For it is uneducated not to have an eye for when it is necessary to look for proof and when it is not necessary.

Aristotle ([4], *Metaphysics* IV, 1006a)

**INTRODUCTION**

Richard Cabot, one of the most celebrated of American diagnosticians, labeled his attempts to anatomize the process of differential diagnosis "a very dangerous topic — dangerous to the reputation of physicians for wisdom. . . . Physicians are naturally reluctant on such matters, slow to put their thoughts to paper, and very suspicious of any attempts to tabulate their methods of reasoning" ([8], p. 19).

Sixty years later most clinicians remain reluctant and more than a little suspicious. Many still take refuge in the "art" and its exclusive mysteries, to resist formalization of their mental operations. In recent years, the "dangerous" subject has been boldly attacked by a few clinicians with unusual facility in the language of logic and statistics so that dissection of the tangle of science, art and conjecture is now well underway ([6], pp. 17–19; [13, 15, 20, 25, 36]). They have been joined by statisticians, engineers, psychologists, and philosophers who are bringing the more sophisticated techniques of their disciplines to bear on this important and complex question.

Physicians and philosophers have puzzled for a long time over the nature of the physician's enterprise. Its dissection began with the Hippocratic physicians who first insisted on the primacy of observations of patients, refined by reason. They thus made medicine a natural science, separating it from both philosophy and religion with which it had so long been intimately associated [16].

Intuitive, hieratic, artistic and even magical elements of the physician's enterprise were not so easily removed however. Celsus, the Roman Hippocrates, spoke of medicine as an "ars conjecturalis"; William Osler, the modern Hippocrates, deemed it "... a science of uncertainty and an art of probability." Medicine has yet to become a science comparable in method and explanatory power with the laboratory sciences — though this is the expressed aim of some of our contemporary thinkers.
The puzzlement continues today in the growing tension between the scientific-actuarial and the artist-intuitionist models of clinical judgment [11]. Each view tries earnestly to understand, and thus to improve, the clinical enterprise. One seeks to transform the conjectural elements into respectable science by formal analysis in terms of probabilistic logic or decision theory. Meanwhile, the other declares the nuances of clinical judgment to be an art, insusceptible to formal analysis, and improvable only by cultivation as one cultivates painting, music or sculpture.

This essay undertakes nothing so pretentious as the resolution of what seems to be a polemically seductive polarity in viewpoints. It takes the view that: Clinical decisions can be made more rigorous logically, without reducing everything to algorithm and regression equations. While much of the process remains opaque and insusceptible to extant methods of formal analysis, this need not forever be the case.

Much of the polarization between explanations of clinical judgment seems avoidable, if two significant features which have been neglected are sufficiently taken into account. These are: First, the over-riding fact that the whole process is ordained to a specific practical end — a right action for a particular patient — and that this end must modulate each step leading to it in important ways. A value screen is thus, in a way, cast over the entire sequence. Second is the fact that no unitary explanation or logical method can encompass the several different reasoning modes and several kinds of evidence acceptable in answering the different kinds of questions the clinician must answer.

The aim of this paper is not to countermand the utility of scientific actuarial formulations, or offer in their stead a benignant eclecticism which allows equal place to the explicable and inexplicable, i.e., to the “science” and the “art” of clinical judgment. Rather, it hopes to locate more precisely the several reasoning modes useful at each of the sequential and simultaneous steps which eventuate ultimately in a clinical action. This localization constitutes the anatomy of clinical judgment, an essential foundation for further formalization of the process.

The complete process is a multi-step, end-oriented concatenation of decisions demanding different types of reasons and reasonings which will justify a particular course of action, for a particular patient, given that patient’s particular existential situation at the time of the decision. Each step is shot through with uncertainties, some eradicable, some not. Selection of the “right” action requires optimization of these uncertainty states.

Inasmuch as the nature of the uncertainties varies, the logical instruments
THE ANATOMY OF CLINICAL JUDGMENTS

...red to achieve optimization will vary also. Thus, the methods of deductive and inductive reasoning, of dialectic, ethics and rhetoric are each appropriate to some step. Prudent and judicious action, rather than a true statement or scientific law, is the end to which the whole is directed. No one kind of evidence is universally applicable, and no single logical or epistemic mode suffices for all.

Customarily, discussion of clinical judgment ends at the establishment of the most probable diagnosis, or at best at the selection of a treatment. The third step — whether the treatment selected ought to be instituted, how, when, under what conditions — is usually not formally analyzed. Yet, one cannot speak legitimately of clinical judgment without seeing the whole process, particularly the way the end conditions the steps that precede it.

Four questions must be examined to sustain these assertions:

(1) What is the character of the end of clinical judgment?
(2) What questions must be answered in attaining that end?
(3) How does the end project itself on each step, i.e., what kinds of reasons does it require?
(4) What are the theoretical and practical implications of the proposed view of clinical judgment?

The answers bear to some extent on the difficult problem of a general theory of medicine. Such a theory must account for the full range of medical activity — seeking general laws of disease and treatment, but also taking specific actions in the interest of specific patients. Science, art, and the virtue of prudence infuse the several operations. But medicine justifies itself uniquely as medicine — as opposed to medicine as clinical or basic science, or as the art of performing medical acts — when it ends in a decision to act for, and in behalf of, a human who seeks to be healed [28]. To the extent that it identifies features which distinguish medicine from other human activities, the analysis of clinical judgment can contribute to the emerging structure of a theory of medicine.

1. WHAT IS THE END OF CLINICAL REASONING?

When a patient consults a physician, he/she does so with one specific purpose in mind: to be healed, to be restored and made whole, i.e., to be relieved of some noxious element in his/her physical or emotional life which the patient defines as dis-ease — a distortion of his/her accustomed perception of what is a satisfactory life. Usually some event has occurred — pain, lack of appetite, fatigue, trauma, a lump, spitting blood — some sign or symptom which
exceeds a certain highly personalized threshold of tolerance in such fashion as to compromise, obstruct or discolor the person's perception of him/herself and his/her health. At the point when this perception leads to the need to be healed, the person becomes a *patient*. This transition has two existential connotations crucial to this discussion. Becoming a patient is to become one who suffers (pator, pati), and simultaneously one to whom something is done, a recipient as distinguished from an agent (O.E.D.). The patient, then, is a suffering person who comes to the physician to have something done to assist him/her to regain his/her former state or a more optimal one.

It is important to interject here that the term "patient" does not necessarily imply a passive restoration in which the physician is the sole agent. The patient ideally also participates in the restoration. He/she is seen as bearing a burden of illness which requires some action or decision mutually arrived at for cure to take place. The patient can yield his/her moral agency to the physician only by direct mandate. Only in the rarest circumstances will the physician legitimately be the patient's moral agent [21, 27].

The end of the medical encounter, and the process of clinical judgment through which it is achieved then, is restoration and healing — some corrective, remedial or preventive action is directed at what the doctor and the patient perceive as a diminution of the patient's wholeness, each in his/her own fashion. The end is not a diagnosis, a scientific truth, testing an hypothesis or evaluating a treatment, though the knowledge derived therefrom enters into several states in making the decision to act.

The clinical decision comes at the end of a chain of deductive and inductive inferences, serially modified by recourse to "facts" and observations, usually themselves to some degree uncertain. Truth and certitude are, therefore, almost always problematic. Out of the uncertain conclusions of earlier syllogisms, a decision to act must be taken which has a different character from the conclusions that precede it. The conclusions of the earlier reasoning chains become premises for further reasoning. This is the normal condition of scientific reasoning — a cumulative and progressive series of hypotheses and conclusions, always open to further recourse to fact and experiment.

Each clinical decision is, however, a terminal and unique event in that it cannot remain forever open and it is not universalizable. It must close on the selection of one or a series of remedial actions — or none. The action chosen must be the "right" one for this patient. That is to say, it must be as congruent as possible with his/her particular clinical context, his/her values and his/her sense of what is "worthwhile" or "good". What the physician and the patient seek together is a judicious decision, one which optimizes as many
benefits and minimizes as many risks as the situation will allow. The definition of risk is highly personal, and it turns on the patient's estimate of a danger "worth" running. The end is, therefore, not a general statement of the probabilities, but a particular statement of what a particular patient should do.

The criteria of a right or good decision lie not in its certitude, rigor, logical or mathematical soundness, though the probability of a judicious action is enhanced greatly when these qualities inhere in the prior conclusions on which it is built. These qualities must be secured wherever possible, but they are not sufficient for a "right" decision. They can, on the view I am propounding, be displaced or modulated by the more complex criteria of a decision "good" for this patient — what among the many things that can be done ought to be done?

Clearly, value considerations and moral issues — for both the patient and the physician — can color the selection of the facts and reasons which justify placing one diagnosis over another, the justifications accepted for taking action, and the degree to which the physician persuades or the patient assents to the final decision. The end must therefore be understood in all its fullness, because it projects itself so forcefully on the entire sequence.

The primary end of clinical judgment — a right healing action for a particular patient — imposes an atmosphere of prudence, over the whole process. Truth, for the practical intellect, is rightness with respect to human deeds, those dependent upon human will and intention. It differs thus from the truth of science which is a certain conformity with the reality it seeks to explain, and art, with the product it wishes to produce.

It is the end of medical judgment which also gives authenticity to the professions a physician makes — that he/she will use his/her knowledge and skill to "heal", according to the fullness of meaning of the word for his/her patient. Not to keep that end paramount is to make an inauthentic — indeed an immoral — profession. Medicine qua medicine is then more than a clinical or basic science applied to individual cases. It is a particularized knowledge of prudent healing actions, dependent upon scientific methods and art, but not synonymous with them.

Whatever formal analysis one favors — traditional syllogistics, the logic of probabilities, Bayesian conditional probabilities, decision analysis theory, information processing models, or judicial algorithms — each must account for the modulation and shaping imposed by the end. This would be so even if a high degree of certitude were possible at every step. Usually, however, we deal with varying "degrees of belief," and the judicious choice of actions
becomes an even more critical and sensitive activity, difficult to formalize and formularize.

II. WHAT QUESTIONS MUST BE ADDRESSED AND WITH WHAT REASONING MODES?

When a person becomes a patient in the sense we have defined that state, a whole series of questions becomes crucial for him/her as a knowing and valuing being. What is wrong? Is it serious? What will it mean to me? Can it be cured, and by what means? Is the cure worthwhile? What will it cost? What should I do? These and corollary questions must be addressed if the process of clinical judgment is to be a complete and authentic medical judgment. They are reducible to three generic questions: What can be wrong? What can be done? What should be done for this patient? (Fig. 1) Let us look briefly at each question to see the kinds of reasoning relevant to each question, and what kinds of justifications are acceptable.

A. What can be wrong? (Fig. 2)

This is the diagnostic and classificatory question — the first part of the process and the one which has received the most vigorous theoretical examination. Given the signs and symptoms presented by this patient, what classificatory patterns fit best? Of the possible patterns, which is most probable, and with what degree of certainty?

This part of the process most closely fits the scientific paradigm and under ideal conditions can yield a diagnostic conclusion with a high degree of
WHAT CAN BE WRONG?

![Diagram](image)

*Fig. 2*

certainty — i.e., the error rate approaches zero. The conditions for such certainty must be stringent, however. The input data of signs and symptoms must be reliably observed, standardized and specified; the classificatory patterns must be equally reliably determined; the probabilities of different combinations of signs and symptoms must be derived from sufficient numbers and combinations of sets and subsets of signs and symptoms; laboratory and other ancillary data must be sensitive, accurate, specific and precise. The rules of deductive or probabilistic logic must be followed rigorously.

In addition, a highly specific and sharply discriminating test is required — like a biopsy, fiber endoscopy, angiography, or an enzymatic or immunological determination. Where all these conditions are met, *diagnostic closure* can be obtained. This means that all essential criteria for a diagnosis have been met. The diagnosis could even meet the test of scientific "elegance" if it is arrived at with an economy of steps.

These rigorous conditions are only rarely satisfied in clinical reality. Bedside data are notoriously unstandardized and poorly quantified [17, 18]; laboratory tests very widely in sensitivity, specificity, reliability and accuracy [24]; "Almost all data on the general incidence and prevalence of disease are inaccurate" ([12], p. 214). Even less secure are estimates of the cost of error of a clinical act so that the hopes of decision theorists to assign a numerical value to every nodal point in a decision tree are even less secure [32, 30, 13]. Finally, probability statements say something about the population of
individuals sharing some common characteristic but they are weakest in their description of the actual state of any individual in that population.

Thus, even when the rules of probabilistic logic are rigorously applied the diagnostic conclusions are still open to question. They are, more often than not, tentative "working" diagnoses and have more the quality of opinions than scientific judgments ([35], pp. 101–117). Adding more empiric data may as easily compound an error as move the conclusion closer to the asymptote of a true statement. At some point adding more tests adds only marginally to certitude if at all.

Differential diagnosis consists then in the selection of some diagnosis as more probable, or more justifying of an action than others. At some point, every diagnosis must proceed without further recourse to empirical input. The strength of the case for each diagnostic claim must be assessable and put in some order of priority against the others. Why, for example, is this chest pain due to angina pectoris and not to the fifty or more other kinds of chest pain? The selection must be made when all the empiric data are "in", and further appeals to the empiric are either impossible or insufficient to bring us any closer to diagnostic closure. This part of the differential diagnostic process is not synonymous with application of the laws of statistical probability. Indeed, a critique of the statistical argument as one among other arguments is itself requisite.

The process of differential diagnosis is really most akin to the process of classical dialectic ([2], p. 31, footnote 1 and pp. 243–247). Each diagnostic possibility can be seen as a "claim"; the strength of arguments for, and against, each claim is evaluated; each position is clarified and set against its opposite; the inherent logical probity of each is delineated. Dialectical discourse properly conducted becomes an internal soliloquy in which the clinician examines his own conclusions critically, or tests them externally against his colleagues or consultants. No new truths are discovered this way, and the dialectic ends if an appeal to experience is possible. The process is therefore not "scientific" in either the classical or modern sense of science.

Differential diagnosis is usually addressed as synonymous with an assessment of relative probabilities. Yet part of the dialectical procedure is to examine the probity of the statistical method itself. When the facts are not determinative, we must establish which diagnostic claim has the strongest logical position. This is more akin to arguing a case in court than it is to proving a scientific hypothesis. The whole effort is to make one diagnosis sufficiently more cogent than the others so that it becomes a defensible basis for decisive action.
The dialectical process is especially important in science where it has been shown that psychologically the tendency is to prove rather than disprove one hypothesis [32]. New possibilities are often uncovered only by disproving an existing hypothesis entirely. Dialectical discourse assures an adversarial stance which challenges the tendency to settle too easily for a merely "workable" hypothesis.

The "old-fashioned" clinico-pathological conference was primarily an exercise in clinical dialectic. It has fallen into disrepute, yet it remains an invaluable way to teach the process of internal soliloquizing which enables the diagnostician to examine his own reasoning critically, when the possibility of adding more observations and tests is no longer open to him. Contemporary pedagogical opinion to the contrary, the dialectical discourse of a clinico-pathological exercise more closely approximates the clinical conditions of differential diagnosis than the scientific model of serial hypothesis testing.

In answering the first of the triad of questions that make up a clinical judgment, several different kinds of reasoning, and reasons, must be employed. To understand the pathophysiology of clinical manifestations, to define and apply a classificatory schema, "scientific" reasons are appropriate. To make general statements of probability for populations, statistical logic is needed. In differential diagnosis the rules of dialectic are the most pertinent. Uncertainty pervades every step of the diagnostic process from its epistemological assumptions to its logical operations. Each of several reasoning modes is suited to optimizing different forms of uncertainty. In the next section we shall see how the practical end modifies each of these modes at every step.

B. What can be done? (Fig. 3)

This is the therapeutic question. Having made some decision about the nature of the patient's problem, what kinds of actions could be taken to remove or ameliorate the probable disorder?

Here again, the process is in part, and under certain stringent conditions, scientific in character. When there is a verifiable data base on the course of the untreated disease, and its modification by drugs, surgery, diet or other measure, the conditions for a scientific decision can be fulfilled. Equally indispensable are quantifiable and precise information about effectiveness and toxicity, since these must be weighed against each other before the decision is made. Under these conditions "closure" on a therapeutic action can approach certitude.

The therapeutic decision is easy to make when there is a specific and
WHAT CAN BE DONE?

BODY OF SCIENTIFIC THERAPEUTIC KNOWLEDGE

THIS PATIENT'S EFFECTIVENESS TOXICITY PROBABLE DISORDER

TREATMENT ALTERNATIVES

Palliative RADICAL RX Preventive

RECOMMENDED ACTION FOR THIS PATIENT

Fig. 3

highly effective treatment which demonstrably alters the natural history of the disease. Penicillin for pneumococcal pneumonia, isoniazide and PAS for tuberculous meningitis, vitamin B₁₂ for pernicious anemia, or abdominal surgery for ruptured peptic ulcer are examples. In these instances, the action recommended can be scientifically validated, and it will in most instances take precedence over other considerations. The recommended procedure then becomes synonymous with right action, and little choice is open to patient or physician, though the patient may in extreme circumstances reject even this kind of advice.

Unfortunately, to a much larger degree than in diagnostic decisions, genuinely scientific information in therapeutics is scanty. The many pitfalls of therapeutic trials have been the subject of a vast literature. They are generally acknowledged to be among the most difficult experiments to design, control, carry out and interpret. Even the randomized clinical trial has come under fire recently [14]. Especially problematic are the large number of therapeutic maneuvers which are not radical — i.e., they do not eradicate the causal agent or the offending process. Their benefits, if any, are marginal and the ratio of risk to benefit often vacillates widely. One has only to recall the sad history of anticoagulants in myocardial infarction, the recent national dilemma about influenza vaccination, or the belated appreciation of the long-term vascular effects of oral contraceptives or antidiabetic agents.

Today, we must often decide whether to recommend complex, expensive, palliative procedures with unpleasant and dangerous side effects — as in chemotherapy for cancer. Data on effectiveness and toxicity are usually
available in these circumstances, but the questions are a different order: Is the discomfort worthwhile for this patient? Is length of life more important to him or her than its quality? This kind of question must rest firmly on scientific data, but that is only the foundation for a discussion permeated by the physician's and the patient's value systems.

The therapeutic and prognostic domains may well be, as Feinstein opines, the truly unique elements of clinical science. They are also the least secure scientifically. We simply lack the long-term observations of carefully selected patients in sufficient numbers to warrant secure prognostications about the course of a particular disease in a particular patient. Without such data, it is impossible to ground effectiveness of any agent scientifically unless it is so radically effective that a few cases will suffice. If the untreated mortality is 100%, any change will indicate effectiveness, as it does in treating subacute bacterial endocarditis or tuberculous meningitis with specific antibiotics.

The choice of what action to recommend involves more questions of value, by far, than diagnosis. The closer we come to the end of the process of judgment — the right action — the less useful and less available is the scientific model. Reasoning becomes, in smaller part, scientific and probabilistic, and in larger part, dialectical — arguing one alternative against another without recourse to new factual data.

C. What should be done for this patient? (Fig. 4)
Having decided what the probable diagnosis is, and what treatment can be expected to be most effective and least harmful, the final question in clinical judgment is whether the treatment should be used in this patient, and what alternatives can be offered. The right action — the best one for a given patient — is not always synonymous with the logically or scientifically deduced action. The amount and kind of information needed to secure a diagnosis may be quite different from that needed for decisive action. It is the task of the last stage of clinical judgment to make these distinctions with as much precision as possible.

Decisive action frequently involves the counterposition of what is good scientifically, what the physician thinks is good, and what the patient will accept as good. Scientific, personal and professional values intersect each other and can be in conflict. The scientific evidence and the probability statements about diagnosis, prognosis and treatment become arguments for or against a choice of alternatives — to do nothing, or, if something is to be done, what must be done, what may be done, and what should be done.

If the patient exhibits the minimal criteria for an acute abdomen, signs of intracranial pressure, a stab wound of the heart, he/she must be operated upon; with severe blood loss, bacterial endocarditis, tuberculous meningitis, or diabetic coma proper, medical therapy must be instituted. On the other hand, a non-strangulated hernia, symptomatic gall stones, or mildly symptomatic benign prostatic hypertrophy are things that should be treated but may not be in the must category. Finally, hemorrhoids, varicose veins or lipomata may be removed surgically; or mild hypertension, a cold or sinusitis may be treated, but need not be.

When it comes to making the right decision — the judicious one for this patient — the categories of must not, must, should and may can all shift, depending upon a myriad of factors in the patient’s life situation and his/her notion of what he/she deems worthwhile. In the more obvious situation — like a Jehovah’s Witness rejecting transfusion or a Christian Scientist rejecting surgery — the shift is to the must not category regardless of the canons of good science. In the more usual case, the categories into which a recommendation falls may shift several times in the course of the illness.

For one person, a lipoma, acne or sebaceous cyst is something to be ignored; for another, it is a horrid blemish, so emotionally disabling that it demands removal. For this person may becomes must. For an elderly man or woman chemotherapy of disseminated cancer may mean a few months more of life, less pleasantly lived. For this patient, a should or may becomes a must not. For another person, the few extra months to do some essential things
I add make the rigor of treatment worthwhile. For still another, mild depression, anxiety or headache is tolerable, and can be coped with without resort to daily medications; to another, as the twenty-four million Americans daily taking mood modifiers will attest, even slight anxiety must be treated ([9], p. 141).

In making the “right” decision for an individual patient then, personal, social, economic, and psychological characteristics of the patient must be factored in. They clearly may modify, or even nullify, the scientifically cogent or logically consistent answers to the questions of what can be wrong? And what can be done? Here, where we are closest to the end, the telos, of the whole process, scientific modes of reasoning and scientific reasons are least pertinent, and indeed must be submitted to drastic revision in consideration of the patient’s value choices.

The reasoning at this stage is mainly dialectical, ethical, and rhetorical. Physician and patient together must clarify the relationship of one recommendation with its opposite and weigh the reasons for each action. The ethical nature of the discourse at this point is obvious. Conflicts in the obligation of patient and physician to each other must be resolved before a “right” action can be settled upon. Where these conflicts are fundamental, the medical relationship may even be severed by either party, to be resumed with another physician.

Once the ethical and logical possibility and “strength” of arguments for one action over another are assessed by dialectic, then the reasoning becomes “rhetorical” — in the more classical sense of artful persuasion, of relating a dialectically established decision to prudent action, generating belief of another kind from scientific or logical cogency, belief that this particular action should be taken in preference to all others ([34], especially pp. 27–28).

We enter here the delicate realms of how much persuasion is ethically defensible, how vigorously the physician should pursue his/her own priority system. Does he/she believe the scientifically recommended action must take priority? Is he/she a therapeutic enthusiast who prefers to “do something” rather than nothing? Does he/she think people should be “strong” and ignore minor infirmity?

Likewise, the patient can use artful persuasion to modify the physician’s scientific or dialectically secured recommendation to gain an action more congenial to his/her view of what is good. The patient’s vulnerability can easily tip the resolution of conflict in the physician’s favor. But these are subtle influences, as well, which can significantly shape the physician’s final judgment.
The last question in the sequence then — what should be done? — the capstone question, as it were, which completes the whole structure, is the most prickly. Scientific and semi-scientific conclusions of varying degrees of certitude are examined under a light strongly tinged with moral hues. The accessibility of the questions to scientific mode of reasoning declines, as does the degree of certitude, as we move from determining what is wrong, to what can be done, to what should be done. The optimization of several kinds of uncertainty remains a central concern even when the conclusions are scientifically defensible.

The intermingling of several modes of reasoning — clinical scientific, probabilistic, dialectical, rhetorical and ethical — does not suggest immunity from explicit statement nor deprecation of attempts to secure truly scientific conclusions. But, it is warrant for setting limits on the utility of any of the current explanatory models — scientific, probabilistic, Bayesian, judicial simulation, decision analysis, inference, information or catastrophe theories. Perhaps the fullest explication will come from some combination of these new theories and more classical modes of reasoning.

III. PROJECTION OF THE END OF RIGHT ACTION ON THE PROCESS OF CLINICAL JUDGMENT

We have seen that clinical judgment requires confrontation with three generic questions which end in a particular decisive action for a particular patient. Several interdependent reasoning modes are requisite and suitable to each question, and no one question is entirely isolable from the others. We are ready now to turn briefly to a more specific delineation of how the end of right action projects itself upon the way the questions are answered. We might accordingly label this section “clinical prudence” — or, medicine viewed as a virtue.

Whenever possible, the clinician will try to achieve diagnostic closure, i.e., satisfy all the stringent criteria for certitude in locating his/her patient precisely in a classificatory schema. This is the admirable aim of scientific medicine; it is the ideal taught in academic settings; the more it is achieved, the better foundation there will be for the decision to act, at least some uncertainty will be eliminated.

Many clinical realities can upset the orderly processes of diagnostic reasoning: the urgency of the patient’s condition, the absence of a diagnostic set or algorithm which fits the presenting signs and symptoms closely enough, lack of specific tests to discriminate among probable diagnoses, incomplete or
inconclusive probability estimates, limitations on data selection related to cost or geographic locale, unreliability of the patient as historian, and the dilemma of weighting the probability of a serious vs. nonserious, and treatable vs. nontreatable disorder, when none of these possibilities is definitely excludable.

Experienced clinicians deal with these commonly occurring inevitabilities with interpretative schemata, which enable them to act prudently on inadequate information and incomplete evidence. These schemata can be loosely regarded as rules of clinical prudence, empirically derived but certainly not mysterious sources of inspiration. We can examine a few of these. (Fig. 5)

**SOME RULES FOR CLINICAL PRUDENCE**

1. Act to optimize as many benefits, minimize as many risks as possible.

2. The serious and treatable must not be missed; the non-serious and non-treatable may be missed.

3. Use the clinical Ockham's razor: don't multiply causes, diseases, tests or treatments without justifiable necessity.

4. "Rest" the case for any diagnosis or treatment with reluctance.

5. Clinical skepticism is the only guard against the tyranny of the "established" diagnosis, or ancillary data, and the findings of colleagues (Lab, X-ray, etc.).

6. Maintain a high index of suspicion for uncommon manifestations of the common.

7. "Hoofbeats don't mean zebras," unless zebras are in the vicinity.

8. When the data are "in," continuing debate is the safeguard against error.

9. Recognize your own clinical style, prejudices and beliefs about what is "good" for patients.

10. Be wary of hunches, intuitions, e.s.p.— gamble with your own fate, not the patient's.

*Fig. 5*
For one thing, the clinician thinks not so much of meeting the criteria for
diagnostic closure, but how much evidence is "enough" to take an optimizing
action. Diagnostic closure for example in streptococcal pharyngitis might
demand sore throat, plus cervical adenopathy, tonsilar exudate, and positive
culture for Beta hemolytic streptococcus. The physician is justified in giving
specific treatment with penicillin on any combination of these signs and
symptoms and positive culture. But he/she usually acts presumptively—
taking a culture, treating, and awaiting the culture to determine whether to
continue or discontinue penicillin. If the patient, however, lives in a family or
school in which streptococcal illness is frequent or currently present, the most
minimal clinical signs may justify treatment even without culture.

Acute abdominal pain is another example. It may result from a wide
variety of conditions all of which can present similar signs and symptoms.
Examples are: ruptured peptic ulcer, appendicitis, twisted ovarian cyst,
strangulated internal hernia, mesenteric adenitis, pancreatitis, cholecystitis.
Some of these conditions require immediate surgery, some delayed surgery,
some none at all, and in some surgery is positively dangerous. The surgeon
looks not for definitive diagnosis but for the least signs of acute abdomen—
spasm and rebound—which justify laparotomy. Only in this way can he/she
assure that the treatable lesion is not missed. Each surgeon is allowed a cer-
tain number of normal appendices or negative explorations, provided he/she
has no cases in which lifesaving surgery is missed.

In every branch of medicine, there are disorders for which specific and
dramatic treatment or genuine cures exist. They must not be missed. They
shape the diagnostic process very often out of proportion to their probability
in a given case or in the general population. Some are rare like pheochromocytoma; some relatively rare like parathyroid adenoma; some are rare only in
a particular locale like malaria or actinomycosis or blastomycosis. Still others
were once common, but now infrequent, though still important like syphilis,
malaria or diphtheria.

The clinician's attention therefore may not be focused on getting all the
information needed to fill out the most probable classificatory set in its en-
tirety. Rather, more emphasis is placed on the information he needs to take
decisive action, or to "rule out" the conditions which in the interest of the
patient's safety must not be missed. The clinician must find justification for
his/her actions, therefore, in terms of what is right and prudent for the
patient. If a serious treatable disease cannot be adequately "ruled out,"
therapeutic trial may be used as a diagnostic maneuver, i.e., specific treatment
is undertaken for the serious disorder, and diagnosis arrived at indirectly by
observing the effect. Such a course of action may be taken justifiably even if the probability of a less serious, nontreatable disease is much higher.

A corollary principle, which to some extent balances the search for the treatable and serious, is the admonition “don’t look for zebras when you hear hoofbeats.” This is a precaution against accepting the rare and esoteric even if the symptom complex is suggestive. Obviously, one cannot justify missing the more common, or losing the more unusual manifestations of a common disorder in the search for the curable but esoteric. Of course, on the African plain, hoofbeats do mean zebras and not palomino ponies or quarterhorses.

Equally influential is the clinician’s Ockham’s razor — “plurality of causes and diseases is not to be assumed without necessity.” Clinicians, particularly in the clinicopathological conference, are conditioned to seek unitary explanations of signs and symptoms. This is another of the organizing principles which become part of the projective schema used by clinicians to select, screen and weigh data and to justify their decision. The same advice is salutary in therapeutics — the rule of therapeutic parsimony states that treatments must not be multiplied without necessity.

Another rule of prudence is the cultivation of a “high index of suspicion” — another quasi-rational way to cope with uncertainties and avoid “missing” something. Clinicians who follow this rule are unusually sensitive to the most minimal criteria for a diagnosis. They use that sensitivity to open up previously unsuspected possibilities or challenge what appears to be a more firmly established diagnosis.

Indeed, the most dangerous ground for clinical judgment is often not in making a new diagnosis, but in maintaining an index of suspicion high enough to challenge what appears to be an established diagnosis. Physicians, like all humans, tend to rest their cases if no contrary position challenges it. They become locked into or even enamored of the patient’s classification, which can render them unresponsive to the most obvious signals of a new disorder, or an original diagnostic mistake. The more prestigious the original diagnostician or institution and/or the more respect one has for the colleague who has made the diagnosis, the more seductive is this error.

Skepticism is, as Santayana so mordantly said, the “chastity of the intellect” — and an indispensable attribute of the prudent clinician is an untiring skepticism about every aspect of a diagnosis or treatment. Perhaps the greatest failing of the contemporary clinician is an overadulation for laboratory and x-ray data fed in by specialists, whose techniques grow more arcane and also more potent daily. Far too often, a right action is justified by the uncritical acceptance of a chemical determination, a biopsy or an x-ray examination.
I do not intend to provide here a complete primer of clinical prudence. These few principles derived from experience illustrate how the intensity of the clinician’s concentration on the end — a good decision for his/her patient — provides a projective schema which shapes every step on his way [1].

Projective schemata are, of course, individualized and personalized. They summate what a particular physician holds to be “good” medicine. Which rules of thumb are selected, why, and how, are fascinating questions still very much open to logical and psychological examination. A whole series of attitudes of mind, logical and epistemological assumptions, are combined to make up a clinician’s diagnostic and therapeutic “style,” just as genuinely as the way word and phrase are used to make up a writer’s style. The clinician’s “style” is really a statement of the reasons he/she will accept as justification for a particular action, for setting aside certain probabilities, or for earnestly persuading a patient to take one course rather than another, equally earnestly propounded by his/her colleagues.

Are these not the elements of the “art” of medicine, and are they not closed to precise analysis, the way the style of Horace or Camus is closed? I think not. I agree with Claude Bernard’s comment in warning against sole reliance on clinical instinct and clinical sense.

Everyone knows in fact that habit may give a kind of empirical knowledge of things sufficient to guide practitioners, even though they may not always be able to account for it at first. But what I blame is willfully staying in this empirical state and not trying to get out of it. ([5], p. 203)

Each clinician’s rules of prudence need more precise statement. Many are held in common by all good clinicians. Their utility or fallacy can and must be better studied. Most theoreticians have concentrated on the normative aspects of clinical judgment. We need to know more about the descriptive nature of the process — who uses what justifications, and how do they benefit or imperil the outcome for the patient? How much difference in mortality, disability, side effects, costs is there between a good and a poor decision maker?

Some physicians are therapeutic enthusiasts. They treat more often than not; they require less justification for using a medication than parsimonious therapists, who insist on demonstrable evidence of effectiveness and frown on the use of placebos or chemical coping for minor disorders. How much of “style” is simply peer conformity, personal intolerance of ambiguity, an obsessive compulsion to “prove” the diagnosis, or satisfy some idealized notion of what constitutes clinical “science”? Much of the cost of medical
care, and even its outcome and satisfaction for the patient can turn on how the clinician plays the "game" of clinical judgment.

They psychological components in different reasoning styles are coming under closer investigation [33, 11]. We also need more extensive empirical descriptions of the reasoning habits of "good" and "bad" clinicians. What is the effect on outcome of different habits of reasoning? Which ones are crucial, which incidental and which positively deleterious? In this era of concern for the quality of care, answers to these questions cannot be avoided for very long.

There remain, to be sure, certain features of clinical judgment which for the moment seem closed to explicit analysis. Clinicians have their undeniable moments of sudden insight and discovery. Some clinicians are more consistently accurate in their insights than others. What does happen at that precise moment when the clinician decides that there is "enough" information to "make" a diagnosis or "take" a decisive action? Or, when a set of signs and symptoms suddenly "assembles" itself into a new classificatory pattern? Or, when a patient's clinical features suddenly "fit" a previously described pattern; or, when the precise datum which will answer a puzzling question is suddenly identified?

There is no reason to suspect that clinical diagnosis is unique in this regard. The phenomena of "insight" and "discovery" are common to scientific and nonscientific endeavors. Polanyi and Lonergan have attempted to describe the deep epistemological structures and relationships which permit the leap from the obvious and the known to the previously unknown. Polanyi holds that scientific knowledge is never wholly explicit but resides in tacit understanding which provides the belief which makes thinking about a truth possible. Lonergan links belief to immanently generated knowledge. Polanyi's "discovery" and Lonergan's "insight" are likened by their authors to the "Eureka" of Archimedes [19].

To what extent these epistemological notions can account for the obscure features of clinical reasoning is problematic. What must be avoided is the easy appeal to some special illumination peculiar to clinicians. To resort to terms like "art" or intuition is to impede explication of a socially significant process. Whatever name we use to subsume the indefinable elements in the process, the effort to explicate them further is a moral as well as intellectual responsibility.

This warning against subjectivism is consistent with a major thesis of this essay — that the nature of the end projects itself on the steps leading up to it. Everything in medicine ultimately is judged by its end — the healing of a
patient — even those steps we think most immune to pre-logical or subjective interpretation like pattern definition and recognition. In defining a disease pattern, for example, we must choose among an infinite set of properties — signs, symptoms, tests, etc. That resultant pattern is useful only if it includes a finite, and manageable number of characteristics. In making the finite selection we apply a test of utility, related to the purpose of the pattern definition. That purpose is making a "right" decision for a particular patient.

In pattern recognition, the selection is similarly shaped by the end. We seek sufficient congruence with the pattern characteristic of the more serious or the more treatable disorder. We select in favor of patterns which optimize the decision for the patient even though they may be less defensible by the rules of logic or probability.

Statisticians, logicians and engineers can help the clinician to apply criteria of validity to the characters he/she selects and to manipulate the sets once they are defined. But these aids are on limited use without definition of the purpose for which the classificatory set is to be used. Sokal, a pioneer in mathematical taxonomy, recognizes that in medicine we may limit ourselves to fewer characters than might be taxonomically desirable because we want those most pertinent to decisive action for a patient [31].

Projective schemata shaped to the practical end of decision making are to a significant degree subjective. But they do not provide warrant for a wholly subjectivist interpretation of clinical judgments. The schemata can themselves become objects of critical scrutiny. We can in fact often judge whether a clinical diagnosis, treatment or decision is the right one by the outcome for the patient. The test of reality is always there in medicine, and it sharpens and corrects the projective schema, and the values assigned in each of the more formal inferential steps. It is as Ernan McMullin said of the interpretive schemata of science which contemporary philosophers of science have aduced to counter the ultra-objectivism of logical positivism:

But what must be emphasized is that the skills of interpretation that help bridge the gap between the formalism of inference and the subjectivism of sheer personal assertion are themselves continually responsive to the demands of the objective order [23].

In medicine we have more immediate and dramatic verificatory possibilities than in many other sciences (death, recovery, disability, complication, dissatisfaction). We can aim realistically therefore to reduce to a minimum the residuum of indefinable elements in each step of the process of arriving at clinical action. This applies even to the more subtle nuances in style which distinguish superior from merely average clinicians.
IV. SOME THEORETICAL AND PRACTICAL IMPLICATIONS

Clinical judgment is what physicians do that most clearly distinguishes their enterprise from other human activities. If there is to be a theory of medicine therefore, an understanding of clinical judgment must be a central element — though certainly not the whole of such a theory.

This essay has argued two major theses which bear on a theory of medicine: that clinical judgment is justified and defined by its end — a decisive action for a human in distress and that different kinds of reasons, and reasonings, are appropriate to the formulation of a "right" end.

There are several important implications for a theory of medicine or at least its prolegomenon as well as medical education. Only two of these will be examined briefly: 1) Is medicine a science, art, or virtue or all three; 2) What information should a physician have?

(a) Medicine — science, art or virtue?

Sober has, in this conference, summarized the arguments on both sides of the art-science controversy and they need no repetition [32]. He firmly identifies clinical reasoning with scientific reasoning. On the view we have proposed there is no question that significant parts of the process do fit both the classical and modern descriptions of a science.

Deductive, inductive and retroductive inference are used to evaluate, interpart and explain clinical observations. Hypotheses are tested by further observation, experiment and measurement, and reliability, accuracy and standardization of data are sought, if not always achieved. These criteria of the scientific method are most clearly pursued in making the diagnosis and selecting and evaluating treatments. Medicine is even more convincingly a science when it seeks explanations of clinical phenomena, in theories and mechanisms of disease. Medicine then fits Einstein's definition of science as:

..., the century-old endeavour to bring together by means of systematic thought, the perceptible phenomena of this world into as thoroughgoing an association as possible. To put it boldly, it is the attempt at the posterior reconstruction of existence by the process of conceptualization. ([10], p. 24)

But the principal aim of medicine, its distinguishing feature, is not the explanation of clinical phenomena, useful as this may be in raising the clinician's enterprise above empiricism and technicism. Explanations in Einstein's sense are the proper business of the sciences basic to medicine, but they are
not synonymous with medicine. Medicine exists as medicine only when it engages in the full range of activities which constitute clinical judgment and which lead to decisive action in the interest of a particular patient.

In its complete expression as medicine, the clinician's enterprise embraces non-scientific as well as scientific reasons and justifications. This essay alludes to the dialectical nature of differential diagnosis, the ethical construction in deciding what is "good" for this patient, and the rhetorical dimensions in the mutual persuasion essential to a decision taken jointly by patient and physician. These latter are skills traditionally imparted by the liberal arts and humanities. They may be exercised in medicine on data validated by scientific method. While dependent upon the reliability of these data, medicine is not identical with the means whereby they are validated.

Is medicine then in any sense an art? Not as the term is used in the current art-science controversy. We have argued that clinical judgments must not be assigned to realms of the intuitive and ineffable which find their source in a presumed special intellectual light possessed by clinicians. I would prefer to reserve the word art in medicine to the perfection of the things done by the physician — the craftsmanship without which the decisions taken would be improperly, unsafely or clumsily done. The art of medicine lies in the degree of perfection each clinician exhibits in history taking, physical examination, performance of manipulative techniques like surgery and various diagnostic maneuvers — the work done.

These must not be mindless activities. They are a tekne in the classical sense — knowing what to do, how to do it, and why one does it. Art and tekne were synonymous in Aristotle and both involve reasoning, "... art is identical with a state of capacity to make, involving a true course of reasoning" ([4], *Met.* VI, 4, 1140a, 10). Aquinas, extending the Aristotelian notion called art a recta ratio factibilium, thus distinguishing it from science, a recta ratio speculabilium and prudence, a recta ratio agibilium. The undeviating determination of the work to be done (art) is distinguished from the undeviating determination of what is to be known (science) and the undeviating determination of the act to be done (prudence) ([22], p. 7, [3]).

If we carry this distinction a trifle further medicine becomes not only science and art, but also the virtue of practical wisdom — "... a true and reasoned state of capacity to act with regard to the things that are good or bad for man" ([4], *Met.* VI, 5, 1140b, 5-6). Aquinas expanded the Aristotelian concept somewhat. He argued that, while art gives the capacity to reproduce a good work it does not assure that the product will be used for a good end. That remains to the virtue of prudence — "Consequently,
ch is right reason about things to be done, requires that a man be
posed with regards to ends” [3].

tly concerned with the perfection of what it does — with the skills needed
take logically secure clinical decisions and to do the procedures decided
t is so a virtue since it must make “right” choices about the ends
purposes for which the decisions and actions are produced. Medicine
must not only perform well but act well, it must choose what should be done
to heal a particular patient whose good is the true end of the whole activity.

Medicine is then all three — science, art and virtue synergistically and in-
tegrally united in the clinician’s daily activities. To disarticulate one member
of this triad from the others is to dismember medicine — the essential feature
of the special relationship each holds to the other. When this happen
comes a scientist, an artist or a practitioner, but not a physician. Clear, any unitarian formalization of the clinician’s activity is bound to be
misleading, and to define a part of what constitutes medicine but not the
whole of it.

(b) What should a physician know?

I have explored elsewhere the many meanings of the term medical humanism
— which can so easily become a slogan for whatever version of intellectual or
practical activities we wish to justify [26]. Here it is only necessary to reiter-
ate that medical humanism is both a cognitive and compassionate response to
the person of the patient. It embraces humanism as a set of cognitive skills
largely derived from the humanities and these are integral to the conception
of medicine as science, art and virtue. Humane medicine — indeed moral
medicine — requires that the physician understand the distinctions between
these intellectual and practical activities, the kinds of reasons each may
adduce, their limitations when applied to each other’s realms, the different
sources of their methodology and the different subject matter appropriate to
each.

If there is any merit in these proposals, they should be reflected in what it
is physicians are expected to know. If medicine is a science, and art, and a
virtue (in the classical sense) — medical students will need a more explicit
education in the non-scientific components of clinical judgment. The skills
required for sound dialectical, ethical and rhetorical reasoning modes must be
more explicitly incorporated into professional education — especially in the
clinical contexts within which decisions for patients are being made. The
liberal arts, and the humanities, even though they might have been presented in pre-medical studies, need vigorous refurbishment in medical education where it will become more obvious to the student that he needs the liberal attitudes of mind to function fully as a physician.

The liberal arts have a legitimate place in medicine, not as gentle accoutrements and genteel embellishments of the medical “art”, or even to make the physician an educated man. Rather, they are as essential to fulfilling the clinician’s responsibility for prudent and right decisions as the skills and knowledge of the sciences basic to medicine.

These are very good reasons for reinforcing the liberal arts into medical education in addition to, but not necessarily to replace, the liberal education in the universities. Premedical education is shallowly rooted for a variety of reasons: The pressure for admission to medical school converts non-scientific subjects into obstacles to be endured rather than essentials to an educated life. Similarly, the humanities may have become too specialized themselves to fulfill their functions as instruments of the liberal arts. Appreciation of the humanities may come more slowly than in the sciences — usually only after the young physician has had some experience of the moral nature of so many of his decisions. Then, the intellectual constraints of a life dedicated only to professional studies are only belatedly perceived. For all these reasons, the liberal arts and humanities are today being taught as part of a medical education in a significant number of schools [29].

The full implications of the anatomy of clinical judgment for the philosophy of medicine cannot be examined further in this essay. Clearly a theory of medicine must account for this, the physician’s most characteristic activity. Hippocrates was partially right to make medicine a natural science; Celsus to call it a conjectural art, and Osler, a science of uncertainty. Any theory of medicine must accommodate all these elements and in the special way demanded by the need to make particular decisions for particular patients. A theory of right thinking, right doing and right acting must then be related to each other. The theory of medicine must also be shaped by the end to which all medical activity points — a right healing action — for that is what defines medicine uniquely.

It is a simple fact but almost universally ignored in modern thought that when one loses sight of the end of one’s thought and action, the thought and action waver between fanaticism and futility. ([7], p. 174)

Yale University
New Haven, Connecticut
BIBLIOGRAPHY