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is not being administered correctly then probably the patient did not improve because the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is not being administered correctly.
b) But in fact the patient did not improve and the correct treatment (Tr) for his diagnosis (Di) is not being administered correctly.

c) Then, probably the patient did not improve because the correct treatment (Tr) for his diagnosis (Di) is not being administered correctly.

Seventh Syllogism,

a) If the patient did not improve and the treatment (Tr) for his diagnosis (Di) is being administered correctly then probably the diagnosis (Di) is not correct.

b) But in fact the patient did not improve and the correct treatment (Tr) for his diagnosis (Di) is being administered correctly.

c) Then probably the diagnosis (Di) is not correct.

Sixth Syllogism,

a) If the patient did not improve and the correct treatment (Tr) for his diagnosis (Di) is not being administered correctly then probably the patient did not improve because the correct treatment (Tr) for his diagnosis (Di) is not being administered correctly.

b) But in fact the patient did not improve and the correct treatment (Tr) for his diagnosis (Di) is not being administered correctly.
c) Then, probably the patient did not improve because the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is not being administered correctly.

Seventh Syllogism,

a) If the patient did not improve and the treatment \( (Tr) \) for his diagnosis \( (Di) \) is being administered correctly then probably the diagnosis \( (Di) \) is not correct.

b) But in fact the patient did not improve and the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is being administered correctly.

c) Then probably the diagnosis \( (Di) \) is not correct.

4.3 The Syllogisms and the Behaviors in the Core.

It now seems appropriate to relate the syllogisms to the Core of Behaviors defined in the second approximation that was made in the previous chapter. The purpose is to see if the behaviors in the core, each symbolized by \( [BhN] \) contain and support the logical structure of the encounter with the patient.

The first syllogism was stated as follows:

a) If the patient presents data \( (Da) \) then he suffers from disease \( (Di) \).

b) But in fact the patient presents data \( (Da) \).

c) Then the patient suffers from disease \( (Di) \).
When the physician encounters a patient he obtains first the minor premise of the syllogism: the data that in fact is presented by the patient. This he obtains when he meets the patient, establishes and maintains rapport and gathers the initial data about the complaint, while observing him. This leads the physician to imagine that the patient may be suffering from a medical problem. Then the physician decides if in fact a problem exists. Usually at this time the physician recognizes a pattern in the data gathered and recalls similar situations.

But physicians, as any other human being, expect that similar sets of data produce similar understandings. Thus, if from the patient in front of him the physician has obtained data similar to the situation recalled, the disease that probably will be diagnosed in this patient is the same one that was diagnosed in the situation recalled.

The physician then proceeds to the development of the initial statement of the problems that afflict the patient. This cannot be completed unless in the mind of the physician is established a link between the data obtained so far from the patient and a set of diagnoses which he knows could be verified in the data. The physician knows of this link either because he has studied publications in which it
has been reasonably established, or because in his experience its existence has been demonstrated.

All of this, the data initially obtained, the data in the similar situations recalled and the hypothetical link between the data and the diagnoses that could be verified provide the physician with the major premise of the syllogism. Having both, the major and the minor premise, the physician is led to the conclusion.

This syllogism operates in the mind of the physician at the beginning and also throughout the encounter with the patient. It operates when he revises the diagnoses made previously, \([Bh11]\) until he makes the decision that the list of problems is complete, \([Bh17]\). At this time he will arrange the diagnoses listed as a function of some criterion, \([Bh20]\), then decides if the final ordering has been reached, \([Bh22]\).

This syllogism has at least one variant:

a) If the patient does not present data \(\{Da\}\) then the patient does not suffer from disease \(\{Di\}\).

b) But in fact the patient does not present data \(\{Da\}\).

c) Then, the patient does not suffer from disease \(\{Di\}\).
The variant allows the physician to decide which diagnoses have been verified or falsified by the data, [Bh10]. While the original syllogism also allows the physician to identify, at any time, data that are still missing, [Bhs8,9,19], in order to affirm the minor premise. He will then search intentionally for it in order to verify his diagnoses, [Bhs9,10]. The physician will also search-scanning so that all relevant data are gathered and decides when this is done, [Bh15]. At the end do the gathering process the physician will judge which of the initial diagnoses have been verified, which have proved to be false, and which new ones have emerged, [Bhs10,11]. He will now decide if all the relevant diagnoses have been made, [Bh16] and will be able to produce the complete list of diagnoses, [Bh17].

The second syllogism was stated as follows:

a) If the diagnosis (Di) is correct then the correct treatment (Tr) may be given to the patient.

b) But in fact the diagnosis (Di) is correct.

c) Then the correct treatment (Tr) may be given to the patient.

This syllogism simply develops the logical consequences of the rational expectation of physicians which has already been mentioned: to give their patients the treatment which is
correct only when the diseases that afflict them have been diagnosed correctly. This expectation is the major premise.

The minor premise of this syllogism is true only if the conclusion of the first is true. Thus, if the conclusion of the first syllogism has been established the physician may truly affirm that of the second.

The function of the second syllogism is to assure the physician of the fact that the correct treatment can be given to the patient he is consulting. With this assurance he will identify the possible management measures for each of the diagnoses in the final list, [Bh22] and then the selection of those that are appropriate, [Bh23]. Once the selection has been made, he will be able to identify the resources necessary to execute the measures, [Bh24], he will obtain the resources, [Bh25] and then will be capable of executing them, [Bh26].

The third syllogism was stated as follows:

a) If the correct treatment (Tr) is given then probably the patient will improve.

b) But in fact the correct treatment (Tr) is being given.

c) Then, probably the patient will improve.
This syllogism develops, as the previous, one of the rational expectations of the physician: that patients who are given the correct treatment will improve. This expectation furnishes its major premise. The minor premise is empirical. Only by knowing the verified diagnoses being treated and the actual treatment being administered can the minor be affirmed.

The conclusion of this syllogism is very important; it allows the physician to arrive at a prognosis about the patient, [Bh29]. The prognosis is the outcome expected from the implementation of the management measures. After the physician identifies the actual results of management, [Bh27] he will decide which of the problems diagnosed have been solved and which remain to be so, [Bh28]. From the results of this decision further management decisions may be made.

This syllogism has at least one variant:

a) If the correct treatment (Tr) is not given to the patient then probably the patient will not improve.

b) But in fact the correct treatment (Tr) is not being given to the patient.

c) Then, probably the patient will not improve.

This variant is very important during the follow up of the patient after treatment. If he does not improve as expected
the physician will be led to consider two possibilities: either the correct treatment is not being administered correctly, or the diagnosis being treated is not correct after all. He will be moved to make a decision [Bhs30,31]. This he will do with the help of the fifth syllogism to be analyzed below.

The fourth syllogism was stated as follows:

a) If the patient improves after treatment \( t_{tr} \) then probably \( t_{tr} \) is the correct treatment \( t_{Tr} \).

b) But in fact the patient improved after treatment \( t_{tr} \).

c) Then, probably the treatment \( t_{tr} \) is the correct treatment \( t_{Tr} \).

This is a syllogism that serves as a criterion to double check on the diagnosis made on a patient. Its major premise is obtained from the fact that physicians consider their diagnoses verified by the improvement of their patients when they have been administered the correct treatment. This is the same expectation that serves as the major premise of the third syllogism. However, the syllogisms are different because their minor premises are. The minor premise of the third syllogism is the empirical verification that in fact the patient is being administered the correct treatment. The minor premise of the fourth syllogism is also empirical, but
in this case is the verification that in fact the patient has improved after treatment.

In the empirical verification of the minor premise of the fourth syllogism is used the prognosis on the state of the patient that is obtained from the conclusion of the third syllogism. [Bhs27,29]

The fifth syllogism was stated as follows:

a) If the treatment given to a patient was the correct treatment \( \{Tr\} \) for the correct diagnosis \( \{Di\} \) and the patient did not improve then either the correct treatment \( \{Tr\} \) is not being administered correctly or \( \{Di\} \) is not the correct diagnosis.

b) But in fact the treatment being given is the correct treatment \( \{Tr\} \) for the established diagnosis \( \{Di\} \).

c) Then, either the correct treatment \( \{Tr\} \) is not being administered correctly or the diagnosis established \( \{Di\} \) is not the correct diagnosis.

This syllogism appears as an explicit element of the logical structure of the physician's encounter with the patient only if the patient does not improve after the administration of the treatment that was selected as correct for the diagnosis that was made. That the patient did not
improve after being administered what was selected as the correct treatment can only be ascertained empirically. [Bh27]

When it has been verified empirically that the patient did not improve then there are only two possible explanations: either the correct treatment is not being administered correctly, or the diagnosis being treated is not correct. The hypothetical link between these two possibilities and the empirically verified status of the patient serve as the major premise. The minor premise is also to be verified empirically. And if both premises are held by the physician the conclusion is necessary.

The conclusion of the syllogism is the non-exclusive disjunction that is contained in the major premise. The disjunction is non-exclusive because it could be that the treatment selected is being administered incorrectly and that the diagnosis treated is also incorrect. In this case, the physician has the obligation to prove empirically if one or both of the elements of the disjunction are incorrect. [Bhs30,31]

The physician uses the fifth syllogism when in spite of having fulfilled all of the logical conditions necessary to see the patient improve, the patient has not done so. The
conclusion of the syllogism leaves the physician with a problem: he must be loyal to the obligation mentioned above. In this he will be helped by the sixth and seventh syllogisms.

The sixth syllogism was stated as follows:

a) If the patient did not improve and the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is not being administered correctly then probably the patient did not improve because the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is not being administered correctly.

b) But in fact the patient did not improve and the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is not being administered correctly.

c) then probably the patient did not improve because the correct treatment \( (Tr) \) for his diagnosis \( (Di) \) is not being administered correctly.

The major premise of the syllogism represents a variant of the rational expectation of the physician, encountered previously, that patients will improve if the correct treatment for their diseases is administered correctly. This rational expectation is added to the empirically verifiable fact that the patient did not improve in spite of the correct treatment. [Bh27]
The minor premise of the syllogism is also empirical. Whether the correct treatment is being administered correctly can only be ascertained though the actual observation of the way it is being administered. [Bh31]

If the major and the minor premises are held by the physician he is led to the conclusion. But since the conclusion of the fifth syllogism is non-exclusive, it could still be that the treatment being administered incorrectly is the correct treatment for an incorrect diagnosis. Thus the physician needs the seventh syllogism.

The seventh syllogism was stated as follows:

a) If the patient did not improve and the treatment \( {\text{Tr}} \) for his diagnosis \( {\text{Di}} \) is being administered correctly then probably the diagnosis \( {\text{Di}} \) is not correct.
b) But in fact the correct treatment \( {\text{Tr}} \) for the diagnosis \( {\text{Di}} \) is being administered correctly and the patient did not improve.
c) Then, probably the diagnosis \( {\text{Di}} \) is not correct.

The physician has verified empirically that the patient did not improve. Through the sixth syllogism he has discovered that one of the reasons for the lack of improvement is that the treatment is not being administered
correctly. He has made the appropriate corrections [Bh33] and now he has the same rational expectation that served as the major premise of several other syllogisms: that the patient will improve because the correct treatment is being administered. Yet, the observation of the patient reveals that inspite of this there is lack of improvement. The expectation and previous observations furnish the major premise of the syllogism. The observation of the patient after ascertaining that the treatment is being administered correctly furnish the minor premise. [Bhs 12,13] If the physician holds the major and the minor premises he must accept the conclusion: the patient has not improved because the diagnosis being treated is not correct. [Bh30]

4. Summary.
This chapter was dedicated to analyze the logical structure of the physician’s encounter with a patient, and the relation that exists between the elements of this structure and the Core of Behaviors that is being proposed to be learned by medical students.

The analysis was undertaken in order to explore if the behaviors in the Core could support the logical structure of the encounter. This seems to be so, at least in so far as in order to adhere to the structure it is not necessary to call
upon behaviors that are not included in the Core and that all of the behaviors in the Core are used in order to erect the structure.

The next chapter will explore the relation between the behaviors in the Core and the Method of Science. Precisely because of this it is important to point out that although the behaviors in the Core are sufficient to support the logical structure of the physician's encounter with a patient, the behaviors are not simply logical operations; they are a combination of logical and empirical operations. A similar combination of logical and empirical observations is distinctive of the way in which modern science is constructed. As in science, the logical operations consolidate what has been gained previously, the empirical operations push the physician toward new data.
LIST OF REFERENCES TO CHAPTER FOUR


4. Ibid.

CHAPTER V
THE METHODS OF THE PHYSICIAN AND THE METHODS OF SCIENCE

5.1 Introduction,
5.2 The Exigences.
5.3 The Argument.
5.4 The Method of the Physician.
5.5 The Method of Science.
5.6 The Method of the Physician and Scientific Method.
5.7 The Method of the Physician and the Canons of Empirical Method.
5.8 Conclusion.
CHAPTER FIVE

5.1 Introduction.

In a previous chapter were identified the behaviors that constitute the Core that must be learned by medical students. In another chapter these behaviors were related to the logical structure of the physician's encounter with the patient. In this chapter the relation between these behaviors and the method of science will be explored: This task is absolutely necessary. At least since the time of Moses of Huesca and Roger of Hereford, it has been the ideal that medical practice be built upon solid scientific theory. In recent times it was C. Bernard that attempted to define a method to establish the scientific basis of medicine. (1) It has been said that the "... central principle of medical education advocated by Flexner was mastery of scientific method and its application to all dimensions of medicine." (2)

5.2 The exigences.

It may be said that modern scientific thought is subject to four exigences from which emerge in the thinker four
different manners of conscious and intentional operation. These four manners of operation give rise to four different worlds of meaning. First, there exists "... a systematic exigence that separates the realm of common sense from the realm of theory" (3) These two realms largely regard the same real objects, but they are viewed "... from such different standpoints that they can be related only by shifting from one standpoint to the other. (4)

For instance, from a common sense standpoint "force" is a muscular sensation of a certain type; while from the standpoint of theory, "force" is a unique relation between "mass" and "acceleration." "The realm of common sense is the realm of persons and things in their relation to us." (5) Whilst the realm of theory is that in which we find objects to which "... one can ascend from common sense starting points, but they are properly known, not by this ascent, but by their internal relations, their congruences, and differences, the functions they fulfill in their interactions" (6)

Thus, from "force" as understood in the realm of common sense we may ascend to "force" as understood in the realm of theory. In its first meaning the concept may be understood by anyone who has had a muscular sensation of the type required.
In its second meaning the concept will be understood only by those who also understand the meaning of the words "mass" and "acceleration"; simply, it will be understood only by those who understand a certain equation.

The differentiation of these two realms raises the question about their relation and their meaning. These questions signal the emergence of a second exigence, a critical exigence. This one asks about the validity of the judgement that distinguishes between common sense and theory. "Is common sense just primitive ignorance to be brushed aside with an acclaim to science as the dawn of intelligence and reason?" (7) What is the value of science? Is its value merely pragmatic, "... teaching us how to control nature, but failing to reveal what nature is?" (8) Or does man know at all, "... is there any such thing as human knowing?" (9) All of these ultimately confront man "... with the three basic questions: what am I doing when I am knowing? Why is doing that knowing? What do I know when I do it?" (10)

With these questions the thinker abandons the realm of common sense and theory to enter the realm of his own interiority in search for the answers. Within this new realm the thinker discovers a third exigence: a methodical exigence when he finds and appropriates his own subjectivity, his own
operations, the structure of these operations, the norms by which they operate, the potentialities hidden in them. Although the technical expression of such appropriation resembles theory, "... in itself is a heightening of intentional consciousness, an attending not merely to objects but also to the intending subject and his acts." (11)

From the formulation of what is discovered in this heightened state of intentional consciousness, the thinker begins to construct a theory about the nature of knowing in the realms of common sense and theory, and the relations between these two forms of knowing. But the important thing to discover is that the discoverer now feels invited to be faithful to his structured interiority, his structured self with its own operations and norms, with its own method which is the origin of every other method.

In being faithful to self the thinker discovers a fourth exigence, a transcendent exigence. "There is to human inquiry an unrestricted demand for intelligibility. There is to human judgement a demand for the unconditioned. There is to human deliberation a criterion that criticizes every finite good" (12) This exigence raises the possibility of the existence of something or someone who will fulfill the demand for the unrestricted intelligibility, for the unconditioned, for a goodness beyond criticism. (13)
5.3 The argument.

It is the systematic exigence that differentiates the realms of common sense and theory. It is the critical exigence that discovers the validity of the judgement that differentiates between these two realms. It is the methodical exigence that discovers the origin of every method in the interiority of the subject. It is the transcendent exigence that asks the questions about unlimited fulfillment. But it is from being faithful to the methodical exigence that the method of science and the method of the physician can be formulated. In this chapter it will be argued that the method of science and the method of the physician are isomorphic.

"Two sets of terms, say A;B;C,..., and P;Q;R..., are said to be isomorphic if the relation A to B is similar to the relation of P to Q, the relation A to C is similar to the relation of P to R, the relation of B to C is similar to the relation of Q to R, etc., etc. Isomorphism then, supposes different sets of terms; it neither affirms nor denies similarity between the terms of one set and those of other sets; but it does assert that the network of relations in one set of terms is similar to the networks of relations in other sets." (14)

5.4 The method of the physician.

Bernard Lonergan has advanced the following definition:

"A method is a normative pattern of recurrent and related operations yielding cumulative and progressive results." (15) Thus, there is method when there are operations and the operations are, at the same time, distinct from each other and related to each other. The relations form a pattern. And,
and related to each other. The relations form a pattern. And, the operations in accord with the pattern can be repeated indefinitely, but the results of the repetition are not repetitive, but cumulative and progressive.

Given this definition, is there a method for acting as a physician? When consulted by a patient the physician usually desires to prevent and alleviate the total impact of illness, possible or actual, upon the person and his family. To accomplish this the physician studies the patient. While studying him the physician insists in observing everything and describing it accurately; and both observations and accurate descriptions recur during the study. But they recur, not because they are the objective of the investigation, rather because they are the way toward the discovery of the disease that the patient has or could have. And discoveries also recur and they are formulated as diagnoses; and diagnoses recur. The physician then thinks about the clinical and laboratory data that could verify the implications of the diagnoses that he has made and could verify the diagnoses themselves. So, physicians recurrently verify their diagnoses and their implications. Having verified them the physician decides upon the treatment that is appropriate. And treatments recur. Having treated the patient the physician follows him up in order to observe and describe the results
of treatment. So, follow up meetings recur. And in these
meetings the results of treatment are observed and described,
and decisions made on how to prevent or alleviate any further
impact of illness.

Each of these operations of the physician is different
from all the others, and each is related to all of the
others. The desire of the physician to prevent and alleviate
the total impact of the illness upon the patient transforms
theirs into a quasi dyadic relation. The patient is
objectified and observed; whatever is observed and thought is
remembered and frequently recorded. In the data gathered
through these observations are identified problems, and in
the problems is identified the nature of the illness that the
patient may suffer or already suffers. From the nature of the
disease diagnosed are deduced its implications, and these
suggest the clinical and laboratory data that it is necessary
to obtain from the patient to achieve rational verification
of what has been diagnosed. The clinical experiences and the
laboratory procedures produce new data, which lead to new
descriptions in which the previously held diagnoses may be
verified, or new ones may be so. When the diagnoses are not
verified the physician must decide if he changes them or
disregards the most recent data; but when the diagnoses are
confirmed he knows he is on the right track. This will be
followed by new observations, descriptions, problems, diagnoses, deductions, clinical experiences, laboratory studies, treatments; all of them will occur repetitively. But their results are not repetitive. The field of clinical observation of the patient has widened progressively and the physician is cumulatively approaching the objective of his effort: to prevent or alleviate the total impact of the illness upon a person and his family.

The physician would not reach his objective if his operations were not recurrent, if they were not related and if they did not yield results which are progressive and cumulative. The physician would not fulfill his prime function if he had no method.

The method of the physician is not contained in any set of rules external to him. Although as a medical student he learned a lot on how to be a physician, ultimately, the origin of his method is to be found in the imperatives that spontaneously arise in his consciousness and ask of him to be attentive, intelligent, rational, responsible and loving. But it must be said that no one will obey these imperatives unless he has made them his own, unless he has appropriated "... one's own subjectivity, one's own operations, their structure, their norms, their potentialities." (16)
The results of physicians are progressive. They move him from ignorance about the problems that may afflict or actually afflict the patient to knowledge about the nature of these problems. Knowing their nature, they move him to the identification of the measures through which they may be prevented or alleviated. Having identified the measures, they move toward concrete acts of prevention or alleviation which have results that may be more or less predictable but have to be evaluated. So, through intentional search and scanning the physician eventually discovers all the data that are relevant, all the problems that are verifiable in the data, all the syndromes in which the problems are integrated, all the diseases which may explain the syndromes, all the treatments through which their impact may be alleviated and all the concrete acts of prevention and alleviation.

The results of physicians are cumulative because in the journey from data to the prevention and alleviation of the multifocal impact of illness each new datum is obtained, and each new insight, judgement, decision and action that are made is added to the previous valid data, understandings and judgements so that the new is incorporated into whatever of the old is valid. So the syndromes incorporate the data considered to be evidence of something abnormal; the syndromes incorporate the abnormalities, and the syndromes
are incorporated under the diagnoses of particular diseases. And, ideally, the treatment is that which is appropriate to the diseases diagnosed.

The operations of the physician are not simply logical. This was pointed out at the end of the previous chapter. Their methodness does not reside in the rules of logic, but in the pattern of their relations. They include operations on propositions, terms and relations according to the rules of logic. But they also include operations like observation, description, the formulation of problems, discovery, synthesis and verification which are not logical. In this it may be said, at least, that the method of the physician is isomorphic to the method of science, for "... at once it may be noted that modern science derives its distinctive character from this grouping together of logical and non-logical operations." (17)

The function of the logical operations is to consolidate what has been achieved up to any given moment. The function of the non-logical operations is to maintain an openness to further advances. "The conjunction of the two results in an open, ongoing, progressive and cumulative process." (18)
5.5 The methods of science

There does not seem to be any single scientific method. Rather, there seems to be at least four of them: classical, statistical, dialectic and genetic. They are given their unity by the operations of the interiority of man. (19)

Classical method studies the nature of things; it discovers laws that are universally valid when the condition ceteris paribus is met. Statistical method studies the frequency and probability of occurrence of chosen events. Dialectical method studies the concrete unfolding of opposed but related principles that are modified by the unfolding. Genetic method studies the emergence of tendencies, and the sequences of operators that successively change the laws to which a thing is subject.

If any of these methods were excluded from those of science, the exclusion would mean that there are laws or events in the universe which are beyond its reach. Science then would have to renounce to its most ambitious ideal: the construction of a scientific model of the entire universe. Yet, whatever may happen to be the method which is considered adequate for a particular investigation, its concrete application is guided, because science intends to be empirical, by the Canons of Empirical Method.
The canons of Empirical Method are: Selections, Operations, Relevance, Parsimony, Complete Explanation, and Statistical Residues.

By the Canon of Selection the investigator "... is confined to insights into data of sensible experience." (20) Its importance is great. It eliminates from scientific research all correlations, hypotheses and theories that have no sensible consequences. It also eliminates all correlations, hypotheses and theories that "... involve such consequences logically yet fail to be confirmed by the results of observation and experiment." (21)

The Canon of Selection is necessary for science. The number of correlations, hypotheses and theories is indefinitely large. They can be created by the simple process of defining or postulating them. But, "... there is no reason why the empirical inquirer should investigate all trees in this endless forest of possible thoughts." (22) So, the Canon of Selection besides "... ruling the irrelevant out of consideration, it directs the scientist's efforts to the issues that he can settle by the decisive evidence of observation and experiment." (23)
The most ambitious ideal of science is the construction of a scientific model of the entire universe. But such an ideal cannot be approximated unless scientific insights accumulate. Thus science has the Canon of Operations; by it the scientist "... aims at the accumulation of such insights, and the accumulation is reached, not in the mathematical circuit through insights, formulations, and symbolic images, but in the fuller circuit that adds observations, experiments and practical applications." (24)

In much it is the existence of this Canon of Operation that differentiates modern science from medieval. This last seems to have confined itself, at least for a time, to the mathematical circuit: insights, formulations, symbolic images. Whereas, modern science also experiments and develops practical applications. This fuller circuit results in a science which is "... an open, ongoing, progressive and cumulative process." (25) Carried on by such a process, science is ever obtaining new data; with these data it is led to new questions, to the search for further insights and the revision or confirmation of what it has and in due time to entirely new discoveries.
Any given set of data could be understood in several possible manners: in relation to the intentions of whomever may have produced them; in relation to the materials that were used in their production; in relation to the processes that operated to produce them; or in relation to the sequence of events of which they are the culmination. But none of these understandings interests science. "Pure science aims immediately at reaching the immanent intelligibility of data and leaves to applied science the categories of final, material, instrumental and efficient causality. . . " (26) This aim is defined by the Canon of Relevance.

The intelligibility immanent in data is the only understanding relevant to pure science.

There is also the Canon of Parsimony. By it the scientific investigator may add to the data of experience only whatever may be verified in the data. He may not add to it whatever he imagines to be, or what he wishes that were. The Canon forbids ". . . the empirical scientist to affirm what, as an empirical scientist, he does not know." (27) Thus, by the Canon of Parsimony the scientist may not affirm what has not been verified; nor may he affirm what is essentially unverifiable. "Because, then, verification is essential to his method, the canon of parsimony in its most elementary
form excludes from scientific affirmation all statements that are unverified and, still more so, all that are unverifiable.

"(28)"

There is also the Canon of Complete Explanation; "... ultimately science must account for all data, and the account must be scientific. (29) Thus, while the Canon of Parsimony does not allow the scientist to add to data what cannot be verified in them, the Canon of Complete Explanation obliges him to explain all of the data available. He is not free to eliminate from his reports data that do not support his explanations.

Finally, there is the Canon of Statistical Residues. Although all data have to be explained, not all will be explained by laws of the classical type. "... there exist statistical residues and their explanation is through statistical laws. . . " (30) Classical laws represent abstract systems, statistical residues represent concrete cases. Both may be understood. But while the concrete case is presented to sense or imagination before it is understood, an abstract system may neither be sensed nor imagined for it "... is a conceptual object constituted by terms and relations that in the last resort are defined implicitly. . . " (31) The abstract system may be used to understand concrete
cases "... only in as much as insight into the situation selects the relevant laws, determines the mode of their combination, and substitutes numerical values for the variable and undetermined constants of laws." (32) The importance of this law is that it points out that insight into concrete cases must occur before the scientist selects the laws that explain them.

5.6 The method of the physician and scientific method.

Classical scientific method is used by the physician when it is his intention to discover the nature of the illness that may afflict or actually afflicts the patient. The exact nature to be discovered varies with the data obtained from the patient and with the horizon and specialty of the physician. The nature of the disease may be anatomic, physico-chemical, genetic, psychologic, or social. But the fact is that the physician always aims at determining the nature of the illnesses that afflict or may afflict his patients. When this nature is discovered it is expressed in a diagnosis.

Physicians are interested in providing care to concrete persons. Only secondarily are they interested in determining the laws and the frequencies that explain why particular illnesses afflict concrete patients. "The patient is a
statistic of one" is said frequently. However, since the meaning of many clinical data is ambiguous, they are always aware of the gross frequency with which a particular disease is manifesting itself in the population for which they provide care. They take this gross frequency into consideration when thinking about a possible diagnosis. And, they arrive at the diagnosis in spite of the fact that "... the size of the problem, the nature of medical information, and the notorious inability of human beings to manipulate possibilities in their heads all conspire against the diagnostician to make it virtually impossible to employ Bayes's theorem in routine diagnosis." (33) The diagnosis is arrived at by using a comparative-deductive strategy in which patterns are compared and "if one disease seems much more likely than the other, the less likely may be dropped from further consideration." (34) This is the basic expression of statistical method in the method of the physician.

As medicine progresses the psychological and social aspects of illness acquire ever greater importance. For the understanding of these aspects dialectical method seems to be essential. Thus, the relation between sadism and masochism can only be understood dialectically. The relationship between poverty, a deprived cultural environment,
malnutrition and maturation can be understood only dialectically. If the physician is to fulfill his prime function he must explore dialectically the relations that exist between the patient, his disease, his family and their environment.

Finally, there is Genetic Method. As the prevention of illness has come to be ever more valued physicians are forced to understand genetically the diseases that may afflict their patients in order to act preventively. "The most fundamental question in medicine is why disease occurs rather than how it operates after it has occurred." (35) It is no longer sufficient to know the nature of the illness that may afflict or afflicts the patient. It is now necessary to know the causal chain of events that lead to it; the succession of operators that successively change the laws to which an individual is subject. The operators that change the patient from a state of health to a state of disease, and then, from disease into a healthy state again.

Thus genetic and dialectic method complement each other to make intelligible the emergence of an illness of a certain nature in patients; and explain the results of treatment. While classical and statistical method complement each other to make possible the determination of the nature of the
5.6 The method of the physician and the canons of empirical method.

At least since the time of Hippocrates and Alcmeon physicians have tried to confine their understandings about their patients to those that are verified in data that are obtained through sensible experience. In *The Canon* Hippocrates says that "Science and opinion are two different things; science is the father of knowledge but opinion breeds ignorance." (36) And in the *Science of Medicine* in which he strongly argues about medicine as a science he states: "the activities of the sciences that are taught are things that can be seen and there is none that is not visible in one form or another." (37)

Physicians also recall situations similar to that of the patient they are encountering. The situations recalled are presented through the imagination. But these situations are recalled and imagined as once they were sensed.

Not only is the data of the patient confined to what is sensible, immediately or through the imagination, but every entity considered as a disease by physicians has sensible consequences. There is no disease so strange that its
presence cannot be sensibly distinguished from its absence. And during the encounter with the patient the physician discards from the set of diagnoses that he is considering all those that are possible but which manifest their presence through sensible consequences that have not been observed.

Physicians also hold to the Canon of Operations. In accord with it, physicians aim at the accumulation of all the insights that can be had with the data obtained about their patients. This accumulation, as mentioned in a previous section, moves from the identification of abnormalities in the data to their identification as problems, to the aggregation of syndromes, to their explanation by a disease entity. But, as in science, the circuit of accumulation is not mathematical. Having accumulated insights into a diagnosis, the physician moves toward the practical applications embodied by the selection of the treatment that is appropriate. Once the treatment is being administered the physician expects that the condition of the patient improve. So, he identifies the data which signal the improvement. Then he awaits until it is time to search for them. If they are found the physician not only verifies the success of the treatment, but indirectly that his diagnosis is correct.
When the physician does not find the data that he expected, he must decide if the treatment is correct, or if it is being administered correctly, or if the diagnosis being treated is correct. Yet, whatever he may do, in the behaviors described above it is demonstrated that at least something analogous to the Canon of Operation is at work in the method of the physician.

The method of the physician is in accord with the Canon of Relevance at least in a first instance. He is interested in the intelligibility immanent in the data about the patient; he is interested in discovering the nature of the disease that afflicts the patient. However, the physician cannot confine himself simply to the dictates of this canon. Diseases are the diseases of human subjects with intentions and concerns. The intentionality and the concerns of the subject are present in the diseases that he suffers. This may be the most important discovery of Freud. Thus the physician has to go beyond the Canon of Relevance, as no scientist has, because for him it is also relevant to have insight into the patient as person, the patient as a subject with intentions; and it is relevant for him to discover how the intentions of the subject influenced the genesis of the disease and will influence the recovery of health. And it is also relevant to him to discover what the material,
instrumental and efficient causes that produced the diseased state.

To be sure, there have been times in the history of medicine when it was thought that the function of the physician was fulfilled the moment that he reached a diagnosis. This was called "Therapeutic Nihilism." (38) It is perhaps only at moments like this that the physician has confined his thought strictly to the Canon of Relevance.

The method of the physician obeys the Canon of Parsimony. The physician may add to the data obtained about the patient only the diagnoses that may be verified in them. To the physician, as to the scientist, it is forbidden to affirm about his patients what he does not know. The physician cannot affirm about his patients what has not been verified, and what in principle is not verifiable.

The physician may have hunches, they may lead him to recall similar situations, or recall diseases studied in textbooks or heard about in conferences and hallway discussions. But in order to make an affirmation about his patients, if he is a rational physician, he will first obtain the data in which can be verified his affirmation. Even the most brilliant idea is not a diagnosis until it has been
verified. Thus, the physician may imagine that a problem exists, may recall similar situations, may elaborate a list of brilliant diagnoses, but ultimately he may only affirm what can be supported by the available data.

The method of the physician obeys the Canon of Complete Explanation. The physician has to account for all the relevant data obtained about the patient and the account has to be scientific. And as long as he has a datum which is not explained he will consider his list of diagnoses incomplete.

The method of the physician obeys the Canon of Statistical Residues. The disease as it exists in the mind of the physician that will diagnose it is a conceptual object which is constituted by terms and relations which frequently are defined implicitly. This conceptual object is to be affirmed in a concrete patient. The definition of the abstract system came after a series of intelligent acts in which a number of concrete cases which were empirically different were understood to be of the same nature. The physician applies the abstract system by having insight into the data of the patient and then selecting the relevant system, that is, the relevant disease. All differences between the disease as abstract system and the disease as manifested in a concrete patient will be disregarded as long
as they appear to be randomly caused.

5.8 Conclusion

From the argument that has been presented it seems that the method of the physician incorporates, not only the four methods of science, but also the canons of empirical method. However, it has been intended to demonstrate not more than a isomorphism between both methods, for it is necessary to point out some notable differences between the scientist and the physician.

The scientist has as his intention the development of theory; but the physician accepts the theories that he uses from the scientist, because his intention is not to develop theory, but to alleviate the total impact of illness upon a patient and his family. The scientist is ingenious in the design and construction of the apparatus with which he carries out his experiments; the physician buys his instruments. The scientist considers his instruments part of the phenomenon that he is studying; the physician considers his instruments as an extension of his senses. The ultimate end of the scientist is to collaborate in the construction of a scientific theory of the entire universe; the ultimate end of the physician is to promote the welfare of his patients.
Thus scientific method is used by the scientist in a manner which is very different from the manner in which the physician practices scientific medicine. This is the reason why not more that a relation of isomorphism has been argued to exist between their methods.

Scientific method emerges from the exigences of the structured interiority of men of science and is ongoingly defined in order to obtain with it data which are publicly verifiable; it serves to eliminate personal biases, and to produce documents that may be criticized publicly, documents through which the advancement of science is promoted.

The method of the physician also emerges from the exigences of his interiority, and he also obtains with it data that can be publicly verified; it also serves to eliminate personal biases. Its use is documented in the patient's record. But all of this is done because the physician wants to fulfill his prime function: to alleviate the total impact of illness.

The quality of the work of a scientist is evaluated by analyzing the protocols in which his research methods are defined, by the results of his researches, by the theory that is verified in them and by the importance that this theory
has for those working in the same field. But the quality of a physician's work is evaluated by the records that he keeps, the theory upon which he bases his actions, and ultimately by the improvement of his patients.

The differences that have been identified seem to be due to what Heelan has called a "Hermeneutical Shift." (39) The scientist uses his method in order to discover the categories that the physician will observe in his practice. But the physician will observe these categories as "manifest" in the signs and symptoms of his patients. (40) "It is traditional wisdom, here reaffirmed, that a good clinician need not be a good basic scientist, nor a good basic scientist is always a good clinician." (41)

The method of the physician displays powers of observation which are made possible because previously the scientist has applied his method and produced the scientific image of what the physician is observing. Through his method the physician reaches "...directly and observationally the scientific components and processes of the human body." (42)

The method of the physician plays a very important role: it explores the space in which the scientific image of man, health, disease and treatment are contained. Meanwhile, the
method of the scientist widens, corrects and makes more comprehensive both the scientific image of man, health, disease and treatment, and the space in which they are contained. (43) Scientific method is necessary for the method of the modern physician and the method of the physician is simply isomorphic with scientific method.
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CHAPTER VI
THE HORIZON OF THE DOCTOR-PATIENT RELATIONSHIP

6.1 Introduction.
6.2 Definition.
6.3 The Horizon of the Physician.
6.4 The Structure of the Human Good.
CHAPTER SIX

6.1 Introduction.

With his method the physician constructs a relation with the patient. According to Lain-Entralgo, this relation has a constant and a variable. The constant is the structure of the relation itself; the variable is the social-historical situation in which a particular physician meets a particular patient. In the preceding pages an attempt has been made to characterize one of the elements of the constant: the mind of the physician and its operations. It does not follow that advanced by Lain-Entralgo, although they appear to be compatible. It now seems necessary to characterize the modern variable: the social-historical situation in which the mind of the physician displays itself. To accomplish this the philosophical concept of "horizon" will be used.

2. Definition.

A Horizon is the maximum field of vision from a determinate viewpoint. It possesses both, an objective and a subjective pole, each of which is conditioned by and conditions the other. Thus, the poles are related
dialectically. The subjective pole is the person whose field of vision it is, with his intentions and the possibilities of discovering meaning that his present stage of human development allow: the questions that he can raise and answer, the questions that he can raise but not answer, the questions that he cannot as yet raise. The objective pole is the realms of meaning that may be open to the subject in his present stage of development: common sense, theory, interiority and transcendence. (2)

3. The horizon of the physician.

The subjective pole of the horizon of the physician is the physician himself, the physician as subject. In the center of the objective pole of his horizon is the other self in the relation: the patient.

The patient is the subjective pole of his own horizon. In the center of the objective pole of his horizon is the physician. Both physician and patient are present to each other with their intentions and their possibilities of discovering meaning; they are present to each other from the subjective pole of each's horizon.
The basic intention of the physician as physician has already been explored: to prevent and alleviate the multifocal impact of illness upon the patient and his family. (3) The intentions of the patient are manifold. He may be really interested in preventing the loss of health or in recovering the health that he has lost. But at other times he may simply be interested in the confirmation of a diagnosis of which he already suspects. At still other times he may be interested in being assured that he is well; and at still other times he may be interested in whatever support he can get from the physician to live through his day. Finally, at other times he may simply be interested in legitimizing through feigned disease, his desire not to fulfill the obligations that he has. (4)

The patient as a human being is constitutively indigent, in need, an ens indigens: "He needs the material energy of the cosmos, thus he breathes and ingests food, no less does he need other men, even from his very birth when he first encounters them; he needs some personal conviction about the end of his existence and some reference to an ens fundamentale, God or a substitute." (5) The indigence of man is very complex; it becomes particularly acute at certain moments, illness among them; then it begs "...to be aided and in the last instance, begs an act of loving donation..." (6)
The intentions of the physician as person are also manifold. He may be moved by an authentic medical vocation that puts him at the service of his patient, but he could also be moved by a pure scientific interest to discover what disease the patient suffers or how this particular disease is to be managed. Or he could be moved because he feels a professional obligation, or the desire to make money, or to become famous. (7)

Yet, whatever his intentions may be, the physician represents an offer, he is an "ens offerens," to another human that needs him. (8) He may go so far as to donate himself lovingly to the patient that needs him, "And for this he is willing to undergo enormous sacrifices. . . ." (9)

If the physician is willing to develop a self-attentive methodology, in the subjective pole of his horizon he finds the operations of his own subjectivity, their structure and norms, their potentialities. (10) He finds the imperatives be attentive, be intelligent, be rational, be responsible, be in love. He finds the freedom to be faithful to the imperatives or to be obtuse, unintelligent, irrational, irresponsible, full of hate.
In the objective pole of his horizon the physician finds more than the patient, he finds a world-in-process, in which:

a. the empirical method has demonstrated its value. From it have risen modern science and technology, and modern medicine, which has to be based on its results. And the results of science are ensured by the large amount of money spent on medical research and by the elaborate social structure which spreads them and turns them into medical technology, to be then made available for actual care delivery through extraordinarily complicated and interrelated economic, political and cultural structures.

b. the disciplines that may be studied have multiplied unimaginably beyond the three offered by the medieval university. And in which the physician is expected to specialize in one of them and become in it a "lifetime learner."

c. modern philosophy articulates the structure, norm and potentialities of the interiority of man and invites to their appropriation.

d. historicity is valued. Thus, people demand to be in control of their own destinies and so do patients. They want to be informed, to participate in the process of medical decision making, to give previous consent to what is done to them.
e. corresponsibility is valued. Thus, while everyone values the autonomy necessary to construct his own history, there is also the belief that others must not be totally alone, that one is also, at least partially, responsible for what is happening to them. Thus patients organize into self-help groups in which they share their experiences with illness and together discover how to cope with them and lead a life as normal as possible.

f. practicality is valued. So one has to learn to administer so that things work. And for this one has to plan, implement, be aware of the costs incurred and the benefits produced. And the physician finds that his profession is being organized, that health care organizations are large, and that he can no longer be the medieval physician-artisan, but has to learn to deliver care as a member of a team.

But along with empirical method, specialization, philosophy, historicity, corresponsibility and practicality, which are found in the objective pole of the horizon of any modern man, in the objective pole of the horizon of the physician are found some elements which are unique to it:

g. the general way in which the physician-patient relationship is to be constructed, which is not the
sole result of the ideas of the physician. Rather, ultimately it is the result of the way their culture conceives health, disease and the role of the physician.

h. the values and general objectives of medicine. Thus, it is only recently that medicine concerned itself with childbirth, and with the aged person.

i. the expectation about the nature of the problems to be found in each of the specialties that may be practiced.

j. the availability of means to solve particular problems. Thus there arises the concept of "orphan diseases," which are those that can be diagnosed and would be easily cured, but because no one has developed the cure they are at present incurable.

k. the paradigms of style of practice. Thus some physicians are oriented toward research, others toward care delivery in a clinical setting, while others may be interested in public health.

l. medical science itself which includes numerous objects:
   - the definition of health and disease, mostly left implicit.
   - the definition of the natural history of diseases and the different levels of prevention that correspond to them.
- the manner in which information about diseases and treatments is organized.
- the numerous specialties into which medicine is organized.
- the basic medical sciences which serve medicine as theory.
- the particular way in which the basic sciences are grouped.

Finally, within the horizon of the modern physician, perhaps for the first time in human history, there is no concern for the existence of God; modern medicine and the modern physician are secular; where secularization means that man, in order to...orient and construct his own life he has wanted to depend exclusively on the possibilities and resources of his own nature...In other words, when he has wanted to eliminate from his historical existence all which is or may pretend to be 'supernatural' or 'revealed.' (11)

These are the elements of the horizon of the physician. To them he has to relate in order to construct his life. This relation cannot be established unless he makes certain judgements about what he values, what he considers worthwhile. Through these judgements the physician relates himself to the good and the good is structured. (12) But
there is freedom and the person discovers that is only through his decision that he becomes a good physician.

6.4 The Physician and the Structure of the Human Good.

The structure of the human good is complex. There are particular goods, there is a good of order, and there is terminal value. Through their operations individuals obtain instances of the particular good. But the operations of individuals may be cooperations, and all cooperations are the fulfillment of a role or the completion of a task within the context of a social institution. And, all cooperations occur within a network of personal relations. These institutions and networks are the good of order; their functioning assures everybody some amount of the particular goods that he needs. But, the particular good of order may not assure everybody a fair amount of the particular goods that he needs, thus, beyond it there is terminal value, fairness in this case, from which any particular good of order may be criticized.

The individual, through his capacity for determining himself, orients himself as best he can, within the particular good of order in which he finds himself. And he will attempt to orient himself according to the terminal values that he has grasped. But the operations of an individual are plastic and perfectible, and not only can he
orient himself through his operations in his own manner toward the particular good of order in which he lives, he can reorient himself, and even reorient himself radically so that he comes to hold as terminal values those that he did not hold so before.

Thus the physician may be initially motivated toward being practicing medicine as a science, but later may come to practice medicine as a service to others. And he may, in fact develop a self-attentive methodology that commits him to be loyal to himself, and from that viewpoint criticize both himself and every object in his horizon, so that in his work he attempts to construct a good of order which is also a terminal value, that is, a good of order beyond criticism.
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CHAPTER VII
THE OBJECTIVES OF MEDICAL EDUCATION

7.1 Introduction.

7.2 The Definition of an Educational Objective.

7.3 The Objectives of Medical Education.

7.4 The Objectives of Medical Education: A First Approximation.

7.5 The Objectives of Medical Education: A Second Approximation.

7.6 Conclusion.
CHAPTER SEVEN

7.1 Introduction.

Earlier it was claimed that the function of the medical curriculum is the communication of the present intellectual development of medicine to a new generation of physicians. This communication must be made in such a way that the students accept as their role within the structure of the human good to fulfill the prime function of a physician; and the acceptance is transformed into a willingness to study and work toward the achievement of the objectives of the curriculum that will transform them into physicians.

The design of a curriculum that will achieve such a task is difficult. The present development of medicine does not exist in a single mind; it does not even exist in the sum of the contents of the minds of the members of a curriculum committee. The best that such a committee can do is to identify the critical instances through which access is gained to the present and ongoing intellectual development of medicine. It seems that one of these critical instances would be represented by a core of behaviors. The idea for the
existence of such a core is to be found in the writings of Dr. L. Weed. (1). To pursue his idea the strategy being followed uses an insight had by B. Lonergan, which restated for the purposes of this dissertation postulates that when a person has come to understand thoroughly as a physician does he would not only have an outline of everything there is to be understood in medicine, he would also have a fixed base and an invariant pattern opening toward all further developments in medicine. (2)

The mind of the physician has been explored and from it was obtained a set of behaviors which represent the understanding proper to the physician, behaviors which in a second approximation were developed further. The behaviors were then related to the logic of the thinking of the physician, then to the method of science, then were given a context which was called Horizon. In this context the operations were said to be the operations of a subjective pole, and the contents of the corresponding objective pole were identified.

In now seems appropriate to express the behaviors that represent the operations of the physician in a manner congruent with current educational practice, while keeping in mind the contents of the objective pole of his horizon.
7.2 The definition of an educational objective.

Recent educational practice defines an educational objective as a statement that fulfills the following criteria: it is the statement of a verifiable behavior that has the student as its grammatical subject, and that such a statement represents the goal of the learning process; the statement defines the appropriate conditions in which it must be shown by the student; finally, the statement defines some criterion, such as efficiency, with which the behavior must be shown. (3)

7.3 The objectives of medical education.

The behaviors of the physician which are verifiable during the encounter with a patient were identified in a previous chapter. These behaviors are related and recurrent. They are the method through which the physician cumulatively and progressively approaches the fulfillment of his prime function. All of these behaviors are verifiable. Their simple statement fulfills the first criterion of an educational objective as defined above. It is now necessary to identify the conditions that are appropriate for each of them and the efficiency with which each must be shown.
Since the behaviors of the physician are related, the clue to identify the conditions in which each of them is appropriate is to be found in its relations to the others. Thus, the behavior "decides if the patient has improved" can be performed rationally if and only if the physician has identified previously the results of the treatment selected and being administered to the patient. With this condition added the behavior may be restated as follows: "once he has identified the results of the treatment selected and being administered to the patient, the physician decides if the patient has improved." It must be noted that the condition itself is a behavior which also has its own conditions to be properly performed.

The criterion with which the behavior must be manifested can be identified by relating it to some congruent object in the horizon of the physician. For instance the conditioned behavior stated above can be related to "practicality." It would then be transformed into: "once he has identified the results of the treatment selected and being administered to the patient, the physician decides if the patient has improved, immediately."
7.4 The objectives: a first approximation.

At the beginning of the third chapter a first approximation was made toward the definition of the Core of Behaviors that should be learned by the medical student. Five behaviors were then identified. If those behaviors are now stated as the objectives of medical education, they are transformed thus:

a. having met the patient to whom he will provide care, and having established and maintained rapport with him, (conditions), the physician attends to all of the data available to him about the patient and his family, and the specific forms of prevention and treatment, (verifiable behavior), through the performance of a history and physical examination which must be thorough and reliable. (criterion)

b. having obtained all of the data available about the patient to whom he will provide care, his family, and the specific forms of prevention and treatment (conditions), the physician will understand the data (verifiable behavior), in a manner such that in this understanding the multicausal nature of the disease and its multifocal impact are expressed. (criterion)

c. having understood all of the data available about the patient to whom he will provide care, his family, and the specific forms of prevention and treatment, (conditions) the physician judges on the correctness of
his understanding (observable behavior), only after soundly analyzing the relationship between the data available and the manner in which it has been understood. (criterion)

d. having judged that his understanding is correct, (conditions), the physician acts responsibly to alleviate the multifocal impact of the disease upon the person and his family (verifiable behavior) using the specific forms of prevention and treatment efficiently and in congruence with his correct understanding. (criterion)

e. having met the patient to whom he will provide care, (conditions), the physician will establish with him a loving, quasi-dyadic relation (verifiable behavior), so that rapport is established and maintained and anxiety about the illness, possible or actual, is dissipated from the person and his family, and motivation and understanding are instilled into them. (criterion)

7.5 The objectives: a second approximation.

In the third chapter, after making the first approximation to the definition of the core of behaviors of the physician a second approximation was made in which the discrete behaviors that make up the five included in the first were defined.
These discrete behaviors may now be expressed as the objectives of medical education as follows:

1. having prepared himself thoroughly (conditions), the physician meets the patient to whom he will provide care (verifiable behavior), in an appropriate manner and begins a quasi dyadic relation with him. (criterion)

2. having met the patient to whom he will provide care and began a quasi dyadic relation with him (conditions) the physician establishes and maintains rapport (verifiable behavior), so that anxiety about the illness, possible or actual, is dissipated from the patient and his family, and motivation and understanding are instilled into them. (criterion)

3. having established and maintained rapport with the patient to whom he will provide care (conditions), the physician obtains the initial data about the person and his family, and when pertinent, about the specific forms of prevention and treatment (verifiable behavior), in a manner which is thorough and reliable. (criterion)

4. having obtained reliably all of the data about the patient, his family and the specific forms of
prevention and treatment (conditions), the physician imagines that a problem exists (verifiable behavior), based on the data that has obtained. (criterion)

5. having imagined that a problem exists (conditions), the physician decides if a problem exists (verifiable behavior), within two minutes of the beginning of the encounter. (criterion)

6. having decided that a problem exists (conditions), the physician recalls at least one similar situation and recognizes patterns of similarity (verifiable behavior), within 2 minutes of having begun the meeting. (criterion)

7. having recalled similarly patterned situations and decided that a problem exists (conditions), the physician develops the initial statement of the problems of the patient (verifiable behavior), so that at least all of the abnormal signs in the data obtained so far are identified. (criterion)

8. having developed the initial statement of the problems of the patient (condition), the physician identifies the data that are necessary to verify or falsify each of the problems included in the initial statement (verifiable behavior), completely and rapidly. (criterion)
9. having identified the data that are necessary to verify or falsify each of the problems in the initial statement (condition), the physician searches intentionally for this data through the interrogatory, the physical examination and the laboratory (verifiable behavior), using these resources in a manner which is efficient, thorough and reliable. (criterion)

10. having searched intentionally for the data necessary to verify or falsify each of the problems included in the initial statement (conditions), the physician decides if the problems diagnosed have been verified or falsified (verifiable behavior), immediately. (criterion)

11. having searched intentionally for the data necessary to verify or falsify each of the problems included in the initial statement (conditions), the physician decides if new problems must be considered and added to the statement (verifiable behavior), immediately. (criterion)

12. having searched intentionally for the data necessary to verify or falsify each of the problems included in the initial statement (conditions), the physician identifies the data necessary for the verification of any of the problems in the statement that has not been obtained (verifiable behavior), immediately. (criterion)
13. having identified the data, necessary for the verification of the problems in the statement, that has not been obtained and having searched intentionally for it (conditions), the physician scan-searches the patient (verifiable behavior), through an interrogation and physical examination that are reliable. (criterion)

14. having terminated the intentional search and the scanning search (conditions) the physician decides if all of the relevant data have been obtained (verifiable behavior), immediately. (criterion)

15. having decided that all of the relevant data have been obtained (conditions), the physician decides which are the problems in the statement that have been verified in the data (verifiable behavior), immediately (criterion)

16. having decided which are the problems that in fact have been verified in the data, and having decided that all of the relevant data have been obtained (conditions), the physician decides if all of the relevant problems have been diagnosed (verifiable behavior), after soundly analyzing the relation between the data and the list of problems that are considered verified. (criterion)
17. having decided that all of the relevant problems have been diagnosed (conditions), the physician produces the complete list of the problems diagnosed in the data available (verifiable behavior), immediately. (criterion)

18. having obtained all of the data about the patient and his family and completed the list of diagnoses verified in the data (conditions), the physician decides if the problems diagnosed explain all of the data available (verifiable behavior), within a reasonable time. (criterion)

19. having obtained all of the data about the patient and his family and completed the list of diagnoses verified in the data (conditions), the physician decides which of the problems diagnosed may only be held tentatively because they need to be supported by data not yet available (verifiable behavior), immediately. (criterion)

20. having completed the list of verified and tentatively verified problems (conditions), the physician arranges the problems diagnosed as a function of some criterion, such as probability, seriousness, treatability or remoteness (verifiable behavior), correctly. (criterion)
21. having arranged the problems verified or tentatively verified as a function of some criterion (conditions), the physician decides if the ordering is final (verifiable behavior), after soundly analyzing the relation between the arrangement and the criterion used. (criterion)

22. having reached the final ordering of the problems verified and tentatively verified (conditions), the physician identifies the possible measures of prevention and treatment for each of the problems diagnosed (verifiable behavior), within a reasonable amount of time. (criterion)

23. having identified the possible measures of prevention and treatment for each of the problems diagnosed (conditions), the physician selects those that are appropriate (verifiable behavior), immediately. (criterion)

24. having selected those measures of prevention and treatment that are appropriate to the problems diagnosed (conditions), the physician identifies the resources necessary to implement the measures (verifiable behavior), immediately. (criterion)

25. having identified the resources necessary to implement the measures of prevention and treatment (conditions)
the physician obtains the resources (verifiable behavior), within a reasonable amount of time. 
(criterion)

26. having obtained the resources necessary to implement the measures of prevention and treatment (conditions), 
the physician implements the measures (verifiable behavior), correctly. 
(criterion)

27. having implemented correctly the measures of prevention 
and treatment selected (conditions), the physician identifies the results of implementation (verifiable behavior), 
correctly and as soon as they become manifest. 
(criterion)

28. having identified the results of the implementation of the measures selected (conditions), the physician 
decides which of the problems being prevented or treated have been solved, which are being solved, which 
remain stationary, which have worsened (verifiable behavior), within a reasonable amount of time. 
(criterion)

29. having identified the manner in which the problems diagnosed are evolving after the implementation of the measures to prevent or treat them (conditions), the physician judges upon the prognosis of the patient (verifiable behavior), immediately. 
(criterion)
30. having identified the manner in which the problems diagnosed are evolving after the implementation of the measures to prevent or treat them (conditions) the physician decides, for each of the problems, if it was a correct diagnosis (verifiable behavior), correctly and within a reasonable time. (criterion)

31. having identified the manner in which the problems diagnosed are evolving after the implementation of the measures to prevent or treat them (conditions), the physician decides if the measures are being executed correctly (verifiable behavior), immediately. (criterion)

32. having decided that the measures selected to prevent or treat a list of problems diagnosed are not being implemented correctly (conditions), takes the actions necessary to see that their execution is correct (verifiable behavior), promptly. (criterion)

33. having participated in the diagnosis, prevention or treatment of the problems of a patient (condition), the physician terminates the relationship with the patient and his family at the appropriate moment (verifiable behavior), and in a manner such that unnecessary anxiety about illness, possible or actual, is avoided, and understanding and motivation are instilled into them. (criterion)
34. having participated in the diagnosis, prevention or treatment of the problems of a patient (condition), the physician records the details that are relevant (verifiable behavior), in the appropriate format. (criterion)

7.6 Conclusion.

After briefly stating an argument in favor of the core of behaviors concept whose possibilities are being exploited in this dissertation a formal definition of educational objective was presented based on current educational practice. Then the operations identified as the behaviors of physicians in two approximations made previously were stated as a first and a second approximation to the definition of the objectives of medical education. Whether as stated they are teachable will be explored in the next chapter.
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CHAPTER VIII
THE STRATEGY TO REACH THE OBJECTIVES OF MEDICAL EDUCATION

8.1 Introduction.
8.2 The Clue.
8.3 The Strategy.
8.4 Summary.
8.1 Introduction.

In previous chapters were identified the operations of the physician and eventually expressed as the objectives of medical education. It has also been argued that when learned these objectives would communicate to the medical student the critical instances through which he can have access to the present intellectual development of medicine; and they would give him a fixed base and invariant pattern which would open him to all further developments. It must now be investigated whether the objectives as defined are teachable, and to identify the strategies that may be used to teach them. In fact, by describing a strategy to teach them it will be shown that they are teachable.

In order to accomplish the purpose of this chapter it must be remembered, as was argued in the chapter about the relations between scientific method and the method of the physician, that in accordance with the canon of statistical residues, a diagnosis is made and a treatment selected when an abstract system is applied to a concrete situation. The concrete situation is the patient in whom, because he
presents certain data, the diagnosis is going to be made and to whom the measures of prevention or treatment will be administered.

Thus, whatever the strategy to teach the objectives of medical education may be it must give the student the opportunity to learn the diseases that may be diagnosed, the measures of prevention and treatment that may be administered, and to encounter the patients in whom the diseases will be diagnosed and to whom the treatments will be administered.

The body of abstract systems that includes the diseases that may be diagnosed and the measures with which they may be prevented and treated is called "Basic Medical Science." This is not more than the viewpoint expressed, a thousand years ago by Moses of Huesca and Roger of Hereford, that the practice of medicine must be grounded upon scientific theory, the theory furnished by the Basic Medical Sciences.

The encounter with the patient can only be made in the clinic, where the word "clinic" means simply anywhere in which actual or simulated health care is provided. In the clinic is where the student will learn to establish with the patient the quasi dyadic relation within which he may fulfill the prime function of the physician. And the student has to
encounter there a sufficient number of patients as to acquire each of the behaviors in the Core.

8.2 The Clue to Find the Strategy.

The clue to find the strategy with which the Core of Behaviors can be taught will be found in the most basic ideas of J. Piaget as explained by Lonergan.

Piaget analyzed the acquisition of skills. According to him skills have elements and each element represents an adaptation to some new object or situation. (1) In each adaptation are distinguished two parts: assimilation and adjustment. Assimilation brings into play "... the spontaneous or previously learned operations employed successfully on somewhat similar objects or in somewhat similar situations." (2) While adjustment, "... by a process of trial and error gradually modified the previously learned operations." (3)

In the case of the student physician who is beginning his medical education, assimilation brings into play, initially, the spontaneous operations of the dynamic structure of his mind which have been employed successfully in situations somewhat similar to those encountered in the medical school, which everyone lives during a normal life; problem solving
situations related to health and disease, like diagnosing illness in self or in a friend, or in someone met on the street.

As a person adapts to ever more objects and situations there occurs a process which is twofold. "There is an increasing differentiation of operations, so that more and more different operations are in one's repertory." (4) And there is also an increasing number of different combinations of the differentiated operations. (5)

Thus the spontaneous operations of the student physician who seeks to be able to fulfill the role go from a state of indifferentiation toward an increasingly differentiated state in which may be distinguished those that have to do with gathering the data available from those that have to do with understanding the data; and these from those that have to do with making judgements about the correctness of the understanding; and these from those that have to do with making the appropriate decision; and these from those that have to do with establishing the appropriate relation with the patient. And when this has occurred, the operations that have to do with gathering the data differentiate further into those that permit him to gather the initial data, those that permit him to recall similar situations and recognize
patterns, etc. And the same happens with those concerned with understanding, with judgement, with decision making for action and with establishing and maintaining a quasi dyadic relation with the patient.

Increasing skill in the implementation of these operations eventually approaches mastery. To define it Piaget used the notion of group. "The principal characteristic of the group of operations is that every operation is matched by an opposite operation and every combination of operations is matched by an opposite combination." (6) So, when a set of operations form a group, "... the operator can always return to the starting point and, when he can do so unhesitatingly, he has reached mastery at some level of development." (7)

The objectives that were defined as those of medical education in this dissertation correspond to the level of development associated with the student who is about to receive the medical degree. The objectives that were defined for the curriculum that leads to the degree were obtained from the operations of the mind of a physician. Each operation, at the first or the second approximation, may be considered as an element in the skill of a skilled physician. Each element deals with a particular object or situation; each new element represents an adaptation to some new object
or situation. Thus the operations of the physician at the level of attentiveness adapt him to the presence of the patient, and to his own spontaneous exigence to be attentive; they result in making the data about the patient available. The operations at the level of intelligence adapt him to the data that has been obtained from the patient and his own spontaneous exigence to be intelligent; they result in the understanding of the data. The operations at the level of rationality adapt him to the fact that there is only one correct way to understand the data and his own spontaneous exigence to be rational; they result in a judgement about the correctness of the way in which the data have been understood. The operations at the level of responsibility adapt him to the fact that he is expected to administer a treatment and his own spontaneous exigence to administer only whatever treatment is congruent with correct understanding.

The objectives that were defined at both approximations represent operations of a skilled physician each of which adapts him to a new object or situation. The skills are developed by the student physician starting from the spontaneous operations of his mind; operations that, as has been said above, have been employed by the student in situations similar to those that he is learning to deal with in medical school. As the spontaneous operations of the
 student develop into the operations of the skilled physician there occurs the process of assimilation. And because the analogate of the canon of operation is at work in the mind of the physician, trial and error gradually adjust the operations. The operations at the level of love adapt him to the fact that the patient is a person in need, an "ens indigens," and his own spontaneous exigence to donate himself; they result in the appropriate doctor-patient relation.

The objectives that were defined at both approximations represent operations of a skilled physician each of which adapts him to a new object or situation. The skills are developed by the student physician starting from the spontaneous operations of his mind; operations that, as has been said above, have been employed by the student in situations similar to those that he is learning to deal with in medical school. As the spontaneous operations of the student develop into the operations of the skilled physician there occurs the process of assimilation. And because the analogate of the canon of operation is at work in the mind of the physician trial and error gradually adjust the operations.
The preceding paragraphs have been searching in the most fundamental ideas of J. Piaget the clue to the strategy to teach the objectives of medical education as they have been defined in this dissertation. What seems to have been discovered so far is that the objectives could be taught and learned through a strategy that allows for the piagetan notion of the adaptation of the spontaneous operations of the mind of the medical student to the objects and situations that must be dealt with skillfully by the physician. This seems to call for a strategy in which the student, at the beginning of his education, encounters objects and situations which are not very different from those that he may have encountered and dealt with before entering medical school. Having dealt with these initial situations successfully the student would then be faced with objects and situations of an ever increasing complexity.

Having described the strategy through which the objectives of medical education may be taught and learned has, at least in theory, demonstrated that the objectives are teachable and learnable. Now it will be argued that they can be learned at the level of mastery. This will be done by demonstrating that the objectives defined form a group: that each objective is matched by its opposite and every combination of objectives matched by an opposite combination, so that at a certain
level of learning the student may show that he has mastered the objectives by going from anyone of them to those that follow, or to the starting point.

Two sets of objectives have been defined: those that are a first and when these were expanded, those that are a second approximation to the Core of Behaviors. Since the second approximation is the expansion of the first, for the sake of simplicity, only those in the first approximation will be shown to be grouped.

First Objective:
having met the patient to whom he will provide care, and having established and maintained rapport with him, the student physician attends to all the data available to him about the patient and his family, and the specific forms of prevention and treatment, through the performance of a history and physical examination which are thorough and reliable.

First Objective’s opposite:
having been given all the data about a patient, his family and the specific forms of prevention and treatment, data obtained attentively through a thorough and reliable history and physical examination, the student physician will meet the
patient and establish and maintain rapport with him.

Second Objective:
having obtained all of the data available about the patient
to whom he will provide care, his family and the specific
forms of prevention and treatment, the student physician will
understand the data in a manner such that in this
understanding the multicausal nature of the disease and its
multifocal impact are expressed.

Second Objective's opposite:
having been given the specific way in which a set of data has
been understood, and understood in such a manner that the
multicausal nature of the disease and its multifocal impact
are expressed, student the physician will obtain the data
about the patient and the specific forms of prevention and
treatment necessary to produce this understanding.

Third Objective:
having understood all of the data available about the patient
to whom he will provide care, his family and the specific
forms of prevention and treatment, the physician judges upon
the correctness of his understanding only after soundly
analyzing the relationship between the data available and the
manner in which it has been understood.
Third Objective's opposite:

having been given the correct judgements that were made on the specific manner in which a set of data about a patient, his family and the specific forms of treatment were understood after soundly analyzing the relation between the data and the understanding, the physician will identify each datum that must have been available to produce such correct understanding.

Fourth objective:

having judged that his understanding is correct, the physician acts responsibly to alleviate the multifocal impact of the disease upon the person and his family using the specific forms of prevention and treatment efficiently and in congruence with his correct understanding.

Fourth objective's opposite:

having been given the description of the specific forms of prevention and treatment that are being used responsibly to alleviate the multifocal impact of an illness upon a patient and his family, the physician will identify the correct understandings for which these forms of prevention and treatment are congruent.
Fifth objective:
Having met the patient to whom he will provide care, the physician will establish with him a loving, quasi dyadic relation with him, so that rapport is established and maintained and the anxiety about the illness, possible or actual, is dissipated from the patient and his family, and motivation and understanding is instilled into them.

Fifth objective's opposite:
Being ready to establish a quasi dyadic relation in which rapport will be established and maintained and the anxiety about the illness, possible or actual, will be dissipated from the patient and his family and understanding and motivation are instilled into them, the physician will meet the patient.

Thus, it seems that it can be argued that every objective defined is matched by an opposite objective so that the set of objectives defined have the properties of a mathematical group and therefore, according to Piaget, could be learned at the level of mastery. (9) Where mastery means that the student who has learned the objectives can always and unhesitatingly return from any operation in the sequence to any other previous one or to the starting point of the whole process.
8.3 Summary.

This chapter has argued that the objectives of medical education as they have been defined in this dissertation are teachable. They are teachable through a strategy that exploits the spontaneous operations of the minds of the student physicians.

The strategy must be such that it present the student first with simple situations to which the spontaneous operations of his mind can easily adapt, where adaptation means the piagetan twofold process of assimilation and accomodation. The strategy then presents him with ever more complex situations until all of the skills of a skilled physician have been learned.

It has also been presented the argument that the learning of these objectives can occur at the level of mastery, since every operation and every combination of operations is matched by its opposite, so the operator may return to any previous one or to the starting point. It has also been said, following Piaget, that mastery occurs when the operator can unhesitantly return to the starting point.

In the following chapter a more precise description of the teaching and learning strategy will be attempted.
LIST OF REFERENCES TO CHAPTER EIGHT


2. Ibid.
3. Ibid.
4. Ibid.
5. Ibid.
6. Ibid.
7. Ibid.
8. Ibid.
9. Ibid.
CHAPTER IX
TEACHING CLINICAL SKILLS AND BASIC SCIENCES

9.1 Introduction.

9.2 Teaching the Clinical Skills.

9.3 Teaching the Basic Sciences.

9.4 The Problem of Teaching the Relevant Science.

9.5 Teaching the Basic Sciences Through a Problem Solving Strategy.

9.6 Summary.
9.1 Introduction.

In previous chapters it has been stated that a diagnosis is made and a treatment prescribed when an abstract system is applied to a concrete situation. This is no more than the operation of the Canon of Statistical residues briefly analyzed earlier. The abstract systems are represented by the Basic Medical Sciences. The concrete situations are the patients whom the medical student encounters in his clinical experiences.

The objectives of medical education have also been defined and it has been argued that they are teachable; the general strategy to teach them is based upon the piagetan notion of adaptation.

This chapter will explore further the nature of the strategy to teach the objectives of medical education in order to arrive at some general statements about the way in which Clinical Skills and Basic Sciences may be taught.
9.2 Teaching the clinical skills.

As mentioned in the introduction, in the strategy to teach the objectives of medical education a central role is played by the notion of adaptation. It is twofold, it consists of assimilation and adjustment. Assimilation brings into play the spontaneous or previously learned operations that the operator has employed successfully on somewhat similar objects or situations. Assimilation incorporates objects into patterns of behavior and these patterns are all those operations that the operator may repeat actively.

The pattern of behavior that is to be taught to the medical student is that of the skilled physician. This is represented by all of those operations that the physician is capable of active repetition. These behaviors have been identified, and may be seen to be the result of the operation of the structured interiority of the physician, analyzed and discovered to be the method of the physician, related to the logic of the physician and to the method of science, given a the horizon of the physician as their context and stated as the objectives of medical education. The object that is incorporated into the pattern of behaviors is threefold: the concrete patient that presents an assortment of signs and symptoms; the abstract system whose name is the disease that may be diagnosed in the concrete
patient precisely because he presents those signs and symptoms; the abstract system called prevention and treatment which will be selected for and administered to the patient precisely because of the diagnosis that was made.

From the above the simplest strategy that could be used to teach the clinical skills of a physician would be:

1. teach the student to meet and relate to the patient in the appropriate manner.
2. teach the student to obtain the signs and symptoms of the patient through a thorough and reliable history and physical examination and the judicious use of the laboratory.
3. teach the student to make the diagnosis of the illness of the patient after soundly analyzing the data available and the diagnostic possibilities.
4. teach the student to select the prevention and treatment that may be appropriate to the diagnosis made.
5. teach the student to administer correctly the measures of prevention and treatment that were selected.

But besides assimilation there is adjustment. And adjustment by a process of trial and error gradually modifies
and supplements previously learned operations. Thus, to the five point strategy that appears above may be added the following point:

6. When the student has learned to meet a concrete patient and relate to him in the appropriate manner, to obtain from him the signs and symptoms and the laboratory data, diagnose his correct disease, select the appropriate measures of prevention and treatment, and administer the treatment correctly have him meet a different patient in whom a slightly different set of signs and symptoms and laboratory data will be found, a slightly different diagnosis will be made, a slightly different set of preventive and treatment measures selected and administered.

This six step strategy to teach the medical student the clinical abilities of the skilled physician seems to be congruent with the spontaneous operation of the dynamic structure of the interiority of the physician which exiges him to be attentive, intelligent, rational, responsible and loving. Thus, the student cannot be taught first those operations concerned with the selection and administration of prevention and treatment because to prevent or treat without a diagnosis is not responsible. He needs a diagnosis in order to be responsible. But a diagnosis is not correct simply
because it has been thought by the physician; it is correct
because it can be verified in the data. And to be verified in
the data a diagnosis first needs to have been considered; it
will not be considered unless it is seen as a possible way to
understand the data. And it will not be considered as a
possible way to understand the data if the data have not been
obtained from the patient. And the data necessary for the
physician will not be obtained if he does not know how to
meet a patient and establish with him the appropriate
relation.

So it is found that whether based upon the most basic
ideas of the Genetic Psychology of Piaget or the Cognitional
Theory of Lonergan the strategy to teach the medical student
the operations of a skilled physician consists of the same
six steps that were defined above. (1,2)

Lest it seem that it is being claimed that an entirely new
way to teach clinical skills has just been discovered and it
is being described it is interesting to note that in 1793
Pinel wrote that

The true method to teach medicine is the one appropriate
to all the natural sciences: focus the student's attention
on concrete situations, impart high standards of accuracy
for their perceptions and observations, warn them against
hasty judgements, choose readings to confirm their taste
for rigor, and impose an orderly progression on their
studies - in a word, train their judgement rather than
their enthusiasm and inspire them with that noble
enthusiasm for the healing art that masters all
difficulties. (3)
In recent years medical educators have discovered that teaching the student the clinical operations of the skilled physician can be greatly facilitated by the use of simulated patients previous to the encounter with real patients. With the simulated patient the it is possible to select the exact patient appropriate to the particular learning needs of the student at any stage; and the student encounters this patient free from the real concern about his welfare, free from the real responsibility of providing care for him, and unembarrassed by the hesitancy of his own clinical abilities. (4) These concerns can be added when the student has reached the level of mastery with the simulated patient.

9.3 Teaching the basic sciences.

According to Flexner, "... the human body is basic to the doctor's occupation. He must know it well, the vital functions in the healthy state, and the general means of preserving health. (5)

If body and organism are taken to mean the same thing, then, "... study of the organism begins from the thing-for-us, from the organism as exhibited to our senses." (6) The first step, then, would be the description of the parts of the organism, that is anatomy. A second step would be to understand these parts in relation to the events and operations of the organism; and that this understanding be of
whatever each of the parts can do and does under determinate conditions, and the relation that exists of the capacity to perform of one part with the capacity to perform of all the others. So, anatomy is followed by physiology. "A third step is to effect the transition from the thing-for-us to the thing-in-itself. . . " (7) To effect these transition the forms that systematize the coincidental manifold of chemical and physical processes in the organs must be understood. So, physiology is linked with biochemistry and biophysics. For this transition it is necessary to invent the symbolic images that are appropriate to the chemical and physical processes that are relevant, because neither chemical nor physical events are revealed directly to the senses. Insight into these images is necessary if one is to grasp the laws of the system that account for its regularities beyond a chemical or physical explanation. These laws are the "... flexible circle of schemes of recurrence in which the organism functions." (8) Through these three steps the organism is revealed as a higher system that systematizes "... an underlying manifold of cells, chemical processes, physical changes." (9)

But because the organism is not only grounded in anatomy, physiology, chemistry and physics, but also in the flexible range of schemes of recurrence in which emergent probability
is at work, it not only adapts, within limits to its environment, the organism also grows and develops, so that the laws with which it may be explained at one given time may not be the set of laws that explain it at another. (10)

From this brief theory of the human organism whose understanding "... is basic to the doctor's occupation" (11) it seems that the strategy to teach the student physician the basic medical sciences could consist of the following elements:

1. teach the student anatomy: the structures of the body.
2. teach the student physiology: the capacities for performance that may be grasped in the structures.
3. teach the student the biochemistry and biophysics that underlies each organ's capacity for performance.
4. teach the student the flexible circle of schemes of that may be grasped in the manifold of events at the levels of biochemistry and biophysics.
5. teach the student the notion of the growth and development of the organism.

However, before continuing it is necessary to point out that the fifth step contains an ambiguity which it is necessary to dispell. Under the influence of the biomedical model that arose from cartesian dualism such a step would be
taken to mean the growth and development of the organism as body. The limitations of this conception have been pointed out by Engel. (12) But the word organism must be understood in the sense of whole person, someone who develops at different levels. So understood, the following steps are:

6. teach the student the differences between somatic, psychic, intellectual and human development.
7. teach the student the schemes of recurrence that characterize each stage of somatic, psychic, intellectual and human development of the organism.

The strategy to teach the basic medical science that has been characterized so far would seem to be able to teach the medical student about the human organism as healthy. However the strategy that is being searched for must also teach about the diseased human organism and the measures through which he may regain his health. It must teach the abstract systems disease, prevention and treatment.

In order to do this the steps of the strategy already defined should be transformed into the following:

1. teach the student the anatomy: the structures of the human organism. And teach also the pathologic anatomy: the abnormalities in the structures of the human
organism and the signs and symptoms that they give rise to.

2. teach the student the physiology: the capacity for function of each of the structures. And teach the pathophysiology: the capacity for malfunction in the abnormal structures and the signs and symptoms that they give rise to.

3. teach the student the biochemistry and the biophysics that underlie the capacity for function of each of the structures. And teach the student the biochemistry and biophysics that underlie the capacity for malfunction, the signs and symptoms and the laboratory data that they give rise to.

4. teach the student the flexible circle of schemes of recurrence that may be grasped in the manifold of events at the levels of biochemistry and biophysics.

5. teach the student the notion of development of the organism at the somatic, psychic, intellectual and human levels, the schemes of recurrence that characterize the stages of development at each of these levels; the abnormalities that may become evident at any stage and the signs, symptoms and laboratory data that they give rise to.
6. teach the student to identify the abnormalities in the signs, symptoms and laboratory data and group them into syndromes and disease entities.

7. teach the student the measures of prevention and treatment that may be selected for each abnormality, syndrome and disease entity; and the criteria for selection.

8. teach the student the effect of the measures of prevention and treatment on the abnormalities, syndromes, disease entities.

Now it seems that the strategy to teach basic medical science is complete.

9.4 The Problem of Teaching the Relevant Basic Science.

A strategy to teach basic sciences to the medical student has been outlined. However, the Basic Science that could be taught with it is enormous, and not all would be relevant. This is a very important problem that would be solved if there existed a rule that permitted educators to identify the basic science that is necessary for the attentive, intelligent, rational, responsible and loving practice of medicine in present circumstances.
Because the problem has not been solved the medical student is overloaded with information. In an investigation it was found that the learning rate of the student "... during his Basic Science period is twenty-four fact/concepts per hour, against our recommended rate of about six facts/concepts per hour." (13) At the end of his basic science courses the student has stored an enormous amount of information and it has not been determined if it is there a few months after he has passed the corresponding examination.

In order to discover the rule that will permit the specification of the Basic Science that the student needs it must be remembered that the purpose of the medical curriculum is to communicate the present intellectual development of medicine to the student in such a way that he is able to fulfill the prime function of the physician while keeping open to all further developments.

And, the purpose of the majority of the medical students seems to be to become practicing physicians who alleviate the impact of disease upon their patients and their families, and not scientists. It must also be remembered that as physicians they will be using a method which is not that of a scientist, but isomorphic with it. They will attempt to master any amount of science only when they are convinced that it is related to their purpose; and they are convinced
when they have had clinical experiences in which they have seen the application of basic science to the solution of problems in clinical medicine.

The science that should be taught to the medical student must be related to his purpose of becoming a practicing physician, and it must be taught within the context of the clinical experiences that make it relevant, and not as blocks of information that have relevance on their own. For it determines "... a space of possible scientific events in which concrete particulars are made manifest in the clinical experience of the physician or revealed directly to him through the text that these particulars write for him with the help of suitable technology." (14) Basic science is important for medicine because it enlarges, corrects and makes more and more comprehensive that space. This seems to have been grasped by physicians since the time of Moses of Huesca and Roger of Hereford.

From the argument that has been stated above may be defined the following rule: teach the medical student within a clinical context that could be real or simulated, all of the basic science that enlarges, corrects and makes more comprehensive the space in which is mirrored the complex scientific image of the developing human organism, its
diseases and their prevention and treatment, for "... the more comprehensive is this space, the finer tuned is the image, the greater are the powers of the physician." (15)

The rule is heuristic, it does not immediately produce a list of the contents of basic science that are relevant. But it does permit, given a possible content, to decide if it should be taught to a medical student.

9.5 Teaching Basic Science through a Problem Solving Strategy.

The strategy to teach basic sciences that has been outlined is similar to that which has been called "problem based learning." It does not require the study of disciplines in an organized sequence. "In problem based learning the learner focuses on a problem which he has identified and which involves real intellectual effort." (16) The learner brings to the problem all that he has learned previously, and the spontaneous operations of his mind, at whatever level of skill they may be at that moment. As he enters the problem the learner begins to ask questions about it and, "... certain issues become defined which will require further information search. After assembling the appropriate information he synthesizes a problem solution." (17) Thus in problem based learning the student is faced with an object or
situation that he would encounter in real life.

The questions that the student asks when he encounters the object or the situation reveal the need that he has to enlarge, correct and make more comprehensive the scientific space that he possesses and in which he may mirror the image of the problem. The questions reveal his need to learn basic science. But what he needs is to enlarge, correct and make more comprehensive the space in which the concrete problem that he is faced with may be mirrored. Thus the questions reveal just what, of all basic science he needs to learn.

As this basic science is learned its relevance to the problem is clearly seen: the issues to which it is related become clarified, but new questions emerge that reveal the solution may be synthesized because all the relevant questions were asked and they were answered with Basic Science.

The student repeats the process with the next problem that he encounters, and all successive problems. At the end he is in possession of a scientific space in which may be mirrored and searched the diseases that he must be able to diagnose and the measures with which he will prevent and treat them.
The problems presented to the student are those that he must be able to solve at the end of his medical education. In this way the learning is highly relevant and "... similar to the method by which many health professionals learn in real life." (18)

It would seem that when the learning of the basic sciences has been based on a problem solving strategy the medical student is sent on his way toward becoming a lifetime learner.

It seems that if a problem based learning strategy were used to teach the student the Basic Science that is relevant then the steps that were defined above would have to be transformed into the following:

1. teach the student to recognize the abnormalities in form and function that are verifiable in the data of the object or situation he faces.
2. teach the student to ask the relevant questions raised by the abnormalities that he has recognized in the data.
3. teach the student the anatomy and the pathologic anatomy: the structures of the human organism and the abnormalities in these structures and the signs and
symptoms and laboratory data that they give rise to, that are necessary in order to come to the answer of the relevant questions.

4. teach the student the physiology and the pathologic physiology: the functions and the malfunctions of the structures studied in anatomy and pathologic anatomy, and the signs and symptoms and laboratory data that they give rise to, that are necessary in order to come to the answer of the relevant questions.

5. teach the student the biochemistry and biophysics that underlie the capacity for function and malfunction of each of the structures, and their correlation with the signs and symptoms and laboratory data that have arisen, that are necessary to come to the answer of the relevant questions.

6. teach the student the flexible circle of schemes of recurrence that may be grasped in the manifold of normal and abnormal events at the levels of biochemistry and biophysics.

7. teach the student the notion of development of the organism at the somatic, psychic, intellectual and human levels, the schemes of recurrence that characterize each of the levels and stages, the abnormalities that may become evident at any stage and the signs and symptoms that they give rise to.
8. teach the student to group the abnormalities evident in the data into syndromes and disease entities.

9. teach the student the measures of prevention and treatment that may be selected for each abnormality, syndrome and disease entity and the criteria for selection.

10. teach the student the effect of the measures selected on the abnormalities, syndromes and disease entities.

9.6 Summary.

This chapter attempted to define the strategies through which clinical skills and basic sciences may be taught to medical students. Yet, it must end with a word of caution: there is more to teach the future physician than clinical skills and basic sciences. In 1910 Flexner wrote:

...the physician's function is fast becoming social and preventive, rather than individual and curative. Upon him society relies to ascertain, and through measures essentially educational to enforce, the conditions that prevent disease and make positively for physical and moral well being. It goes without saying that this type of doctor is first of all an educated man. (19)

Perhaps, once again, following a clue furnished by Lonergan, to become an educated man can be accomplished if and only if a person thoroughly understands what it is to understand. (20)
LIST OF REFERENCES TO CHAPTER NINE


7. Ibid.

8. Ibid.

9. Ibid.

10. Ibid.

11. Ibid.


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15. Ibid.


17. Ibid.

18. Ibid.


CHAPTER X
EVALUATION OF LEARNING MEDICINE

10.1 Introduction.
10.2 The Argument.
10.3 The Method of Evaluation.
10.4 The Validity and Reliability of the Evaluation.
10.5 The Report of the Results of the Evaluation.
10.6 The Evaluation of the Learning of the Basic Sciences.
10.7 The Evaluation of the Student as an Educated Man.
CHAPTER TEN

10.1 Introduction.

In the development of this dissertation and pursuing the Core of Behaviors insight of Dr. Weed a set of the objectives of medical education has been defined. (1) An argument has been advanced to demonstrate they are teachable and that they can be learned at the level of mastery. Also, a strategy has been described which could be used to teach them. It will now be argued briefly that the learning of these objectives can be evaluated, and a brief description of the method of evaluation will be given.

10.2 The argument.

The argument in favor of the fact that the learning of the objectives of medical education proposed in this dissertation can be evaluated is as follows:

1. every one of the objectives is a verifiable behavior. Any properly trained observed will be able to decide if a student manifests any particular behavior or not.

2. every one of the verifiable behaviors is appropriate in circumstances which are well defined and whose fulfillment is verifiable. Thus, any properly trained
observer can not only decide if a student manifests a particular behavior, but he can also decide if the behavior is manifested in the appropriate conditions. 3. every one of the behaviors must be manifested in a manner such that it fulfills some well defined criterion which is also verifiable. Thus, any properly trained observer can not only decide if a student manifests a particular behavior in the appropriate conditions, he can also decide if the behavior meets the criterion defined to be met.

An argument such as this is not new. It is common knowledge among some modern educators, at least, that the objectives of a curriculum are defined as verifiable behaviors that are appropriate to certain circumstances and which must meet a certain criterion because that way their evaluation becomes a relatively straightforward procedure. Also, this argument seems to lead into a type of evaluation which is criterion-referenced rather than the norm referenced type of evaluation. (2) That is, the standard for evaluating the learning of the student is to be the objectives of learning as they have been defined above, rather than the performance of the group of students to which he belongs.
10.3 The Method of Evaluation.

The method of evaluation should not test the acquisition of isolated skills or facts. Rather it must determine if the medical student is becoming a physician. Also, it should "...be a constructive and integral component of the learning process rather than a detached activity." (3) It must be both formative and summative.

Diagnostic evaluation refers to a type of assessment in which the student is feedback the results of the evaluation in order to provide him with an opportunity to modify or make the corrections that may be appropriate so that the objectives of his education may be reached. Its purpose "...is primarily to facilitate student learning and to modify the learning program." (4) After the student is feedback the results it is not necessary to register them permanently. This type of evaluation is best implemented when the student himself becomes his own primary evaluator, while teachers, fellow students and programs become a resource for his self evaluation. This approach to evaluation seems to be consistent with the overall goal of medical education of turning the student into a self directed life long learner.
Summative evaluation refers to that assessment which is made at the end of the time assigned to the learning process. Its purpose is to determine if the objectives were learned. In this case, its purpose is to obtain the data that will permit the medical school to decide if the student has in fact become a physician. Its results are recorded permanently. Certificates are issued on the basis of this record.

10.3 The Validity and Reliability of the Evaluation.

The evaluation of the student, whether formative or summative, has to be valid and reliable. Also, it is important to discover what has been pointed out by Newble: "no single test method is capable of providing a valid and reliable evaluation of all defined aspects of clinical performance." (5) The observation of the student physician while he is caring for a patient is obviously the most valid manner to evaluate if he is learning or has learned the objectives of the curriculum. Such observations may be written and reported much as many social scientists report their observations in the field. These reports will be the data in which, through insight into them, it will be verified how far the student has progressed toward the achievement of the objectives, or whether the student has already achieved them.
This type of observation may be aided by such instruments as rating scales, check lists, etc. However the construction and validation of these instruments represents a problem; the validity of a report cannot be greater than the validity of the instrument used to make the observation. Solving this problem, the validity of the immediate observation of the student for the purposes of evaluation cannot be challenged.

The audit of the medical records of the patients being cared by the student is another valid method for evaluating the learning of the objectives. It is used commonly. However it seems that this audit evaluates the quality of the record immediately and only in a mediate way it evaluates the quality of the method that the student employs to solve the problems of his patients.

The methods of evaluation mentioned above may be used in conjunction with simulated clinical experiences. It seems that when the student is evaluated using a simulated patient, the same behaviors would be observed in the real patient and the results of the evaluation would at least be similar. McGuire has developed a method for measuring clinical problem solving using simulation techniques. (6) These simulation techniques seem to have differentiated into Patient Management Problems and simulated clinical encounters. (7)
Both have been used in the evaluation of the student.

The reliability of the evaluation methods that have been described resides in the reliability of the observer that uses them. Thus, the evaluator must receive specific preparation to fulfill his role.

10.5 The Report of the Results of the Evaluation.

The objectives defined as those of a medical curriculum in this dissertation are of such a nature that either the student reaches them or not; or they are achieved at the level of mastery or they are not. They cannot be reached partially. They are all interrelated, and ultimately the expression of the piagetan adaptation of the operations of one single cognitive and formally dynamic structure.

If the learning of these objectives is coupled to the appropriate support, such as that offered by a tutorial system (8) there will be a number of formative evaluations along the way to help the student reach them. But at the time of the summative or final evaluation either the student passes or fails. There does not seem to exist other possibilities of a grading system for these objectives.
10.6 The Evaluation of the Learning of Basic Sciences.

The evaluation procedures described so far seem valid for the learning of the clinical skills of the physician. A word must be said about the evaluation of the learning of the basic sciences. It must be remembered that "... basic science serves a twofold function: it determines for the clinician the observational space associated with the scientific image (of health and disease), and it makes possible the technology that extends the clinician's powers into that space." (9)

From this clue it may be argued that the valid and reliable way to evaluate if the student is learning the basic science that he needs is not by testing the memorization of isolated facts. Rather, it is by testing the student's capacity to search efficiently in that space and find the correct diagnosis and the correct measures for prevention and treatment. And by testing the student's capacity to explain with the contents of that space the reasons for the diagnosis made, the measures selected to be administered, the results of their administration and the technology that has been used to accomplish all this.
10.7 The Evaluation of the Student as an Educated Man.

It was Flexner who said that the good physician must be first of all an educated man. In the previous chapter was suggested that the student physician becomes an educated man through dealing with his own capacity for insight until he comes to understand what it is to understand and acquires a fixed base and an invariant pattern that opens toward all further developments in human understanding. But in order to come to understand what it is to understand the student must make an experiment in self-awareness and appropriate the results. This seems difficult in the student has not entered the modern philosophical space and searched there for the mirrored image of what he needs, of what he is undergoing. With this it is simply being suggested that the evaluation of the student as an educated man could be based on his capacity to talk philosophically about himself.
LIST OF REFERENCES TO CHAPTER TEN


4. Ibid.


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CHAPTER XI
A CRITIQUE OF THE DISSERTATION

11.1 Introduction.
11.2 The Theory.
11.3 The Scientific Validity.
11.4 The Desirability for Medical Education and Practice.
11.5 The Relation to Flexnerian Education.
11.6 Some Empirical Consequences.
11.7 Conclusion.
CHAPTER ELEVEN.

11.1 Introduction.

The objective of this dissertation was to explore the power of the Core of Behaviors concept to define the objectives of medical education and develop a curriculum to achieve them. So far it seems that this is what has been accomplished. It now seems appropriate to evaluate whatever has been accomplished in terms of the theory upon which it is constructed, its scientific validity and its desirability for medical education and practice.

11.2 The theory.

The theory of what has been accomplished in this dissertation has at least the following elements: a definition of the function of the physician; a theory of the physician-patient relationship, a cognitional theory applied to understand the mind of the physician; a theory of learning as the adaptation of the operations of the mind to new objects and situations; a theory of the role of basic sciences in the education of the physician; a theory of educational evaluation.

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The definition of the function of the physician is basically that of Dr. Phillip Tumulty adapted to the needs of this dissertation. (1) The adapted definition states simply that the physician is one whose prime function is the management of the health resources available with the purpose of preventing illness or alleviating its total impact upon the patient and his family. It requires that the physician have sound clinical skills and interpersonal abilities in order to gather valid clinical data and instill understanding and motivation in the patient and his family.

The editors of *Harrison's Principles of Internal Medicine* would seem to agree with this definition, they say: "(physicians) must use wise judgement and never forget that their primary and traditional objectives are utilitarian—the prevention and cure of disease and the relief of suffering, whether of body or of mind." (2) Further down they add: "illness is never limited to one system, nor necessarily to a single disease, and whether the physician is a family practitioner, an internist who provides 'primary care,' or a subspecialist, the patient must be viewed not as an organ system but as a person." (3)

That the physician requires sound clinical skills as well as interpersonal abilities to gather valid information and
instill understanding and motivation in his patients would seem to be underscored by the editors of the same textbook who in an earlier version said: "in treating the suffering, there is need for technical skill, scientific knowledge and human understanding...Tact, sympathy and understanding are expected of the physician, for the patient is no mere collection of symptoms, signs, disordered function, damaged organs and disturbed emotions." (4)

Thus, the definition of physician used in this dissertation seems to be compatible, at least, with that offered by one of the most influential books of medicine.

The theory of the physician patient relationship used in this dissertation is that developed by Pedro Lain-Entralgo. Such a theory envisions the relation between the physician and his patient as a relationship which is quasi-dyadic. This means that the physician transforms the patient into an object to be explored by all available means in order to arrive at a diagnosis and then select and administer whatever prevention and treatment are appropriate. But the physician also subjectivizes the patient in order to encounter the person who is ill, the person-in-the-object as it were. (5) As theorized here, the physician grasps the feelings, values, beliefs and understandings in the patient’s present state and
his capacity to develop toward new feelings, values, beliefs and understandings with which he may collaborate with the physician for the success of the measures of prevention or treatment that he is being administered.

That the physician-patient relationship has these two aspects also seems to be supported by the editors of Harrison's Textbook. In it they clearly distinguish between the approach to the disease and the care of the patient. (6)

The approach to the disease, which seems to correspond to the objectivizing dimension of the relation, usually begins by gathering all the facts of medical significance in the life and body of the patient. The care of the patient, which seems to correspond to the subjectivizing dimension, begins with "... the development of an interpersonal relationship between the patient and the physician." (7)

The approach to the disease and the care of the patient are distinguished because "the physician has a special function in society and should be skilled as a psychologist as well as a biologist." (8) The physician possesses a highly technical knowledge and the skills that can affect the forms and the functions of the organism of the patient. Thus, he should also communicate "... a feeling of humaneness, a
sense of confidence and security based upon the conviction that all will be done that can be done." (9)

However, because Dr. Lain-Entralgo has published his most important contributions to this topic in Spanish and only one of his small volumes has been translated, his work is yet to influence English speaking medicine.

The cognitional theory applied to the analysis of the operations of the mind of the physician is that developed by Bernard Lonergan in his diverse writings. This theory proposes that the mind of the human subject is a cognitional, formally dynamic structure that spontaneously moves through several levels of awareness in order to deal attentively, intelligently, rationally, responsibly and lovingly with the self and others.

This theory also considers that the human subject is an intentional subject always within a horizon of which he is one of the poles. The other pole being made up by the objects that the subject can deal with in his present state of development.

Such a cognitional theory seems to have its roots deep into the modern philosophical movement. It seems to develop
from the ideas of Descartes, Kant, Hegel, Dilthey, Husserl, all of whom have analyzed in one way or another the role of mind in history. (10)

The theory itself was developed by Lonergan by slowly coming to understand the human mind at work in creating its everyday reality and its world of theory. Its entire development has been documented in a book by David Tracy. (11)

The thought of Lonergan has been criticized at points that seem to be crucial. Thus E. Coreth differs from him on the way the mind comes to grasp the existence of beings. (12) For S. Ogden the soundness of the theory is doubtful and so is its derivation from it of a metaphysics. (13) From the perspective of P. Ricoeur the fact of will and the possibility of willing evil and what they reveal about the workings of the human mind have not been sufficiently considered. (14) From a heideggerean perspective Lonergan is not sufficiently concerned with the ground of beings, with the source that lets them be. (15) And for Pannenberg, he has not taken into account fully the context in which the mind discovers meaning. (16)
But the theory of Lonergan seems to agree with the viewpoint of Gadamer on the viewpoint of knowledge of self in history. (17)

However, the influence of Lonergan's work is still growing and it is being applied in a number of fields, such as psychotherapy (18), that seem distant from Cognitional theory.

For a number of years there has been a one week Lonergan Workshop during the summer at Boston College in which the implications of his ideas are discussed from many different perspectives.

But the important question is not whether everybody agrees with Lonergan's theory of mind. He says in the beginning of one of his books:

If I may be sanguine enough to believe that I have hit upon a set of ideas of fundamental importance, I cannot but acknowledge that I do not possess the resources to give a faultless display of their implications in the wide variety of fields in which they are relevant. I can but make the contribution of a single man and then hope that others, sensitive to the same problem, will find my efforts shorten their labours and that my conclusions provide a base for further development. (19)

Thus, Lonergan himself considers his theory as no more than a breakthrough into something basic that will be further developed by others. But it will not be subject to radical revisions, for "... the conditions of the possibility of a revision have to be admitted by any reviser and when they
are, they are found to coincide with the already proposed cognitional theory." (20) They coincide with the already proposed theory because the reviser will make sure that his revision is attentive, intelligent, rational and responsible.

Finally, in so far as the theory may be verifiable, "the crucial issue is an experimental issue, and the experiment will not be performed publicly, but privately. It will consist of one's own rational self-consciousness clearly and distinctly taking possession of itself as a rational self-consciousness." (21)

Such private experiments are usually not reported in the scientific literature. But the growing influence of Lonergan on modern scholarship would seem to indicate that they are being performed and his results being reproduced.

It was Lonergan's Cognitional theory that was used to develop a theory about the workings of the mind of the physician. In this, aid was obtained from P. Heelan who has studied the structure of clinical science. (22) His viewpoint develops from that of Lonergan. However in order to clarify the relation between the physician and his method and his instruments he draws on the philosophy of M. Merleau-Ponty.
Heelan's theory is, because of that from which it develops, also to be confirmed by a private experiment in which a physician would take possession of himself as someone that uses scientific method and tools as part of his "subjective body" in order to discover in scientific space the diseases and treatments that his patients need. Heelan's ideas were also used to develop a strategy for teaching the medical student the Basic Sciences. (23)

However, the details of the theory of the operations of the mind of the physician and its relation to the logical structure of medical thinking and to scientific method, are the responsibility of the author of the dissertation. He feels that in this he is supported, at least partially, by the results of the investigations of Alfred, (24) Barrows et al., Elstein et al., (25) Blois, (26) and Eddy and Clanton. (27)

Finally, it is interesting to note that the curriculum that was developed from this theory of the operations of the mind of the physician bears an extraordinary resemblance to those that have been developed thinking of the physician as a problem solver, such as those at the medical schools of the University of McMaster and Michigan State University. (28), (29)
In order to develop the strategy to teach clinical skills to the medical student the most basic elements of the Genetic Psychology of J. Piaget were used: adaptation, assimilation and adjustment. This will be discussed further down, however, it is interesting to note, as it was done in the text of the dissertation, that in 1793 the French physician Pinel had proposed a teaching-learning strategy that is very similar.

The theory of educational evaluation that was used in the dissertation would seem to be congruent with that practiced at medical schools that have curricula similar to the one proposed in this dissertation.

11.3 The scientific validity.

It seems that to demonstrate the scientific validity of a curriculum is not an easy matter, for it results from insights of a type which is different from the type of insights that give rise to scientific theory.

The insights that give rise to a curriculum are practical. They relate things to the intentions of persons. They do not, like scientific insights, relate things to each other in an intentionless world.
The practical insight, as any insight, "... results from inquiry and emerges upon the sensitive flow in which it grasps some intelligible unity or correlation." (31) In the case of the curriculum proposed in this dissertation the insight grasps some correlation between the problems faced by medical education, thus the long introduction on its history, and their possible solution through a curriculum that would lead the student to acquire a Core of Behaviors rather than a Core of Contents. The insight also grasps that perhaps this Core of Behaviors could be made up by the operations of the mind of the physician that are used during the encounter with the patient. It also grasps that perhaps these operations are what they are because the physician's interiority is structured, and, because there is an understanding proper to the physician that is manifested in these operations.

The practical insight also grasps the unity between the elements of the solution proposed. But,

As in any practical insight, the mere fact of grasping the unity or correlation does not imply that the unity exists or that the correlation governs actual events. For beyond the question for intelligence that is met by insight, there is always the question for reflection. However, while the speculative or factual insight is followed by the question whether the unity exists or whether the correlation governs events, the practical insight is followed by the question whether the unity is going to be made to exist or whether the correlation is going to be made to govern events. In other words, while speculative insights and factual insights are concerned to lead to knowledge of being, practical insights are concerned to lead to the making of being. (32)
Thus, while the insight has grasped the unity of the elements of the curriculum and their different correlations, it is still not known whether the curriculum is going to be implemented, whether it is going to be made to govern the events. The curriculum proposed in this dissertation reveals not more than the unities and relations of possible courses of action.

But are the possible courses of action scientific?

The curriculum proposed in this dissertation has three basic elements: the objectives, the strategies to teach them and the process to evaluate their learning. The possible scientific quality of each of these elements will be analyzed separately.

The objectives of the curriculum are based on a verifiable theory of cognition. Certainly they are not verified by Classical Empirical Method, concerned as it is with theory that can be demonstrated exclusively by sensible data. But there are data which are not sensible, rather, they are the data that make sensible experience possible.

Besides the data of the senses there is the datum of human consciousness itself, which is aware of itself and its
operations on data, their norms, their exigences. If science is to be faithful to the Canon of Complete Explanation it will have to account for the data that may be provided by consciousness itself with its structures, norms and operations; and it will have to move toward a Transcendental Method which allows for theories which are verifiable through, experiments conducted with consciousness itself using a Self Attentive Methodology. (33) These experiments would be private, not public, and they are the experiments through which, Lonergan believes that his breakthrough into an unrevisable viewpoint for cognitional theory can be verified.

This idea raises numerous difficulties, but difficulty is not a scientific argument against what seems to be an intelligent argument.

However, the argument in favor of the statement that the objectives of the curriculum proposed in this dissertation are scientific is stated from the viewpoint of a philosophy that allows for experiments to be conducted with a method which is not used, it seems by the majority of scientists. The objectives are also congruent with the results of more classical empirical investigators who have studied the processes by which the physician solves the encounter with the patient, like Barrows et al, Elstein et al, etc.
However, it must be clearly stated that, even beyond the possibility that the argument that has been presented in this dissertation may be scientific, it has been called so only because the author considers it to be ultimately verifiable. But, above all, the argument is philosophical, where the word philosophy is taken, in its modern sense, to refer to that discipline which intends to articulate the interiority of man. (34) Which is to say that the argument that has been presented has been constructed from a theory about that interiority.

The strategy to learn the objectives of the curriculum is based both on the Genetic Psychology of J. Piaget and on Lonergan’s description of the mind moving from the thing-for-us to the thing-in-itself. "Piaget poses his questions from the point of view of psycho-epistemology; his methods, in the realm of cognition are exploratory and flexible; and his methods of analysis those of logical symbolism." (35)

Piaget has explored such questions as under what laws does knowledge develop and change? To answer them he and his colleagues have analyzed the "... mechanisms of the growth of knowledge insofar as it pertains to scientific thought and to discover the passage from states of leastn knowledge to those of the most advanced knowledge. (35)
These mechanisms have been studied in children as they develop categories and concepts such as space, time causality and number. The methods they have used differ from classical:

... in our investigations designed to lay bare the operational mechanisms of thought, he (the child) is brought to grips with physical or spatial transformations of materials. For instance, he deals with problems related to the pouring of liquids from one container to another or with the spatial displacement of rods. We then observe the manner in which throughout the course of his development the child overcomes the conflict presented by variations in the constancies involved. (37)

Piaget and his collaborators are aware that at least two events must be avoided: imposing upon the child a point of view which is not his, and accepting his responses as true. They have avoided the imposition of preconceptions on the data observed by initiating each investigation with an exploration adapted to the level of comprehension of each child, both, in respect to the questions that will be posed to him, and the order in which they will be made. The experimenter takes down the responses of the child, but he also asks explanations for them. "And, by modifying the questions and the experimental conditions the investigator seeks to test the genuineness and the consistency of the child's responses." (38)

The results of Piaget do not lend themselves to easy statistical treatment. Nevertheless, some of the exploratory procedures have been standarized, and when data have been
gathered with them the analysis of the observations is done in four steps: first is made a qualitative classification of the different types of reasoning; second an analysis is made in terms of logical models; third, an analysis is made of the frequencies of responses and dispersions by age; fourth, a hierarchical analysis is made by means of ordinal scales. (39)

The use of these standardized procedures and the analysis that follows lend "... broad confirmation to the succession of stages of reasoning which had been established in preliminary form by qualitative and logical methods." (40) Thus, in so far as the strategies to reach the objectives are effectively grounded upon the Genetic Psychology of Piaget they seem to be based upon scientific ideas.

But the strategy to teach the objectives is also based on the ideas with which Lonergan discusses Genetic Method. According to him the study of an organism begins from the thing-for-us, from the thing as it is exhibited to the senses and continues until is made the transition to the Thing-in-itself. Such a movement produces first the science of anatomy which is followed by physiology and then biochemistry and biophysics.
That the mind does move as Lonergan states seems to be supported by the concrete historical unfolding of the Basic Sciences. Anatomy, the science of the things revealed to our senses was the first to develop, above all by the genius of Vesalius in the Sixteenth century. (41) It was followed by Physiology; its first truly scientific contributions occurred with Harvey in the Seventeenth century; (42) but its scientific foundations were established by Claude Bernard in the Nineteenth century. Physiology, which still studies the thing-for-us was rapidly followed by Biochemistry and Biophysics, which study the thing-in-itself, thanks to the work of O. Loewi, Erlanger, Gasser, etc. (43)

It is unusual that it be required that an evaluation be scientific. Rather it is required that it be valid and reliable. Since the curriculum proposed in this dissertation was developed following an insight of Dr. L. Weed it is interesting that in one of the new premises that he advances for medical education he states his belief that the performance of a physician should be audited "...according to the rules for medical practice clearly defined and used from the very beginning of medical education. (44)

Such an audit would seem to be a valid evaluation of the learning of the objectives of the curriculum based as they
are in the operations that unfold in the mind of a physician
when he encounters a patient. The evaluation proposed in this
dissertation in fact is based upon the audit of performance
since it proposes that the student be observed in the actual
encounter with the patient, and that the records of the
encounter also be observed in order to verify the achievement
of the objectives.

The evaluation proposed is also compatible with that
suggested by Hubbard in a study of the evaluation of clinical
competence done for the National Board of Medical Examiners
(45) And it is adaptable to the problem solving oral
examination described by Van Wart, (46) to the method that
Pavla describes for measuring clinical problem solving,(47)
and to the approaches for evaluating problem solving in
medical students developed by others, including the use of
simulation techniques for measuring problem solving abilities
described by McGuire and Babbot, (48) and to the performance
based method of student evaluation used by Nelson et al.(49)

It seems then, that the method of evaluation of the
learning of the objectives of the curriculum proposed in this
dissertation is a method similar to those widely used for
similar curricula, and considered valid and reliable.
The desirability of the curriculum proposed in this dissertation for medical education and practice was argued in its first chapter. That something has to change in medical education is agreed by many. A view commonly expressed is: "... medical schools have failed in their obligation to educate doctors who can meet the health care requirements of communities. Some critics consider contemporary medical education so divorced from public needs as to have become irrelevant." (50) Some critics, like L. Weed have gone so far as to propose that medical education be reconstructed on entirely new premises. (51) It is precisely one of his new premises that has been developed to its conclusion in this dissertation, that which proposes a Core of Behaviors to replace a Core of Contents.

The objectives based, as they are, on the operations of mind of a skilled physician would demand of the student just that, to become skilled: to become an attentive, intelligent, rational, responsible and loving physician.

The strategies to reach the objectives, based as they are on the ideas of Piaget and Lonergan, exploit the spontaneous capacity of the student to solve problems and learn on his
own and within a relevant context. It was argued that the objectives can be learned at the level of mastery, but the strategies do not specify any amount of time in which the student must reach the objectives, thus allowing students with different learning abilities to reach that level.

It was argued that the strategies are basically those that permit learning based on problems, and it was said that the student be faced with problems from the beginning of his education would learn the basic science that is necessary without having to learn that which is irrelevant. These problems would be initially simulated and when the student has mastered what he may from them he would be presented with real ones. With a strategy like this the student is practicing the abilities that he should have mastered by the time that he graduates from the very beginning of his education. Thus, his performance as a physician can be audited throughout his career and feedback the results so that the appropriate corrective measures be taken.

All of these qualities of the curriculum: the fact that its objectives are based on the operations of the mind of a skilled physician; the fact that it exploits the spontaneous process of learning; the fact that the objectives can be learned at the level of mastery; the fact that students with
differing abilities can be accommodated; the fact that from the beginning the student is faced with problems like those that he will encounter in his practice; and the fact that the performance of the student can be evaluated at any time during his studies and the appropriate feedback given to him would seem to make the curriculum proposed in this dissertation desirable for medical education.

But, the objectives of the curriculum were defined as they are because they are the behaviors of a skilled physician. It was said, when discussing the evaluation of learning, that these objectives seemed compatible only with a Pass/Fail criterion. Thus, the student who has mastered the objectives has become a skilled physician. And only the students that have mastered the objectives can graduate from the curriculum. To graduate only skilled physicians seems to be desirable for medical practice.

11.5 The Relation to Flexnerian Medical Education.
Perhaps the essentials of flexnerian medical education could be stated as follows: the medical curriculum must allow the student, first to learn about normal and abnormal phenomena and then the practical treatment of these phenomena as manifested in disease. The treatment of disease must include its prevention, in much, through measures that are
mainly educational. Yet, the medical student must not only learn to treat disease, he must also deal humanely with the person. In the education of the student a primordial role must be given to the development of his capacity to frame working hypotheses, called diagnoses, and to frame them in scientific terms. From his hypotheses he must learn to obtain his lines of action. And having acted, he must learn to evaluate the progress of his patient and interpret it, in order to learn from it. (52)

For Flexner such an education leads to the scientific and intelligent practice of medicine, which is in the last instance, what his medical education must prepare the physician for. But the curriculum argued for in this dissertation is based on a theory about the structure and workings of human intelligence itself, thus it should lead to intelligent medical practice. And, the curriculum also provides for the learning of science, through a problem based strategy, which allows for this to occur within a relevant context. So, the practice that it should lead to would not only be intelligent, it would also be scientific.

The curriculum insists that the physician must alleviate the total impact of the disease upon the person and his family. That he must grasp the present state of development
of the person with its skills, feelings, values and beliefs, and its capacity to move toward new skills, feelings, values and beliefs which would improve the chances of success of the physician's intervention. Thus, the curriculum should lead not only to the scientific and intelligent practice of medicine, it should also lead to the humane practice of medicine.

What is being argued, in brief, is that the curriculum for which this dissertation is an argument intends to be thoroughly flexnerian.

There has been a lot of criticism, verbal mostly, about the physician who graduates from flexnerian curriculum, with his capacity to solve the biological needs, but incapacity to respond to the needs of the whole person. However, as Engel has argued, it is not Flexner's conception of medical education which is at fault, it is the biomedical model in which medical education and practice are embedded. (53)

11.6 Some Empirical Consequences.

The curriculum is flexnerian, but does it work? Does it succeed in communicating the student the present intellectual development of medicine, as it was said to be its function at the beginning of the dissertation?
It has already been mentioned that the curriculum the that is proposed in this dissertation resembles in outline one proposed by Pinel in the last quarter of the Nineteenth century. (53) And that it resembles more recent curricular innovations. It is not very different from curricula such as that which is offered by McMaster University. (54)

However, that does not settle the question. The curriculum may work but that has to be demonstrated with an experiment of its own and not with the evidence gathered to demonstrate the virtues of other curricula. But this only raises the question of just how it is that one may experiment in education and stay within the bounds of what is attentive, intelligent, rational, responsible and loving. A similar question may be raised at medical experimentation. Is it ethical to experiment with syphillitics in order to discover what is the best treatment? Can one experiment with medical students in order to discover which of two is the best curriculum?

The argument on which the curriculum is based is philosophical and this dissertation has been a study in philosophy of education. Perhaps the answer to the question about the capacity of the curriculum to fulfill its mission is also philosophical: the curriculum will work because it is
congruent with the formally dynamic structure of human intelligence.

It is not at all clear that one can do the experiment. However, if the curriculum were implemented there are a number of questions about it that may be investigated.

The curriculum assumes that the students already know how to diagnose some common symptoms and diseases when they begin medical school and pretends to start building their medical education from there. Thus, two questions to be investigated are:

1. Just how much medicine do students know when they begin the first year of medical school?

2. Independently of the amount of medicine that they may know, how much of the basic reasoning strategy of a physician is already used by them.

When students enter a medical school they usually have very clear ideas about the way a physician is educated. The education of a physician is thought to be through the study of a number of disciplines, disciplines which must be studied in some unique order, beginning with anatomy and
ending with the specialties. There is the possibility that when enrolled into the curriculum proposed, which moves from basic sciences to clinical experiences without a clear chronological distinction between the two and without following some unique order, some of the students may feel uneasy about the manner in which they are being educated. Thus, three more questions that may be investigated, if the curriculum were implemented are:

3. What sort of emotions are awakened in the students by their being in a curriculum which is structured like this one?

4. How do these emotions compare with those felt by students enrolled in a curriculum with a more traditional structure?

5. Given the emotions felt by students in a curriculum like this, what strategies do students develop to cope with them, personally?, as a group?

These three questions would seem to lead, eventually, to others which are rather important:
6. Can any person who desires to be a physician become a physician if enrolled in a curriculum like this, or does the curriculum require that students with a certain personality profile be selected for it?

7. What is the nature of the personality profile of the student that should be selected for studying with this curriculum?

8. What are the differences between this profile and that of students in more traditional curricula?

The curriculum makes the explicit claim that it exploits the structure and dynamisms of human intelligence. If this is so, it seems that a student would acquire the behaviors of a physician in a shorter time than in a curriculum which does not exploit it. Thus, other questions that may be investigated are:

9. Do students become competent physicians when they study under this curriculum?

10. What is the average time it takes a student to become a competent physician?
11. What is the difference between this time and the time taken by the student in a more traditional curriculum?

Since the strategies for teaching and learning the curriculum are different from those used in one which is more traditional, it is to be expected that learning resources be used differently by its students. Thus it is important to investigate questions like the following?

12. Do the students in the curriculum use the library in the same manner that do students in more traditional curricula?

13. Do the students in the curriculum use the laboratories in the same manner that do students in more traditional curricula?

14. Do students in the curriculum learn the same basic things as the students in more traditional curricula when placed in the same clinical situation?

Again, since the strategies for teaching and learning are different and the students are not exposed in lectures to all that a physician needs to practice medicine there is one very important question:
15. At the end of their education, have they learned at least what has been learned by the average student in a more traditional curriculum?

And, when the students graduate from the curriculum the following questions could be investigated:

16. What is the attitude of the graduates of the curriculum toward scientific research?

17. What specialties do the graduates of the curriculum choose? Are they the same as those chosen by graduates of a more traditional curriculum?

One of the aims of the curriculum is to help the student become a life-long learner. Thus, it is important to investigate if this is achieved;

18. Do the graduates show self-instructional habits in a manner which is consistent?

19. Are the students more efficient self-instructors than students who graduate from more traditional curricula?
As it may be seen, the number of questions to be investigated is large. Are there any of them which are specific to the curriculum proposed?

There is at least one. The curriculum was built following the Core of Behaviors idea first proposed by Dr. L. Weed. Thus, it is necessary to investigate if such a curriculum does prepare the students for the attentive, intelligent, rational, responsible and loving practice of medicine.

11.7 Conclusion.

This chapter has attempted a brief critique of the argument presented in this dissertation in favor of a curriculum based on a Core of Behaviors. With that the dissertation is concluded.


3. Ibid.

4. Ibid.


7. Ibid.

8. Ibid.

9. Ibid.


11. Ibid.


20. Ibid.

21. Ibid.


23. Ibid.


32. Ibid.

33. Ibid.


35. Ibid.

36. Ibid.

37. Ibid.

38. Ibid.

39. Ibid.

40. Ibid.


51. Ibid.


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