منابع حیطهٔ فلسفهٔ پزشکی

دهمین دوره المپیاد علمی دانشجویان علوم پزشکی کشور

کمیته علمی حیطهٔ فلسفهٔ پزشکی

بهمن ۱۳۹۶

بسم الله الرحمن الرحيم

موضوع: چیستی پزشکی (The Essence of Medicine)

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منابع اصلی

Medicine as Art and Science

46

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Abstract

Conceptual understanding of the essence of medical practice is important for many reasons. For example, it is crucial for how doctors interpret their role and effectuate it in practice, to help societies regulate and organize adequate provision of health care, and to enable critique of ongoing practice and identification of improved solutions for the future. Also, it is of importance to the medical

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T. Schramme, S. Edwards (eds.), *Handbook of the Philosophy of Medicine*,
DOI 10.1007/978-94-017-8688-1_35

profession itself as it helps distinguish medical practice from other healthcare practices as a way of supporting medical professionalism. Accounts of the essence of medical practice have extensively used the terms "art" and "science." However, the conceptual meanings of these terms are not obvious, and neither is it evident how one should perceive the relation between them. In this entry, various meanings of these terms will be addressed and their suggested internal relations in medical practice described. Finally, some practical and political challenges connected to one of the more comprehensive accounts are pointed out. In this way, the relevance of getting a firmer conceptual grip on the normative essence of medical practice is illustrated.

Introduction

Historically, discussions of medicine in terms of art and science are based on a conceptual understanding of medicine as *medical practice*. Thus, medical practice will also be the focus of this presentation. So what is the essence of practicing medicine? This question can be reformulated as both a descriptive and a normative question: What is the essence of medicine as it is in fact practiced? How should medicine ideally be practiced? The first question cannot be answered in isolation from descriptive accounts of how practicing medicine is actually organized and divided in real-world healthcare systems, and the latter question cannot be answered in isolation from normative accounts of what is considered to be the overall aim of medicine.

There is no direct access to the epistemological processes that support medical practice. Since one cannot gain knowledge of these processes by simply observing clinical work, one's understanding of them has to be based on conceptual analysis. Descriptively, one can try to account for what is actually going on in doctors' minds when they are practicing medicine. Normatively, one can discuss what should – ideally – be going on in their minds during this work. Importantly, these different perspectives must be kept apart to avoid the mistaken presumption that all doctors' medical practices coincide with ideal standards. (This assumption might be true but has to be explored empirically before being justified as an assumption.) Fortunately, much work has been carried out to elaborate accurate descriptions of processes of medical reasoning and normative ideals of medical practice. Central to many approaches are the concepts of "science" and "art" and elaborations on how these conceptualizations capture the essence of medical practice. The heading of this entry might invite one to think of these alternatives as apparent counterparts, but the general tendency in the literature is to acknowledge both categories as necessary parts of medical practice. Still, approaches may differ in how art and science in medical practice relate – or should relate – to each other.

Discussions of how to conceptualize medical practice on these terms are important for several reasons. The discussions have a bearing on how the role of being a physician is understood in general and more specifically on how doctors themselves interpret their role and effectuate it in practice. Conceptual clarification of medical practice is important for how society regulates and organizes the provision of

healthcare; this can only be done adequately insofar as it corresponds with a reasonable conceptualization of the ideal content of clinical work. Also, conceptual clarity of medical practice enables one to scrutinize and criticize the impacts of external organizational arrangements on real-world practice and, in turn, enable one to identify better organizational solutions. Furthermore, conceptual clarity is called for to delimit medical practice against other kinds of healthcare activities. It also enables decisions on relevant methods for developing and improving ongoing future practices. Conceptual clarification is also increasingly important for the medical profession itself in order to justify the privileged position it occupies in organized societies. It helps the professionals to be accountable to authorities and citizens and may support trust in that the medical profession handles its societal task of providing good medical care.

This entry is structured as follows: In the first section, a general epistemological framework for clarification of the fundamental conditions for the different approaches is presented. In the second section, meanings of "medicine as art" and "medicine as science" in relation to modern medical practice are presented. Next, versions of conceptual relations between art and science in medicine are described according to assumptions that the art and the science dimensions of medical practice are (a) independent of each other, (b) integrated with each other, or (c) the art dimension encompasses essentially different knowledge bases (including science) that supplement or complement each other. In the final section, philosophical and practical challenges involved in the art of balancing different knowledge bases in medical practice are described.

Epistemological Frame

Conceptualization of medicine as art and science gives associations to two basically different scientific traditions: science of humanities and science of nature. Since the Renaissance, humanistic disciplines have been concerned with disclosing and understanding the meaning of products created by humans through hermeneutical approaches, while science of nature traditionally has been taken to disclose and explain hidden facts about nature by experimental research. More recently, the social sciences have emerged as independent disciplines. Social sciences concern societies, human behavior, and social human relations and draw upon both methods of sciences of humanities and nature. These fundamentally different objects of scientific concerns imply different methods for reaching knowledge that is justified as scientifically valid. Depending on how the core tasks of medical practice are defined, seeking to establish knowledge within medical practice has the potential of calling on all of these traditions.

The Hippocratic Oath has for thousands of years served as a conceptual frame for defining the core tasks of practicing doctors. In the original version of the Oath translated into English, medical practice is basically referred to as "art." In the modern version of the Oath, the following statement is included: "I will remember that there is art to medicine as well as science, and that warmth,

sympathy, and understanding may outweigh the surgeon's knife or the chemist's drug" (Hippocratic Oath). In the old version, art refers to the whole practice of medicine considered as all-needed-capacities-included (Original Version Hippocratic Oath). However, it is described as art that can be taught to others. It is thus presumed that this art has some character of being *reproducible,* which is a criterion acknowledged for establishing knowledge within the science of nature rather than within knowledge production in the humanities. In the modern version of the Oath, art is basically related to the dimension of promoting understanding while science connects to actions involving the patient's body and that are based on knowledge that can be theoretically explained. Thus, historically, conceptualization of medicine as art within the medical profession's own constitutive declaration seems to differ with respect to its substantial meaning. In the following, medicine as art and science is basically understood according to modern medicine and existing tensions between conceptions of art and science.

Practicing medicine according to the ideal description of the modern Oath requires doctors to seek medically relevant knowledge along two different axes. They have to relate to nature in terms of seeking to identify and explain relevant features of the body in light of theoretical explanations. At the same time, they must seek to understand human products of meaning in terms of interpretations and explanations of patients' communication, reactions, and actions.

Most conspicuously, there is a fundamental epistemological gap between relating medicine to art – and by implication to the soft discipline of human science – on the one side and to science understood as the hard science of nature on the other (Snow 1998). Although the ideal description of modern medicine (the Oath) assumes that doctors base their knowledge on both, this gap allows for a different emphasis on these epistemologies and uncertainty with respect to how they should be taken to relate to each other. Empirically, emphasis on either dimension might depend on where in the medical process of identifying illness, treating or caring – and consequently, where in a specialized healthcare system – the practice to be described or assessed is found. The closer to the treatment of the bodily malfunction that medicine is practiced, the more the focus has to be on the explainable relations between intervention and expected outcome. When striving for identification of the medical issue or in providing nonphysical interhuman care, the more a focus on obtaining knowledge in terms of understanding is called for. However, one cannot conclude that in the first case medicine should be understood as science while in the latter case it is a matter of art. As the following sections will show, the science and art dimensions of practicing modern medicine have various interpretations, and the relation between them might be a bit less straightforward than suggested in the modern Hippocratic Oath.

Medicine as Science

In what sense is medical practice understood as science? One way to preliminarily clarify this dimension is to say that medical practitioners strive to be scientific and base their practice on scientific foundation (Sassower and Grodin 1987) or that

medical practice is scientific (Munson 1981). Another way of putting this is to say that medical practice requires the application of science (Munson 1981; Saunders 2000). In this sense, medicine is not taken to be a science itself; medicine is rather seen as an activity being based on translation of scientific knowledge into practice.

The question, then, is: what has been considered *relevant science* for medical practice? Again, descriptive and normative perspectives must be kept apart. For the following descriptive perspective on medicine as science, the focus is on what has been considered relevant science for medicine and thus has largely shaped the development of this practice. From a normative point of view, however, this historic perspective on medical science has been contested as representing an inadequate scope of scientific concerns (Malterud 1995).

Science Versus Nonscience

Scientific knowledge should be conceptually distinguished from nonscientific knowledge. Different criteria have been suggested (e.g., scientific knowledge must be empirically testable, explanatory, predictive (Sassower and Grodin 1987). However, as the history of science shows, criteria that qualify knowledge as science are not written in stone. So, from a normative point of view, some precaution is required when it comes to claiming absolute universal distinctions between science and nonscience in general and within disciplines, like medicine, in particular. From a general point of view, however, it might be uncontroversial to say that the aim to produce articulated and systematically justified knowledge is essential in science while it is not in nonscience.

In order to claim knowledge about a state of affairs, three criteria have been considered central since being discussed in Plato's dialogue *Theaetetus*: A proposition has to be true, one has to believe it, and one has to be able to justify it. Intuitively, these claims seem reasonable. From a philosophical point of view, however, the actual meanings of these criteria can all be scrutinized and discussed (What is truth? What is it to believe? What is it to justify?). This gives rise to various theories of science, which in turn base different methodological approaches to what is considered valid knowledge. Thus, in terms of science, modern medicine can descriptively be accounted for according to the dominating scientific view on how to reach valid knowledge in the field.

Medical science in modern times has unquestionably been dominated by biomedical science (Foss 1989). Thereby, the essence of medicine understood as science in this entry basically relates to biomedical knowledge and the criteria defining the scientific activity within this area. This approach can be traced back to Descartes and his dualistic account of the human mind as something distinct from the human body (Foss 1989). Hence, the human body and the mind were subjected to different fields of study. The concept of science applied on the body remained tightly connected with what can be derived from the laws of nature. The science of nature expanded into organic disciplines, like anatomy, biology, and physiology, and these approaches proved to be a helpful and effective means to understand and

develop tools to cure illness. Hence, science involved in medicine in modern times has basically been explained and practiced within a biomedical paradigm. (This applies to somatic medicine as the status of psychiatry as a science has been more contested.) At the same time, criteria defining scientific activity within this particular paradigm have also constrained the scope of what is considered valid knowledge on which to base medicine considered as a scientific medical practice.

Based on consensus, the medical community has broadly accepted the standards for evidence-based medicine (EBM). The ideal of EBM is to search for well-justified knowledge about efficacy and effectiveness of medical interventions based on experimental approaches within patient populations (Cochrane 1999). A basic principle of these clinical experiments is to strive for objectivity. For the results of the studies to be as objective as possible, one has to control for biases that might arise with respect to patient selection and outcome observations (and inherent interpretations). Therefore, participants are divided randomly into treatment and control groups. Also, the trials are double or triple blinded. In the first case, neither participants nor investigators know who receive the interventions being tested or who are in the control group. In the latter case, the groups of treatment assignments are also concealed for the team that analyzes the data. This approach is called a randomized controlled trial (RCT) and is referred to as the gold standard for medical research on clinical treatment; it tops the hierarchy of methodological approaches to knowledge ranked by the strength of evidence they produce. Scientific knowledge on which to base medicine correlates with research outcomes produced at the highest obtainable level of evidence. However, for pragmatic or ethical reasons, not all kinds of clinical research can be carried out as RCTs. Scientific knowledge can then be obtained by studies producing weaker evidence (e.g., controlled studies without randomization and observational, cohort, and case–control studies). At the bottom of the evidence hierarchy, and with very low scientific status, one finds expert opinion (e.g., expert reports of expert committees and experienced clinicians) (Essential Evidence Plus 2014).

The justification for the monopoly that the biomedical paradigm seemed to enjoy for a while has been contested (DiMatteo 1979; McWhinney 1986; Wulff 1986; Foss 1989; Malterud 1995; Saunders 2000). For instance, the recognition that medicine involves encounters between human subjects and not merely human bodies calls for a different kind of scientific approach than the one vindicated on the quantifiable conditions characterizing biomedical research alone (Malterud 1995). Human interaction is taken to be an essential part of medical practice. Thus, interpretive qualitative approaches developed within the tradition of humanities are called upon to inform medical practice. This acknowledgment also implies the need for including not only quantitative but also qualitative research approaches in the EBM framework.

From Science to Practice

Scientific results do not present themselves with a manual of how they should be used in medical practice. There is a gap between medical scientific research

(broadly construed) and medical practice that needs to be bridged. At least two fundamental challenges arise, and these are both connected to epistemic uncertainty. For one, how can practitioners be expected to gather all information and make use of the best available evidence in the myriad of published research? There is, of course, a practical side to this issue that has to do with time allocation. Philosophically, the core of this problem has to do with feasible expectations concerning individual assessments of strength of evidence. Proponents of basing medical practice on evidence have found a solution to the first challenge. Frameworks for systematically synthesizing knowledge and evidence assessment within medical research into guidelines have been developed (Woolf et al. 2012). The development of guidelines aims to reduce the messiness of the field of published research and provide healthcare personnel with tools for smoother and more feasible implementation of evidence in practice. It is worth noticing that the process of gathering and assessing knowledge cannot be considered as an objective and value-neutral activity in itself; clinical guidelines represent recommended policies for shaping practice and involve value trade-offs and judgment (Opel et al. 2013). Nevertheless, guidelines provide doctors with helpful manuals to handle the uncertainty related to the assessment of evidence. However, at the end of the day it is left to the doctors – and their clinical judgment – to choose whether to rely on these tools in their daily medical practice.

Proponents of EBM have been careful in pointing out that simply complying with evidence-based guidelines will not necessarily amount to adequate healthcare (Sackett et al. 1996). The evidence is based on population studies, and individual patients might present themselves with atypical conditions, comorbidity, and various personal preferences. Ultimately, this translational process has to lean upon an individual healthcare worker's judgment. It has to do so both to judge which recommending (synthesized) guideline is relevant in a particular case and then to assess whether this guideline actually covers the situation of the patient in question. Within this translational work bridging between general knowledge and particular cases, the art dimension of clinical work – or at least part of it – is located (Saunders 2000). This is independent of whether science is understood specifically according to an EBM framework or to a less specific knowledge concept. I will elaborate on this interpretation of medicine as art below. For now it is worth noting that art understood in the broad sense of representing a kind of translational judgment is also considered a crucial condition for adequately realizing science in successful evidence-based practice.

Medicine as Art: General

Attempts to grasp the content of medicine in terms of art can be a challenge. A reason for this is that medicine as art has, to a large extent, merely been negatively defined by pointing out what medicine as science does not cover. It has succinctly summed up how the art of medicine is often described by contrasts – being concerned with the particular rather than the general, practical knowledge rather

than theoretical; it includes the soul and is not merely focused on the body; it pays attention to mental processes and the unspecified effects of treatment (the doctor as a scientist tries to exclude the placebo effect; as an artist he/she makes use of it); it is concerned with values and not only facts; it concerns intuitions and affections and not merely rationality and knowledge; it provides courage and not merely medicine; it listens and not merely hears; it aims to restore rather than construes or generates; it integrates diagnosing and treatment (as science has separated) (Hofmann 2001).

The art of medicine is also accounted for independently of science. The art dimension has been described to encompass interpretations stemming from interhuman action (Malterud 1995); it can be taken to include tacit know-how based on experience (Malterud 1995), as well as any heuristics used to bring about practical conclusions under uncertainty (McDonald 1996). Moreover, it has been associated with the skill of bringing about a healthy outcome by technical interventions (i.e., according to the antique term *techne* (Hofmann 2003)) and the intellectual virtue *phronesis* (Gatens-Robinson 1986; Widdershoven-Heerding 1987; Davis 1997).

These ways of defining medicine as art can meaningfully be cataloged across two different accounts of how art comes into play in clinical care. This can happen, as already mentioned, within the work carried out by the judgment in translating general knowledge (broadly construed) into particular cases by practical reasoning and more specifically by involving and combining both nonmedical and biomedical knowledge in clinical care in order to bring about health.

Medicine as Art: Translating General Knowledge into Particular Cases

The process of translating theoretical knowledge into clinical practice cannot itself be labeled a scientific activity. From an epistemic point of view, particular clinical assessments are always subjected to some extent of uncertainty in knowing whether all relevant symptoms are uncovered, knowing which guideline – if any- to apply and in knowing how a particular body will react to treatment. In this translational process where the individual patient does not present him- or herself in any predefined manner, human reasoning cannot purposively work in a predefined automatic manner if the goal is to reach a certain health outcome. The literature describes heuristics available to the doctor's reasoning like rules of thumb and extrapolation (McDonald 1996). In sum, clinical judgment can encompass any ad hoc strategy or heuristic the individual doctor actual makes use of in order to bring the particular clinical situation of uncertainty to a practical conclusion. Thus, judgment can address issues concerning the patient's emotions; it can strategically produce health effects by comforting and not merely by medical theories (e.g., by actively alleviating fear and by downplaying the significance of observed anomalies); it can be based on values, experience-based intuitions, affections, and interpretative listening to what the patient – consciously or not – is communicating; it can encourage rather than provide medical fixes.

It is important not to confuse medicine as art with the idea that it represents a gift or some kind of esoteric knowledge. Strategies and heuristics can be learned through experiences (Malterud 1995). When they work automatically in experienced doctors, their clinical perceptions and conclusions may occur as being intuitive. This, however, does not necessarily make the emerging knowledge about the particular case tacit in the sense that it is impossible to articulate. Nevertheless, the translational reasoning process required to bridge between general knowledge and particular cases under uncertainty is not objectively controllable in the way scientific processes are required to be. The process is both context driven by features of the situation in question and personal in the way that trade-offs invoke a doctor's personal values. Thus, exercised clinical judgment does not follow any detectable systematic patterns that can be picked up, described, and reproduced in an objective scientific matter. In this sense, associations to uncontrollable, unforeseen reasoning processes supposed to be part of making art an aesthetic activity explain the labeling. But this alone does not promote any reasons to disregard the reasoning activity as something mysterious – it might simply represent another kind of rationality than the one presumed by the biomedical paradigm (Malterud 1995). The art of making clinical judgment along these lines can logically result in both failures and successes depending on the outcome. This is important to remember since one might be inclined to associate the art characteristic of medicine merely to clinical success stories.

Medicine as Art: Combining Contributions of Both Nonmedical and Biomedical Knowledge

As just pointed out, judgment is inevitably called for, even when translating science into practice. However, the interpretation of medicine as art is also distinguished from the interpretation of medicine as science in yet another way. In this version, the essence of medical practice considered as art is seen as being based on substantive contributions of knowledge coming from outside the biomedical domain. This conceptualization of medicine as art comes in at least two versions. On the one side, this conceptualization of medicine as art can be seen as referring to merely moral aspects of interhuman interaction (Saunders 2000). That is, the art elements refer to elements required for a morally justified medical practice where respectful treatment of the patient is emphasized.

In the other version, the elements involved in art are basically understood as everything involved in clinical encounters, including biomedical knowledge. Patients are fully recognized as human beings with lives and contextualized worries; they present themselves with both physical and mental attributes that must be taken into account in order for doctors to be able to respond with good and effective care. Malterud (1995) specified capacities that stem from interhuman encounters and that are considered crucial in order to adequately handle a patient's need together with biomedical knowledge. These capacities are not compatible with the construed rationality of the traditional biomedical perspective on medicine.

Malterud noted that these capacities should also be acknowledged for producing core knowledge for an ideal medical practice and as a consequence should be included in clinical epistemology.

Conceptual Relationships Between Medicine as Art and Medicine as Science

How is the conceptual relation between art and science in medicine described? Based on the literature, it seems apt to distinguish between three different versions of how art and science might relate conceptually in medical practice:

(a) *The art and the science dimensions of medical practice are independent of each other.*
The perspective reflected in the modern version of the Oath indicates some separateness between "art" and "science": Art is associated with promoting interrelational understanding while "science" is associated with skills required for technical interventions. Also, if art is basically considered as skillful treatment of patients merely in a moral sense, then art and science can be considered as distinct and independent elements in medical practice.

(b) *The art and science dimensions of medical practice are integrated with each other.*
When art captures the sense of translating general knowledge into particular cases, art is at the same time considered as an intrinsic part of practicing medicine on line with applying science. This would be the case independently of how successful the translation is according to any evaluative perspectives on medical performance. Analytically, any perspectives on medical practice that claim the inseparable nature of art and science, or claims that practical reasoning in principle can be broken down to such elements being inextricably bound together (like in conceptualizations of techne and phronesis), present the relationship between art and science as an matter of integration.

(c) *The art dimension encompasses essentially a different knowledge basis that supplements or complements the science dimension.*
The view that both biomedical and nonmedical constructions of knowledge are needed for *adequate* care and thus an adequate clinical epistemology presumes that knowledge emerging from interhuman encounters either supplements or complements scientific knowledge (i.e., biomedical science) in medical practice. In the first case, art will supplement biomedical knowledge if it provides nonbiomedical information that justifies nonstandardized interventions (e.g., a lack of a social network might justify a longer hospital stay or a patient's preference on intervention alternatives is taken into account). In the second case, art will complement biomedical knowledge if it is crucial in identifying what is at stake and what intervention is called for in order to achieve a beneficial outcome (e.g., when burdening social relations create physical symptoms). In both these cases different "types of knowledge construction are intimately interwoven in dialectic interplay" (Malterud 1995).

Synthesizing Approaches to the Role of Art and Science in Medicine

Exercising medicine as an art requires interpretive capacities which are called for in the translation of general scientific biomedical knowledge into particular cases; in acting as moral agents in encounters with patients; in establishing nonbiomedical knowledge with relevance for providing adequate care; and in the overall activity of combining all of these elements, including biomedical science, in the practice of medicine. This latter version of an all-things-considered art might very well equate with a broadly construed conception of practical, medical reasoning.

Concluding Remarks

Empirically, in medical practice all of the conceptually different relationships between art and science might very well be played out in a single clinical consultation. There are no logical bars to that. In that case, the conceptualization of art in the original version of the Hippocratic Oath as a comprehensive all-things-considered kind of art might in fact be closer to real-world medical practice than the more specified art concept presented in the modern version of the Oath.

In version (c) above, when the art dimension encompasses differently construed knowledge bases that either complement or supplement each other, careful balancing between the two categories is required. Structurally, evaluations of such a balancing process depend on what the aim of the medical practice is considered to be. This aim is rarely clearly stated in other than very general terms (like in legal regulations of provided healthcare). For instance, the aim of medical practice can be described as providing healthcare of high quality or healthcare according to the patient's best interest. In their clinical practice, doctors must both give this aim a substantive interpretation on a case-to-case basis and balance the concerns to emphasize accordingly. Uncertainty with respect to how balancing between different knowledge bases should be carried out within medical practice gives rise to various philosophical and practical issues. The list is not exhaustive but points to the fact that conceptualizations of medicine as art and science have relevance for the shaping of real-world healthcare provision and politics.

Epistemological Challenges

Malterud's account of a more adequate clinical epistemology requires supplementing/complementing qualitative research on premises of the tradition of the humanities. Still, the fundamental question concerning the normative limits of what to include/exclude in medical practice remains to be answered. Moreover, who decides on where to put the limits, i.e., what are relevant concerns and what are not?

Challenges in Organized Healthcare and Medical Education

The aim of medical practice may differ across different departments of a healthcare system, e.g., between primary and secondary healthcare. In primary care, diagnostic work may require doctors to take on a very broad perspective on what might be at stake before eventually referring the patient to the specialized care, i.e., for less broad approaches to specific domains of somatic or mental care. To correctly view the overall picture, GPs might be required to take more nonbiomedical information into account than their colleagues in secondary care specialities. Thus, adequate care might require unequal stress on the art dimension versus the scientific dimension depending on where in the system the healthcare is provided. How can this be handled by educational training?

Political Challenges

With a lack of clear instructions on how to balance the art and science dimensions of medical practice, unequal performance among clinicians is to be expected. For instance, clinicians might differ in what scope of nonmedical social concerns they find reasonable to include in their medical practice. This will, for one, lead to inequality in healthcare provided to patients with equal conditions and equal circumstances by different doctors. From certain positions on the social justice of healthcare, this will be unfair. Secondly, within public healthcare systems, doctors are given decisive discretionary power on distributional matters that ideally should be up to those with democratic powers to decide (Eriksen 2001). Should something be done to counter these "black holes" of democracy?

Challenges for the Medical Professionalism

The indeterminate nature of the overall goal of medical practice and its uncertain implications for how individual medical doctors should balance different knowledge bases in their practice also creates challenges for professional accountability. If there is no way to hold doctors accountable for the way they stress core elements in clinical epistemology relative to each other, there is nothing to support patients' trust in the professional's judgment in this regard.

Definition of Key Terms

Descriptive	Describes how something *is* without evaluating.
Normative	Describes how something *should be*/*should not be*, i.e., what would be ideal, good, right, fair, bad, wrong, unfair, etc.

Epistemology	Philosophical approaches concerned with the nature and scope of knowledge.
Biomedical paradigm	Set of broadly accepted premises structuring biomedical research.
Heuristics	Experience-based strategies for problem-solving and inquiries.

Summary Points

- Medical practice is often described in terms of "art" and "science."
- It is not obvious how these terms should be understood, neither how the relation between them should be described.
- Various meanings of medicine as science and medicine as art and the relation between them are presented.
- Medicine as science tends to refer to biomedical sciences, but an adequate clinical epistemology calls for supplementing/complementing this research with interpretive, qualitative research on phenomena occurring in interhuman encounters between doctor and patient.
- Exercising medicine as an art requires interpretive capacities, which is called for in the translation of general scientific biomedical knowledge into particular cases; in acting as moral agents in encounters with patients; in establishing nonbiomedical knowledge with relevance for providing adequate care; and in the overall activity of combining all of these elements, including biomedical science, in the practice of medicine.

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Conclusion: What Is Medicine?

What is medicine? Is it an art or a science—or a combination thereof? The debate over the nature of medicine is an ancient and a spirited one, which has not abated even in modern times but has intensified since the beginning of the twentieth century when the fortunes of medicine were tied to those of the natural sciences. The current debate over the nature of medicine is in terms not so much of art or science but rather in terms of evidence-based or patient-centered medicine. Traditionally the biomedical model envisions medicine as a science and as evidence-based, while the humanistic or humane models perceive medicine as an art and patient-centered. Much of the quality-of-care crisis, as discussed earlier, is a result of establishing medical practice on the natural sciences or reducing it to a science. The humanistic or humane modifications, in terms of stressing the artistic dimensions of medical practice or founding it on the patient, are to enhance the quality of medical care.

In a final section of this chapter, the nature of medicine is explored in terms of the biomedical model, which focuses on the *logos* or rationality of medicine that in turn drives its *ethos* or character, and in terms of the humanistic or humane models, which focus on the *ethos* of medicine that in turn drives their *logos*. My proposal is that modern medicine must undergo a revolution in terms of transforming its *logos* and *ethos* by grounding them in *pathos*.

Specifically, *pathos* can transform the *logos* of a biomedical practitioner's objective knowledge or technique and of a humanistic or humane practitioner's subjective information into wisdom, a wisdom that discerns the best and appropriate way of being and acting for both the patient and the physician. *Pathos* can also transform the *ethos* of a biomedical physician's emotionally detached concern or a humane physician's empathic care into a compassionate love that is both tender and unrestricted. That love is not a mawkish sentimentality but a vigorous passion that enters into the suffering of illness. Only a wise and loving stance will relieve the quality-of-care crisis of American medicine, by transforming both the *logos* and *ethos* of the biomedical and humanistic models.

J.A. Marcum, *Humanizing Modern Medicine: An Introductory Philosophy of Medicine,*

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1 Art or Science?

The debate over whether medicine is an art or a science has a long history (Pellegrino, 1979b). However, it was most turbulent during the late nineteenth to early twentieth centuries, when the fate and fortune of medicine were tied to those of the natural sciences. The task for many scientifically minded physicians was to sever medicine from a vitalistic approach and to secure its foundation on scientific rationality (Welch, 1908). No longer was medicine an ineffectual discipline but throughout the twentieth century startling, if not miraculous, advances in terms of diagnostic and especially therapeutic procedures and protocols made scientific medicine a powerful and effective means of treating patients—or so the rhetoric ran. What was once medical ignorance under the guise of art was replaced by the certainty of the natural sciences.

As the twentieth century progressed, for many the art of medicine was eclipsed by or reduced to the science of medicine. But could, or even should, the art of medicine be reduced to the science of medicine? For example, physiology, with its emphasis on precision and the quantitative, became the backbone of medical practice, which was reserved historically for anatomy (Meltzer, 1904). But as J.R. Botkin (1992) fretted, the beauty of physiology is seductive and precaution must be taken to secure the humane treatment of the patient. In this section, the art of medicine is first explored followed then by the science of medicine. Two derivative questions concerning the reduction of art to science and the combination of art and science are examined next. Finally, the point of the debate, if there is one, is explored.

1.1 The Art of Medicine

For many physicians, medicine has always and foremost been an art with science ancillary to its main goal—to heal *this* patient. For example, "Overall medicine is as it has always been—not a science but an art. Science may help, but it must not be allowed to rule the art" (Bourns, 1983, p. 56). What was meant by the art of medicine is the establishment of a personal relationship between the patient and the physician that addresses the patient's emotional and psychological needs. Others included in the art of medicine the link between soul and body, especially in terms of the discipline of psychology (Rushmore, 1923).

Besides the patient's psychology others included as part of the art of medicine the physician's sympathy for the patient, as well as other features of the physician's personality including ambition and enthusiasm for medicine's intellectual development, confidence in training and imperturbability and courage in the face of disaster and disease, and intellectual honestly when confronted with the unknown (Riesman, 1931).[1]

[1] For some physicians the art of medicine referred just to the physician's personality. For example, Robinson noted that this art "is associated with the so-called force of personality, knowledge of human nature and prestige by which a physician is often able to persuade or command or influence or even mislead a patient into a better state of health and comfort" (1929, p. 459).

The art of medicine "concerns itself not only with the sick individual but with the totality of his environment—his family, his friends, his occupation, his social and pecuniary status; indeed with everything that can favor or retard his recovery from illness" (Riesman, 1931, p. 374). It is a skill, then, in which the physician attends to the total care of the patient and its goal is the healing of the whole person not simply the curing of a diseased organ.[2]

The art of medicine certainly involves the application of the science to medical practice, which is its objective side, and includes the technical dimensions of patient care. "Art," according to Homer Swift, "implies arrangement, a creation of special conditions or relationships from available material…art has a never-ending task in arranging new combinations of materials which are constantly increased by science" (1928, p. 168). Art then is a craft or a doing. And, the art of medicine is a craft based on and at times guided by scientific and technical knowledge. Pellegrino likened the art of medicine to Aristotle's *techné*: "art had to do with the making of things, encompassing the necessary techniques and skills as well as the reasons underlying them" (1979b, p. 48).

The art of medicine is concerned with the concrete and particular aspects of medical knowledge and practice as they pertain to the individual patient. It is "the application of useful knowledge to attain beneficial results" (Hundley, 1963, p. 53). For John Fulton (1933), the development and use of the physician's hands played an important part in the objective side of medicine. Moreover, Swift demarcated between two roles for art in medicine: "Although the art of medicine may indicate the manner in which that knowledge may be applied it should also assist in the technique for acquiring new knowledge" (1928, p. 171).

1.2 The Science of Medicine

What is the science of medicine? Although medicine has been connected to the natural sciences since antiquity, most commentators locate medical science's contemporary appearance with the scientific revolution of the seventeenth century—especially with William Harvey's discovery of circulation (Riesman, 1931). However, the identification of medicine as a science by the profession at large did not occur until the late nineteenth and early twentieth centuries. The issue at this time for many physicians and other scientists was whether life or living organisms could or should be explained simply in physico-chemical or in vitalistic terms. For William Welch, as for many other scientifically minded physicians, the former terms were adopted and medical knowledge and practice were viewed as "rational…observational and inductive, mainly physical, as distinguished from

[2] The art of medicine, claimed Gay, involves "the skill in human contact in its most intimate and revealing complexities" (1926, p. 511).

vitalistic, and nearly devoid of superstition and the supernatural" (1908, p. 53). During the first half of the twentieth century, definitions of medicine as a science reflected this perspective. "The science of medicine," according to Fulton, "has reference to the analysis and interpretation of normal and pathological processes of the body in terms of physical and chemical laws (in so far as this is possible) with the end in view of instituting sound therapy" (1933, p. 112).

Whether medicine is a science for many depended upon how science is defined, even though most admitted that there is no good definition for science. For example, Alfred Cohn adopted George Sarton's definition of science as "systematized human knowledge" (1928, p. 405). For Cohn, the science of medicine entails the systematic study of diseases, especially using Virchow's doctrine of the cellular pathology and the methods of physiological and pathological investigation. Others also viewed the science of medicine as the systematic study of disease: "medicine, the science that most intimately concerns man,…deals directly with his body in a state of disease" (Swift, 1928, p. 169).

Lee Forstrom utilized R.B. Braithwaite's characterization of science to identify two features of clinical science: domain of investigation and investigative function. "The domain of clinical medicine," according to Forstrom, "is the human organism, in its manifold environmental contexts, in health and disease" (1977, p. 9). An important constraint is the notion of human disease and health, which narrows the domain of clinical science and distinguishes it from other scientific disciplines. The investigative function of clinical medicine pertains to both the clinic and operating room, spaces in which clinicians investigate the complexities of human illness. In these "laboratories," clinicians advance medical knowledge for their practice: "In its observation, testing, and intervention in these complex phenomena, clinical medicine exercises investigative as well as the more immediately apparent 'diagnostic' and 'therapeutic' functions" (Forstrom, 1977, p. 11).

Many commentators viewed medicine as a science, based on the traditional canon of science. "That canon," according to Pellegrino, "contained three elements: a method, a body of knowledge built up by that method, and an ex post facto explanation of reality based on generalizable laws which related the facts acquired by scientific method to each other" (1979b, p. 46). The scientific method was generally considered *the* method by which physician-scientists diagnose the patient's disease and then determine the best means to treat it. The method, as Lester King defined it, is "the foundation, on the basis of raw data, of articulate hypotheses, through which definite predictions, subject to verification, can be made" (1952, p. 131). Again, Swift characterized the scientific method as empirical, which involves "a tripod of observation, reasoning and experiment" (1928, p. 169).[3]

As for the second element of the canon, the method of medical research and investigation has delivered a specific body of knowledge, as well as its own technical language: "medicine has accumulated theoretical knowledge of its own and this has

[3] Swift went on to assert that "it is necessary for the physician, whether in the laboratory or at the bedside, to approach his problem from the experimental viewpoint" (1928, p. 170).

had its origins in age-long and varying experience" (Cohn, 1928, p. 405). Of course, this body of knowledge also reflects the knowledge obtained from the other natural sciences like biology, chemistry, and physics (Swift, 1928).

The final element of the canon is identification of generalizations based on particulars. Although medicine deals with individual patients, this does not preclude generalizations. "Each individual patient," according to Clouser, "is indeed a nexus of causal chains making a unique particular. But that by no means makes abstraction and generalization over these particulars impossible" (1977, p. 5). Rather, generalizations in clinical medicine are possible "in principle" but are currently prohibited because of the complexity of medicine's subject matter.

Although these definitions seem straight forward for many others the definition of science or natural science *per se* was problematic, thus making any definition of medical science also problematic. Commentators on the nature of medicine felt that identifying medicine as a science was, for example, reductionistic. They asked whether medicine, especially its art form, can be reduced to science. For example, Canby Robinson queried whether "it is not unlikely that medical practice can ever be reduced strictly to a state of applied science, such as engineering" (1929, p. 460).[4] Moreover, Ronald Munson argued that medicine cannot be a science because of fundamental differences between them: "the aim of medicine is to promote health through the prevention and treatment of disease, while the aim of science is to acquire knowledge; medicine judges its cognitive formulations by their practical results in promoting health, while science evaluates its theories by the criterion of truth" (1981, p. 204).

Recently, Hunter has claimed that medicine is not a science. Although she is aware that the circumstantial evidence points to medicine as a science, she insists that "medicine is not a science as science is commonly understood: an invariant and predictive account of the physical world" (1991, p. xviii).[5] For Hunter, as for Cassell (1991), the goal of medicine is to relieve *this* patient's suffering and to accomplish that goal science is certainly drawn upon but "medicine is (as it always has been) a practical body of knowledge brought to bear on the understanding and treatment of particular cases" (1991, p. xviii). Medicine is not so much a science as it is an art of interpreting the patient as text.

Besides the natural sciences, some commentators have examined the sociological nature of medicine, i.e. "Is medicine a social science?" For example, Michael Martin (1981) explored three possible interpretations of this question. The first is that medicine is wholly or just a social science. He rejected this interpretation on *prima facie* grounds, since physicians engage in scientific or technical analysis of the patient's physical state. Patrick Heelan (1977) identified the picture of the patient from this analysis as a "scientific image."[6] The second interpretation is that

[4] Robinson did acknowledge that if the physician has exhaustive knowledge of the patient then he or she would be a "great artist."

[5] For her understanding of science, Hunter draws upon Plato's *Gorgias* (464).

[6] Heelan defined scientific images as "the products of theory construction and testing, experimentation, and objective measurement" (1977, p. 21).

medicine is "in part" a social science. In other words, there are social factors that can influence a patient's health or disease. Martin certainly acknowledged that this interpretation is true but in a trivial sense.

Martin also proposed a third interpretation in that medicine as a social science is a "slogan." By this, he meant that "the social scientific dimension of medicine is larger and more important than is usually recognized" (Martin, 1981, p. 348). To substantiate this proposal, he discussed the social influences on the origins, explanation and prevention of disease. Again, Heelan (1977) denoted the social picture of the patient as a "manifest image."[7] This image of the patient provides the clinician with "access to resources for understanding of the social, cultural, and hermeneutical complexity of the life-worlds of man" (Heelan, 1977, p. 32). Thus, the scientific image of the patient requires the manifest or social image in order to provide the physician with a complete picture of the patient. Only with such a full image of the patient, then, is holistic healing possible.

1.3 Combination or Tertium Quid

Is medicine a combination of art and science? Many commentators on this question believe that medicine must combine both to be effective. For example, Fulton (1933) championed a "union" of art and science—while Hundley (1963) a "balance" between them—for a successful clinical practice. Many metaphors have been used to illustrate the connection between the art and science of medicine. For example, Riesman suggested: "The art and the science of medicine are like the two sides of a shield; neither can exist alone; neither by itself can achieve the grand goal for which medicine has been striving through the ages—to relieve suffering and to prevent disease" (1931, p. 373). In other words, the physician should not only be scientifically or technically competent but also a caring and compassionate person. "The art of medicine and the science of medicine," according to Peabody, "are not antagonistic but supplementary to each other" (1984, p. 813).

Blumgart (1964) also claimed that the science of medicine and the art of medicine are not "mutually antagonistic" but rather "complementary." For him the intersection of the science and art of medicine is the patient. "Without scientific knowledge," argued Blumgart, "a compassionate wish to serve mankind's health is meaningless. But scientific knowledge without wisdom," he stressed on the other hand, "is a frozen storehouse" (1964, p. 449). The wisdom necessary for efficacious application of medical knowledge from scientific endeavors is obtained from years of caring for patients as persons and not simply as diseased parts that are reduced to their physical and chemical states.

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[7] Manifest images, according to Heelan, "manifest objects directly as functions of shared subjective intentions within some context spanned by the instruments and embodiments of shared values, meanings, and purposes" (1977, p. 20).

Finally, is medicine neither art nor science but something else? Some commentators agree that the art and science of medicine are necessary for medical knowledge and practice but insufficient for explicating the nature of medicine.[8] For example, Marinker claims that "medicine should be regarded neither as an art nor as a science in itself, but as a special kind of relationship between two persons, a doctor and a patient" (1975, p. 83). For Pellegrino, what guides that relationship is the end or purpose of medicine—the healing bond. "Medicine in its function as medicine" argues Pellegrino, "resides in making of a prudent healing decision for a specific person" (1979b, p. 49). Although medicine cannot accomplish this end without both art and science, its practice is separate from both. Pellegrino and Thomasma claim that "medicine is a distinct intermediate discipline, a *tertium quid*" (1981a, p. 59). They view medicine as a unitary and unique discipline, in which the science of medicine in terms of its healing technology is applied with a humane or an artistic touch.

Interestingly, Pellegrino (1979b) claims that the debate over whether medicine is an art or a science is pointless. However, having made this bold claim, he seems to retreat from it. "How science and art are construed, and how much of each we think we use in medicine" Pellegrino admits, "must be assessed by each of us. The physician's self-image, education and satisfaction are" he adds, "inextricably bound to these construals" (1979b, p. 51). He believes that each physician must come to a consensus concerning the role of art and science for how he or she is going to practice medicine. Indeed, earlier Swift argued that "the skill in which we mingle the two will determine our success" (1928, p. 171).

However, the above position on the point of the debate begs the larger normative question. How should the profession itself view or address the debate? Besides the standard interpretations of the debate, it is important for another reason—the temptation to reduce the art of medicine to its science and the patient to a machine. As John Hundley has warned: "It is the *art* of medicine, applying with reason and judgment the science on which much of medicine is based, which enables the discriminating and wise physician to make the distinction, and by so doing, avoid the apparently increasing risk of becoming only a scientific medical technician" (1963, p. 54). The distinction between the art of medicine and the science of medicine is an important distinction and one that is crucial for understanding the very nature of medical knowledge and practice.

2 Evidence-Based or Patient-Centered?

Although the debate over whether medicine is or should be an art or a science appears to have faded during the latter part of the twentieth century, it really took on a new form—the debate over whether medicine is or should be evidence-based

[8] According to Tauber, "medicine cannot attain the status of a natural science, nor should it. Instead, allow biomedicine to establish its own scientific ethos" (2005, p. 35).

or patient-centered. Evidence-based medicine (EBM) is driven by the metaphysical and epistemological dimensions of the biomedical model, i.e. the physician is to apply the latest therapy proven effective through RCTs. Patient-centered medicine (PCM), however, is based on the moral or humane nature of the patient-physician relationship, i.e. the physician takes into consideration the patient's emotional state and value structure. Besides PCM there are a host of closely related versions, such as "real-world medicine" (Hampton, 2002). However, two related versions include narrative-based medicine (NBM) and value-based medicine (VBM). In this section, EBM is discussed first, followed by PCM and finally by NBM and VBM.

2.1 Evidence-Based Medicine

Although the phrase EBM is recent in origin, the idea has a long history in medicine; at least this is the claim according to its proponents.[9] There are three historical periods to EBM, with one transition period (Claridge and Fabian, 2005). The first period, ancient era EBM, involved anecdotal accounts transmitted through authoritative teachings. The next period, Renaissance era EBM, began during the seventeenth century with challenges to popular therapies, such as bloodletting. For example, trials were conducted to evaluate the efficacy of bloodletting. The result was the abandonment of bloodletting by the end of the nineteenth century.

A transition period from the 1900s to the 1970s issued in the RCT, which made possible modern era EBM in the latter part of the twentieth century. The two framers of contemporary EBM are Archie Cochrane from the United Kingdom and the Evidence-Based Medicine Working Group chaired by Gordon Guyatt of Canada. The Cochrane Collaboration, founded in 1993, provides reviews of up-to-date evidence from clinical trials (Chalmers, 1993). Contemporary EBM is an attempt to manage large amounts of medical research evidence, in order to help "patients and societies make better choices and thereby optimize patient outcomes and public health" (Woolf, 2001, p. 41).

The Evidence-Based Medicine Working Group provided one of the first comprehensive and most recognized articulations of EBM. EBM is often envisioned as a new paradigm in contrast to the old paradigm of traditional medicine. The old paradigm is predicated upon unsystematic observations and traditional medical training that focuses exclusively on pathophysiology and clinical experience. "This paradigm," according to the Working Group, "puts a high value on traditional scientific authority and adherence to community standard approaches, and answers are frequently sought from direct contact with local experts or reference to the writings of international experts" (Evidence-Based Medicine Working Group, 1992, p. 2421).

[9] The phrase "evidence-based medicine" first arose during the early 1990s at McMaster University and is the descendent of clinical epidemiology (Claridge and Fabian, 2005; Liberati and Vineis, 2004; Sackett, 1997).

The new paradigm, EBM, puts less stock in traditional medical authority and more in systematic observations, especially obtained from RCTs, and interpretation of those observations though meta-analysis (MA). The outcome of this paradigm is that "physicians whose practice is based on an understanding of the underlying evidence will provide superior patient care" (Evidence-Based Medicine Working Group, 1992, p. 2421). According to the Working Group, the new paradigm represents a Kuhnian paradigm shift and the future of medical practice.

David Sackett, an original member of the Evidence-Based Medicine Working Group, and colleagues formulated one of the first and best known consensus definitions for EBM: "the conscientious, explicit, and judicious use of current best evidence in making decisions about the care of individual patients" (Sackett et al., 1996, p. 71).[10] EBM is a combination of the best available research evidence from RCTs and MAs, along with the clinician's personal expertise and experience. The "good" physician requires both for practice since either alone is insufficient: "Without clinical expertise, practice risks becoming tyrannized by evidence, for even excellent external evidence may be inapplicable to or inappropriate for an individual patient. Without current best evidence, practice risks becoming rapidly out of date, to the detriment of patients" (Sackett et al., 1996, p. 72).

Besides identifying what EBM is, Sackett and colleagues also identify what it is not. EBM is certainly not "old hat" medicine, since the rise of evidence from RCT is rather recent. Moreover, it is not impractical, in that it is not impossible to practice EBM, as evident from studies demonstrating that clinicians and surgeons are successfully applying it. Finally, EBM is definitely not "cookbook" medicine since it requires the input of the clinician's expertise in applying a treatment established by the best available scientific and clinical evidence. EBM, then, provides the best possible medical care based on the latest technological advances, experimental and clinical data and observations, and the best theoretical explanations and logical thinking.[11]

Sackett and colleagues have proposed five steps for the practice of EBM (Sackett et al., 1998). The first is the articulation of clinical question(s) concerning the patient's disease state. An important feature of these questions is that they must be clearly focused on the patient's problem and answerable by searching available literature databases. They propose that the question(s) should be structured in a PICO format: patient or problem, intervention, comparison of interventions, and outcome(s). The next step is finding the relevant evidence within a medical literature database, like PubMed, to answer the question(s). The success of such searches depends upon identifying the appropriate key words and databases.

[10] For example, Amit Ghosh uses Sackett's definition of EBM to formulate his own: "Evidence-based medicine refers to the conscientious, explicit, and judicious use of the best available evidence in health-care decision-making" (2004, p. 60).

[11] According to Woolf, "EBM emphasizes comprehensiveness and applies systematic criteria to ensure that all relevant evidence is considered, rather than being cited selectively, and that the quality of studies is evaluated fairly, regardless of preconceived biases" (2001, p. 39).

The third step is the appraisal of the evidence obtained from the search, with respect to its validity or soundness and its clinical usefulness. Appraisal is a skilled activity that requires training and experience. The next to last step is applying the evidence to the patient's problem, especially in terms of the patient's values. The decision is often the patient's obligation, given the evidence presented by the physician. The final step is formal evaluation of the four steps to determine the effectiveness of the process.[12]

There is generally little, if any, room in the biomedical model, especially in terms of EBM, for the intuitive dimensions of either the physician or patient. Indeed, the biomedical model of medical knowledge and practice strives to be strictly rational and evidence-based. According to Liberati and Vineis, "intuition and unsystematic clinical experience as well as a pathophysiological rationale are insufficient grounds for clinical decision making. On the contrary," they insist, "the modern practice of medicine finds its way by reliance on formal rules aimed at interpreting the results of clinical research effectively; these rules must complement the medical training and common sense of clinicians" (2004, p. 120). Moreover, EBM requires an extended commitment on the physician's part in terms of training: "The practice of evidence-based medicine is a process of life-long, self-directed learning in which caring for one's own patients creates the need for clinically important information about diagnosis, prognosis, therapy, and other clinical and health care issues" (Sackett, 1997, p. 4).

EBM also depends on advances in computer technology. The reliance of medicine on such technology was presaged in the early 1970s. At that time, the application of the computer to medicine was heralded to revolutionize medical practice in the near future: "it seems probable that in the not too distant future the physician and the computer will engage in frequent dialogue, the computer continuously taking note of history, physical findings, laboratory data, and the like, alerting the physician to the most probable diagnoses and suggesting the appropriate, safest course of action" (Schwartz, 1970, p. 1258). Although the application of the computer to medical practice took longer than originally anticipated, we now benefit from the use of computers in diagnostic procedures such as computerized tomography. Moreover, search engines, like PubMed, provide ready access to results from RCTs and MAs. Finally, the application of artificial intelligence holds great promise—or so its adherents claim—for tomorrow's medical knowledge and practice (Coiera, 1996).

Although no one argues with the rational basis of medicine or even with its evidentiary base, there is considerable discussion and debate over the notion of EBM. Consequently, EBM is severely criticized on several fronts. For example,

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[12] Porzsolt and colleagues have proposed a sixth step for EBM practice (Porzsolt et al., 2003). They find that including after the first step an additional step in which the physician attempts to answer the question(s) based on internal evidence, i.e. the physician's current knowledge, assist physicians in implementing EBM into their practice. This additional step also allows the physician to compare his or her previous knowledge with current evidence and to determine which is best for the patient.

an anonymous organization that calls itself Clinicians for the Restoration of Autonomous Practice provided a scathing attack on EBM in a 2002 issue of the *British Medical Journal* (CRAP Writing Group, 2002). This Writing Group claims to have "irrefutable proof that EBM is, indeed, a full-blown religious movement, complete with a priesthood, catechisms, a liturgy, religious symbols, and sacraments" (2002, p. 1496).

The above criticisms are in response to the aggressive claim made by EBM's proponents that EBM represents a "paradigmatic shift" in medicine, from a nonscientific medicine to a scientific one. It is this claim to which the defenders of the older, traditional medicine bristle and take umbrage. However, this claim is "not only simplistic but, as any closer scrutiny will reveal, profoundly wrong. The difference that needs to be marked is not that before EBM people did not use the evidence. Rather, the real failure was the lack of a framework and a set of rules to use the evidence in a systematic and explicit fashion" (Liberati and Vineis, 2004, p. 120).

Critics of EBM also raise other objections and concerns. For example, Abhaya Kulkarni (2005) identifies several empirical and conceptual problems, including differing opinions of MAs over evidence, conflicting results from RCTs, and threshold for accepting current evidence. Also, John Worrall (2002) raises the problem associated with EBM's dependence on randomization. He claims it only controls for selection bias.

In addition, Mark Tonelli (1998) distinguishes several philosophical limitations to EBM. The first limit is that evidence obtained from population-based studies like RCTs is not readily applicable to any individual patient, given the variation from one patient to another. This limit is epistemological in nature. Another limit is ethical, in that EBM cannot address the ethical question of whether the patient wants to undergo the treatment based on the best evidence. Finally, there is a tacit limit to medical judgment that outstrips the algorithmic approach of EBM. "Clinical judgment appears to contain a tacit element," Tonelli opines, "one that cannot be captured by decision analysis or any other explicit model" (1998, p. 1238). For him, clinical judgment is more akin to casuistry than to scientific rationality.

The proponents of EBM have responded to these criticisms. They certainly recognize that there are a number of limitations to EBM but believe that they can be addressed successfully. For example, "the elimination of individual difference in trials does not render trial data inapplicable to individuals; rather, it makes it applicable to the extent that individuals share relevant characteristics with trial participants" (Parker, 2002, p. 275). But critics counter that the patients corresponding to the test population represent only a small part of the larger "real world" patient population. Sharon Straus and Finlay McAlister (2000) acknowledge this problem but report that subgroup studies to the main RCTs are conducted to include patient values and particularities. Moreover, Malcolm Parker cautions that stressing the uniqueness of patients underestimates the commonality of patients: "Overweening particularism is a conceit as harmful as coercive scientific generalization" (2002, p. 279). Finally, Straus and McAlister (2000) address what they consider to be the predominant misperception: EBM is an "ivory-tower" notion, with little "real world" application. Clinical surveys, however, reveal otherwise.

2.2 Patient-Centered Medicine

Can EBM provide the necessary resources for comprehensive medical knowledge and practice? Although EBM is revolutionizing medicine and providing a solid empirical basis for medical knowledge and practice, especially in terms of RCT and MA, some commentators believe that EBM is unable to under gird modern medicine adequately or completely. "There is no doubt," according to Liberati and Vineis, "that EBM does not, and cannot, answer all the epistemological and practical questions surrounding the practice of medicine" (2004, p. 120).

EBM certainly provides physicians with the methodological skills to utilize current empirical evidence needed for medical knowledge and practice; but, claim many critics, what about the patient's personal information. In the last several decades, PCM arose to prominence in medicine to address this need (Stewart et al., 2003). It is based on the patient's personal information and history, especially information the biomedical model finds distracting: "in RCTs patient characteristics are considered a nuisance that might disturb the results of the study, instead of providing valuable extra information" (Bensing, 2000, p. 19). It is that information that is critical for the practice of patient-centered or humanistic medicine.

PCM is often contrasted with EBM. EBM is thought to represent the natural or "hard" sciences, while PCM the clinical or "soft" sciences (Stewart et al., 2003). Whereas EBM "has basically a positivistic, biomedical perspective…Patient-centered medicine…has basically a humanistic, biopsychosocial perspective" (Bensing, 2000, p. 17). According to Jozien Bensing PCM is also distinct from EBM's "diseased-centered" perspective, since "the patient is more than his or her disease" (2000, p. 21). PCM "deals with the content of the consultation, the choice of topics that should or could be addressed, according to the patients' needs and expectations" (Bensing, 2000, p. 21). It also "deals with the control over the consultation, with the question whose agenda is dealt with, who is expected and has the power to make decisions" (Bensing, 2000, p. 22). Moreover, PCM is distinct from EBM's "doctor-centered" tendency, particularly with an emphasis on patient autonomy. In PCM, the focus is shifted from diagnostic accuracy in the physician-centered consultation to the patient's illness experience.

The goal of PCM is to bring the patient's world into focus. "The physician," according to Ian McWhinney, "is enjoined to discover the patient's expectations, his feeling about illness, and his fears. He does this by trying to enter the patient's world and to see the illness through the patient's eyes" (1988, p. 225). Moreover, the patient-physician consultation is a "moral encounter, and the responsibilities that spring from it (for both parties), can then provide the framework *within* which any effective consultation can take place" (Evans, 2003, p. 9).

The means to achieve PCM's goal is effective communication. Bensing emphasizes that "the best way to know the patients' agenda is still, and will perhaps always be, listening to the patients' story and seeking the right balance in the decision making process" (2000, p. 23). Communication, then, is critical for the success of PCM: "communication is the royal pathway to patient-centered medicine"

(Bensing, 2000, p. 23). There are three reasons why communication is essential for PCM: the patient is *the* expert in terms of the patient's illness experience, different patients have different preferences in terms of healthcare, and patient morbidity depends upon patient's adaptation and coping mechanisms (Bensing et al., 2000).

Moria Stewart and colleagues have identified six, interacting components to PCM (Stewart et al., 2003). The first is the assessment of the two elements of the patient's presenting complaint, in term of the physical disease itself and of the patient's illness experience. The first element is obtained through the traditional medical history and physical exam, while the second through communication with the patient in terms of the impact the illness has on the patient's lifestyle and emotional wellbeing. The next component is integrating the information obtained in the first component with an overall understanding of the patient as a whole person, including the patient's proximal and distal contexts.

The third component is uncovering a common ground between patient and physician, particularly with respect to identifying the patient's health problem, agreeing on the therapeutic modalities, and defining the roles played by both the patient and physician. The next component involves promoting patient-physician consultations as an opportunity to promote wellness and to prevent further health problems. The fifth component is the growth and establishment of the patient-physician relationship, especially through compassion on part of the physician and compliance on part of the patient. The final component is that both the patient and physician must be realistic about the limitations of modern medicine: the former cannot expect miracles and the latter cannot promise them.

Although EBM and PCM appear to be polar opposites of one another there is significant overlap between them, according to some commentators. For example, Stewart and colleagues claim that EBM and PCM are "synergistic," in that both approaches to the practice of medicine converge to produce "creative tension" between the physician's and the patient's perspectives (Stewart et al., 2003, p. 12). Bensing proposes an integration of EBM and PCM. He advocates improving PCM by developing more rigorous communication studies that mimic RCT, which would provide explanations for behavioral activities between patients and physicians during the clinical encounter. Bensing also proposes to bridge the gap between EBM and PCM through communication studies, particularly by incorporating patients' preferences into the design of RCTs, thereby making EBM more patient-centered. "The challenge for the near future," according to Bensing, "is to bring these separate worlds together" (2000, p. 17). The obvious benefit is a more robust medicine, in which the patient's health needs are met and the physician's role as healer confirmed.

2.3 Narrative-Based Medicine

Communication between physician and patient, as noted above, is critical for the success of humanistic or humane medicine. Besides PCM, another type of humanistic medicine—NBM—has also gained prominence in the last several decades.

The physician enters the patient's world of illness and suffering and learns what it means to the patient, by listening sympathetically to the illness story. For example, Arthur Kleinman champions the importance of the patient's narrative and the physician's responsibility to take it into account, during the healing process:

> The work of the practitioner includes the sensitive solicitation of the patient's and the family's stories of the illness, the assembling of a mini-ethnography of the changing contexts of chronicity, informed negotiation with alternative lay perspectives on care, and what amounts to a brief medical psychotherapy for the multiple, ongoing threats and losses that make chronic illness so profoundly disruptive (1988, p. 10).

The meaning that a patient attaches to illness and suffering, especially chronic or fatal illness, is critical for the healing process—and that meaning is readily accessible through the patient's illness story. Consequently, it is imperative that the physician take this story seriously when diagnosing and treating the patient. According to Rita Charon, "narrative medicine can give physicians and surgeons the skills, methods, and texts to learn how to imbue the facts and objects of health and illness with their consequences and meanings for individual patients and physicians" (2001, p. 1898).

Trisha Greenhalgh and Brian Hurwitz (1999) point out several important advantages of NBM. For diagnosis, NBM provides an atmosphere in which professional intimacy can be fostered between patient and physician and also assists both patient and physician in developing an understanding, respectively, the meaning of the illness. It also facilitates sympathy between the physician and patient by permitting the patient to tell the illness story and the physician to listen intently to it. Often by listening to the patient's illness narrative the patient reveals the diagnosis to the physician, since narrative represents the "phenomenal form" of the illness. For therapy, NBM provides the occasion for a holistic approach to healing. It also facilitates the analysis of alternative therapeutic modalities or for palliative care instead of an aggressive therapeutic modality. "The core clinical skills of listening, questioning, delineating, marshalling, explaining, and interpreting," claim Greenhalgh and Hurwitz, "may provide a way of mediating between the very different worlds of patients and health professionals" (1999, p. 50).

2.4 Value-Based Medicine

VBM is proposed not so much as an alternative to but more as an extension of EBM; and, it reflects the rise of consumerism in medicine (Kottow, 2002). VBM is pyramidal in structure, with EBM at its base and with an intermediate tier composed of patient-perceived values in terms of quality and/or length of life, and with a top tier in which the patient-perceived values are converted to economic values by cost-utility analysis. "Value-based medicine," as defined by Melissa Brown and colleagues, "integrates the best EBM data with the patient-perceived quality of life improvement conferred by a healthcare intervention" (Brown et al., 2005, p. 5).

Cost-utility analysis is the means by which to quantitate treatment outcome in units of monetary expense per gain in quality or length of life. This analysis is imperative for distinguishing between interventions that provide little, if any, gain from those that provide maximum gain at minimum cost. VBM is an "information system" that improves the quality of healthcare and, at the same time, makes healthcare more cost-effective or efficient. "VBM," according to Brown and associates, "allows clinicians to practice the highest quality of healthcare…Because it permits clinicians to selectively utilize interventions that deliver the greatest value from the viewpoints of patients who have lived in a health state" (Brown et al., 2005, p. 9).

3 From *Logos* and *Ethos* to *Pathos*

The earlier debate between the art and science of medicine and its contemporary manifestation in terms of EBM and PCM belie a deep problem with the nature of medicine, particularly with respect to the quality-of-care crisis. A complementary position or even a third alternative position to this debate is unlikely to resolve the crisis; rather, the resolution involves the connection of medicine with its *pathos*. For the underlying problem, especially for American medicine, is that its *logos* (rationality) and *ethos* (character) are severed from its *pathos* (passion).

The paradigmatic shift that American medicine must undergo is not just from the biomedical model to one of its humanistic or humane versions or even to one of the alternative models, but from a medicine concerned only with *logos* and/or *ethos* to a medicine rooted in *pathos*. For scientific knowledge or personal information and emotionally detached concern or empathic care to be effective, they must be rooted in passion.

Contemporary medicine must secure a sensitive and responsive *pathos* to guide its rationally oriented *logos* and character-driven *ethos*, before it can address the issues surrounding the quality-of-crisis facing it. This *pathos* reflects a way of being present in and to the patient's suffering and not just knowing accurately or acting appropriately in the presence of the disease or illness. *Pathos* implies here more than simple emotion or desire; rather, it reflects a passionate or ardent way of being fully present that makes *possible* both accurate knowing or understanding and right doing or acting. Fundamentally, humans are conscious and irritable persons that respond as self to their environment and to others in it and by such responding are responsible for that response. It is that self-conscious respondability or response-ability that makes *possible* rational and virtuous or passionate medical knowledge and practice.

But how can rooting of *logos* and *ethos* in *pathos* affect change in the healthcare industry, from a philosophical perspective? The answer is two-fold. First, *pathos* can transform the *logos* of technique, facts, objective knowledge, and subjective information into wisdom, a complete or comprehensive wisdom that can discern the best and appropriate way of being and acting for both the patient and the physician. Second, *pathos* can transform the *ethos* of the biomedical physician's emotionally

WOLFGANG WIELAND

THE CONCEPT OF THE ART OF MEDICINE

The essays in this volume concern the nature and interplay among science, technology, and the art of medicine. All three of these human endeavors have to some extent been submitted to critical analysis. This essay will focus on the development of the concept of the art of medicine. Many have understood this concept as a designation for any irrational remnant in medicine that the onslaught of science has as yet failed to eliminate and which will someday disappear with the scientification of medicine. I will argue, however, that the proponents of that position have failed to appreciate the development of the concept of the 'art of medicine'. In doing so, I hope to shed light on the importance of this element of art in our understanding of medical practice.

If one speaks today about art, one usually refers to the realm of the aesthetic. In light of this usage, it makes sense to infer that accepting the designation of medicine as an art means viewing physicians alongside poets, musicians, and pictorial artists. Certainly, this is not bad company; and surely, the aesthetic perspective is of some importance in medical practice. Most will admit, however, that the physician's task cannot adequately be described from this point of view.

If one understands the concept of art solely in the aesthetic sense, one has fallen victim to a persistent and wide-ranging interpretation. One has overlooked the fact that the actual idea of art in the expression 'art of medicine' represents a relic of an older level of language ([27], pp. 83ff). The expression 'art' was originally not limited to the aesthetic sphere; rather, it represented in line with the Latin *ars* and the Greek *techne*, the human capacity for production by planned action. In this older sense, not only the statesman and the military person, but every competent craftsman practices an art. The breadth of this understanding of art is typified in the so-called liberal arts (*artes liberales*) of the Middle Ages that included disciplines such as arithmetic and geometry (which, according to contemporary usage, are not arts but sciences). The narrow understanding of art in the aesthetic sense is a relatively late product in this historical development. Until the last century when it was necessary to discuss the aesthetic realm, one spoke not of arts, but rather of the 'fine arts' [16].

Corinna Delkeskamp-Hayes and Mary Ann Gardell Cutter (eds.), Science, Technology, and the Art of Medicine, 165–181.
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One must recognize, then, that the concept of the 'art of medicine' originally referred to everything that medicine represents in contrast to the natural sciences. The concept of the art of medicine reminds us that medicine is a practical discipline whose final goal lies not in understanding matters of facts and reasoning about them, but rather in acting reasonably or prudently.

Let us review in greater detail the history of the concept of the 'art of medicine'. At the beginning of this history we find the *Corpus Hippocraticum*. Here, the concept of 'art' (*techne*) is still a generic term covering medicine as a whole. It includes reference to the theoretical knowledge of the physician as well as to his judgmental capability and his practical skills. In the first aphorism: "Life is short, the art is long", the "art" of the doctor in no way contrasts with medical science. In this context, a study of the Hippocratic work, *On the Art*, is instructive. This work does not intend to determine the essence of the art of medicine; rather, through discussion of certain opposing positions, it serves to suggest that such an art does in fact exist. The author, who is probably not a physician, is concerned to prove that the doctor is not talking without meaning when he claims that his actions will produce very specific effects, namely, that they will free the sick from their sufffering. The opponents with whom the author argues had adduced cases where either the physician could be of no more help or where the sick person regains health all by himself and without being treated by a doctor. As the author tries to show, it does not follow at all from such cases that the art of medicine is ineffective and that every cure depends purely on chance. The fact that the art of medicine has its limits does not justify calling the existence of that art itself into question. The concept of art is thus not at all defined in contrast to the concept of science; rather, it stands in contrast to the concept of chance. In the *Corpus Hippocraticum*, it still includes the entire realm of medical knowledge, actions, and capabilities and skills.

The second current of the tradition that is important for understanding the concept of art proceeds from Aristotle. Aristotle undertakes to limit the concepts of art (*techne*) and science (*episteme*) more precisely as exclusive of one another (*Nichomachean Ethics*, Bk. VI, Ch. 3–8; *Metaphysics*, Bk. I, Ch. 1). The scientist is the theoretician; he strives for knowledge for its own sake. The object of this knowledge is not individual things or events, but universal essences and laws. This universality, which science wishes to discover, is always unaltered. It is not subject to mutation and change. In particular, it is not influenced by the scientist. Focused on this universality, science seeks to capture its discoveries in terms of statements that are capable of, and require, a foundation. In contrast to science, art is focused on activity. It

wants to produce concrete results and to form and change its objects. In contrast to scientific understanding, art directs itself, as action does, toward the single and individual. This is the realm where art must prove itself, even while remaining oriented toward universally valid principles in utilizing the products of theoretical science. Thus, according to Aristotle, there exists a tension between the realms of science and art, because the realm of the individual and the changeable can never be completely apprehended by science. Nor can art (or practical reason in general) ever be reduced to theoretical science. In this sense, it is characteristic of the physician, Aristotle's favorite example of the practical man, that he deals not only with universally valid knowledge, but also most importantly with individual patients and specific situations. His art lies in his ability to do justice to that realm of the particular to which science does not extend.

Although the *Corpus Hippocraticum* proceeds from an all-inclusive conception of art, while Aristotle's concept proceeds from a strict distinction between art and science, no unbridgeable contrast exists between the histories of their influence. Medical tradition was able without difficulty to incorporate the Aristotelian distinction. Distinguishing between art and science in medicine was considered necessary only when reflections on methodology or theory of science would so require it. Thus, the Galenic tradition could distinguish between *scientia medica* and *ars medica* in a properly Aristotelian manner [22]. This distinction, however, did not yet possess any explosive polemical power. Except for contrasts motivated by methodological interest, the terms 'art' and 'science' were for a long time used in medicine without difference in meaning. Certainly the Aristotelian tradition continually emphasized the unknowability of the individual. The validity of the principle that no science arises from particulars (*de singularibus non est scientia*) was seldom attacked during the Middle Ages or during the greater part of modern times. This, however, did not impede talk about art and science from becoming commonplace. Users of these expressions no longer needed to think in terms of the Aristotelian categorical distinction. Thus one finds medical authors up to the beginning of the nineteenth century using the two concepts interchangeably when speaking of medicine ([4], [5], [21], [8], [15], [11]).

The absence of a polemic relationship between medical art and medical science during the eighteenth century is easily understood. Pre-eighteenth century medicine was a closed, dogmatic discipline. It was taught at universities, largely in the form of a commentary on the classical teachers Hippocrates, Galen, and Avicenna. Within the framework of this tradition, not yet haunted by any crisis regarding its foundations, a closed and dogmatic

medical science and the art of (the practice of) medicine could be neatly joined to one another. The decisive turn occurred as research into the fundamentals of medicine developed. At least, since Harvey's discovery of the circulation of blood in 1616, one finds an open, inquiring, progressing science that must be distinguished from the practice of medicine. Other than within a closed, dogmatic science, the question of how to mediate theory and practice will now remain pressing. The concept of 'application' was designed to express the manner of this mediation. Rational practice results from the application of theoretical knowledge to the individual cases of practice.

The balance between the theoretical and the practical, which had characterized the Aristotelian tradition, is thereby disturbed. In general, the assumption of the practical disciplines' independence is gradually given up. This can be seen in the example of ancient political science [13]. The ancient practical disciplines, like medicine or politics, were oriented around the model of a closed, dogmatic science. After this model was replaced by the model of an open, progressing science, it was necessary for the old practical disciplines to redefine their position. The turn of the nineteenth century introduces an early peak of methodological reflection in the history of medicine.

In the course of further developments in medical thought, science and art increasingly contrast with each other. The question as to whether medicine should be seen as a science or as an art becomes pressing. J.W.H. Conradi responds to this question in 1828:

> Medicine is to be considered as a science (a science of healing, a science of drugs) insofar as it presents a mass of knowledge, traces this knowledge back to basic principles and derives it from them, insofar as it orders this knowledge and presents it in a systematic fashion. It is an art (an art of healing, an art of prescribing drugs), however, insofar as it consists in the capability of acting according to particular rules ([7], p. 8).

This distinction between knowledge and action is easily compatible with the Aristotelian distinction between universal and particular. Indeed, Selle, certainly the most important theoretician of medicine in the eighteenth century, complained that beginners are seldom given a proper concept of the difference between theoretical and practical medicine: "Understanding the particular is the essential object of practice . . . ; science always just deals with more or less universalized concepts. Understanding the particular remains the proper area of art and of immediate practice" ([24], p. 189). This is not attained by science. "The artistic insight for the particular can, after all, easily escape the learned and quick-witted doctor" ([24], p. 2; [25], p. 260).

In the context of modern science, this division of tasks between art and

science in medicine leads to yet another difficulty. This arises from an imbalance in the division that reveals itself when one compares the certainty attained, or at least pursued by science, to the much lower degree of certainty that the physician can claim when practicing his art on individual patients. As Zimmermann writes in his "Von der Erfahrung in der Arzneykunst":

> An art rests very often on mere probability when it does not have irrevocable rules for all cases, when it is impossible to follow a certain prescription in all cases, when one's mind, while not having sufficient instruction, must proceed as though it had, when one can make judgments only on the basis of very changeable conditions and merely approach the truth rather than reach it. Statesmanship, the art of war, and the art of medicine are of this nature ([28], p. 282).

The question as to the degree of certainty possible in medicine thus becomes a central theme of methodological discussion. A major participant in these discussions was Cabanis ([6], whose thought influenced Ayrer [2]). People had become aware of the fact that the application of knowledge in practice follows less strict rules than does the acquisition of the knowledge. But already, Selle held that this is only a matter of passing deficiency. He hoped that some day this deficiency would be eliminated and claimed that we "... in time and with future experience must expect the perfection and exultation of the art of medicine into a science" ([25], p. 240). For many eighteenth century philosophers of medicine, the ideal state of affairs would be one in which the art of medicine will have been reduced to a medical science. The naive optimism of believing that this ideal might one day be realized was supported again and again. Nevertheless, developments in the nineteenth century are characterized by a rapidly increasing disproportionality between, on the one hand, the progress of research into the foundations of medicine, and on the other hand, the practice of medicine. The rapidly growing theoretical knowledge found at first only partial application in medical treatment. So-called "therapeutic nihilism" characterized a situation in which medical science and the art of medicine came to occupy an ever more antithetic and polemic relationship.

In 1879, Billroth makes a timid attempt to rehabilitate the art of medicine *vis-à-vis* medical science. Interestingly enough, this happens in a book bearing the title, *On Teaching and Learning Medical Science* [3]. The concept of the 'art of medicine' designates for Billroth that part of medicine which does not include abstract knowledge or a knowledge transmitted in writing, but rather a skill that is always bound up with the person of the individual physician. In addition, it is conveyed only through direct communication between teacher and student, between master and apprentice. Billroth

recognizes that the prevailing opinion of his time considers this element of artfulness to be a flaw in medicine that has yet to be eliminated. "To render medical ability independent from personal tradition, to establish the art of medicine for all time so firmly in writing that it will be independent from the talent of individuals, and to transform it wholly into a science is the ideal goal of our current efforts" ([3], p. 4). Nevertheless, Billroth remains skeptical of such hopes. He believes that the concept of the 'art of medicine' designates an element of medicine that is fundamentally irreducible to the 'science of medicine'. As he puts it: "I doubt that this goal will ever be reached: it will at least not be reached by the art of medicine any sooner than the art of poetry dissolves into metrics, painting into color theory, or music into theory of harmony" ([3], p. 4). It is revealing that at this time the idea of art as limited to the realm of the aesthetic had become so current that the aesthetic arts provide the natural point of comparison for Billroth when he explains the concept of the 'art of medicine'. One must note, however, that the concept of the 'art of medicine' indicates nothing irrational for Billroth. On the contrary, Billroth holds that the art of medicine is concerned with a teachable and learnable discipline.

To be sure, the scientific nature of medicine was at this time never seriously doubted. The dispute solely revolved around the question of whether in the long run medicine would be able to reserve a certain area into which science could not intrude. The following often falsely quoted and usually misunderstood statement goes back to the clinician B. Naunyn: "Medicine will become a science or it will not be" ([19], p. 1348; [20], p. 3). Naunyn is usually cited as crowning evidence for an unbound scientification of medicine. One easily overlooks, however, the polemical point of his statement. It is directed toward permitting medical therapy to participate in scientific progress. Thus, the statement aims at overcoming 'therapeutic nihilism'. Naunyn challenges the view that therapy constitutes a realm of the art of medicine that cannot profit from scientific progress. He sees clearly that such an idea about therapy and the art of medicine represents *an asylum ignorantiae*. On the other hand, the scientification of medicine has a limit for him as well. "It will scarcely ever become a natural science, because every science places its boundaries around its capabilities: Medicine cannot accept such self-restriction, since it is too deeply involved with humanity" ([19], p. 1384).

Toward the end of the nineteenth century and with the sharpening of the polemical relationship between art and science, M. Mendelsohn published his *Ärztliche Kunst und medizinische Wissenschaft* [18]. To this little book we

owe the sharpening of the contrast between the physician and the medical professional, as it is still prevalent today.[1] For Mendelsohn, the situation of the medicine of his time is characterized by tension between the art of medicine and medical science.

> ... That medicine, practical medicine, the practice of the art of medicine finds itself now in a period of decline, of inner decline, we as doctors must confess ... [m]edicine is a science — this statement transmits itself like an eternal disease ... And yet, this statement is absolutely false, at least in its generalization ([18], p. 15).

After all, medical practice has science only as its basis. In itself, it is, however, not a science, but an art.

> For our profession the one constant factor in the flight of phenomena is the art of medicine, which, in independence from all variable outlooks and theories of science, has one goal and one task: to lead each patient back to health by all possible means, but not only by those of so-called 'exact science' which represents only a small fraction of the many available means ([18], p. 15).

In his writing, Mendelsohn's goal was primarily to challenge critically the medical education system of his time. In his view, this system of education focused too extensively on scientific theory; it produced no practical physicians but only medical scientists. Thus, he was concerned to ensure that the practical, individual, and patient-oriented side of medicine be given appropriate attention in the education of the physician. "In practicing his profession, the doctor must reckon with imponderables of which the world of exact science does not even dream" ([18], p. 16).

It is only a small step from this view to medical irrationalism. Here the art of medicine is first established in an opposing position to science that is perceived as inhumane. It is here not the art of medicine, but medical science that must retreat in the presence of is adversary. The orientation of the art of medicine towards aesthetic art (for the interpretation of which the concept of genius becomes important) leads to the ideal picture of the physician-artist [23]. Even though the physician-artist will apply the results of science whenever this cannot be avoided, he mainly orients his actions around points of view that reside outside of the sphere of scientific rationality. The true physician no longer excels on the basis of his possessing scientific knowledge, nor even so much of his controlling teachable and learnable techniques. Rather, he is marked by the grace of a talent for which those who have not been similarly blessed by fate will only strive in vain.

Erwin Liek represents medical irrationalism in its most stark form [17]. For him the scientification of medicine is synonymous with the destruction of

the soul of medicine. Thus, quite apart from teachable knowledge and skill, the personality of the physician is assigned the primary place in medicine. He even goes so far as to propose to the physician the role of a priest. Only the elect are called to this office: "One is either born a doctor or one is never a doctor. Benevolent gods laid gifts in his cradle, which can only be given, never sought after" ([17], p. 197). A more considerate representative of medical irrationalism is Diepgen, who restricts the role of the irrational. This realm coincides with that of the art of medicine and it should be secured and defended against every attack by science. "It concerns rightfully what is called intuition; that is, the insight which is gained through spiritual vision, an inner suggestion of the moment" ([9], p. 18). The trust that the patient places in the physician is founded on that irrational part of healing that belongs to the art.

The art of medicine as medical irrationalism is understood in such a way that it stands in contrast not only to all the sciences, including medical science, but also in contrast to everything teachable, learnable, and capable of being substantiated. In addition, the whole realm of proper medical routine and technique is excluded from the art of medicine. With irrationalism, the concept of the art of medicine appears disfigured almost to the point of caricature.

Having reviewed the history of these difficulties, let us now ask whether there are conditions under which one may still meaningfully employ the concept of the art of medicine today. The problems involved in this concept are more relevant today than ever because they concern questions as to the function and significance of science within the realm of medicine. We still remain interested in whether there are areas of medicine, particularly involving the actions of physicians, which cannot be sufficiently accounted for by science and research. Certainly, the products of scientific research are applied in clinical medicine, yet no program of basic research tells the doctor how he should deal with these data. The question concerning the art of medicine involves, after all, the question of how the hiatus between science and patient can be bridged by the physician's actions. In this context, the term "application" is generally favored. Yet, what can be sensibly intended by this term is a question that is more difficult to answer than at first appears.[2] Frequently, this word signifies only an *asylum ignorantiae*. But there is yet another problem: the physician is always destined or committed to action. He must also act even when the knowledge that he would like to apply and that could motivate and legitimize his action is not, or is not yet, available to him. And it is just such predisposing action not arising from medical science that is the

subject of my essay about the art of medicine. Thus, questions concerning the art of medicine involve considerations about the practical character of medicine. One is led to suspect that a theory of medicine is not reducible to a theory of science and the analysis of the theoretical disciplines underlying its knowledge ([27], pp. 5ff).

Let us examine this supposition with respect to three areas of medical practice in which the concept of "art" is currently used. A clearly legitimate use of the concept of the art of medicine is to be found where one speaks of the manual dexterity and ability of physicians. Such skills differ substantially from the knowledge and understanding of medical researchers. Of course, such skills can themselves be made the subject of scientific research aiming at generally acceptable principles. But even the precise knowledge of this kind of research relieves no physician of the trouble of learning and training the required skills. It is a truism that proficiency in the performance of manual tasks can never be replaced by any number of sound principles. Rather, one says of a physician that he possesses the art of medicine when he can carry out these tasks skillfully. As long as medicine exists, there will always be the point at which particular manual tasks must be skillfully undertaken. It is improbable that scientific research will ever be able to free the physician from this necessity. The respective state of scientific research has, however, a powerful influence on the way, the degree, and the choice of the tasks that physicians undertake. Thus, even though the necessity of manual tasks will not disappear from medicine, one can clearly recognize progress in medical research gradually rendering the problems that need to be solved by manual skills ever more trivial.

A second area where the art of medicine is opposed to the science of medicine concerns clinical judgment. To be sure, an adequate medical judgment about an individual patient is impossible without training in the medical sciences. The art of medicine is required in order to bridge the gap between the concrete condition of the individual patient and the universally valid laws and rules of medical science that as such do not reach the individual case. The question arises here as to whether medicine necessarily requires a specific medical art or whether we can conceive of a stage in the progress of the basic sciences that is sufficient for covering the individual as well so that a special art would be rendered superfluous.

In view of this latter question, let us examine the structure of the laws and rules of medical science employed by physicians. Reduced to their simplest form, they have the shape of ordinary universal statements: $(x)\ (Kx \rightarrow Sx)$. This means: for any individual x, if x has the disease K, then x displays the

symptom or symptom-complex S. This is the basic form of the laws underlying the diagnostic process. The basic form of the laws underlying therapeutic actions looks very similar: $(x)\ (Kx \rightarrow Tx)$. This means: for any x, if x has the disease K, then the therapeutic measure T is indicated for x. It must not be overlooked that here we are dealing with only the most simple form of this kind of rule. In this formulation we have neglected the probabilistic character of most valid laws of biology as well as all the possibilities for variation arising from the individual constitution and situation of each patient.

The diagnostic endeavor proceeds in such a way that for the particular objective or subjective symptoms and signs in a given case, a suitable disease K is sought which is characterized by a symptom-complex S containing the symptoms and signs that one already knows. In extreme cases, one must work through all of the known disease entities that fulfill the required conditions. Then it requires a so-called differential diagnosis to discover further symptoms so that finally only one disease entity remains that satisfies the conditions. In practice, however, this goal may not be reached in this fashion. On the other hand, the therapeutic process may appear simpler. If the physician knows that a particular disease is present, this knowledge leads to a particular course of action that must at most be modified by his knowledge of the patient's constitutional an individual constants. The difference in logical procedures provides an epistemological explanation for the fact that the diagnostic task is usually more troublesome than the choice of therapeutic measures. Many of the difficulties facing the physician as well as the medical scientist are connected with the fact that in our system of medical concepts, rules, and insights, there is not always a clearly defined chain of implications that leads directly from symptoms to therapy.

In each of the diagnostic or therapeutic rules made available by medical science, at least two concepts are joined with each other. The individual patient does not occur, however, in such rules. They contain no individual names, but rather only bound individual variables. But the doctor always deals with individual patients whom he must diagnose and treat. Thus, he must employ statements containing individual names when he wishes to describe and justify his actions. To be sure, one can individualize the general rules. That is, one must go from statements containing bound individual variables to the statements with individual names which they imply. But even then, one is not dealing with simple statements about individuals, but only with conditionals. The physician who wishes to describe and justify his actions requires, however, only simple statements. Even when advancing and documenting a finding, he makes use of this kind of simple statement.

Medical science can facilitate this task considerably for the doctor. It gives the physician orientations for action and helps in decision-making: it can help him substantiate each of his judgments. However, the knowledge of ever so many general rules and laws can never relieve the physician of the task of diagnostically evaluating each individual patient from — as it were — top to bottom.

To work with the diagnostic and therapeutic rules of medical science, the physician needs as a starting point simple statements about individuals that can themselves not be further derived. Henceforth, I will call these statements, which can be based either on subjective symptoms or on objective signs, *basic statements*. Their reference to the respective individual patient is evident from their very foundation. A further analysis of their meaning reveals that such statements refer to individuality in yet another sense: they reflect the views of an individual physician that are in addition related to a particular point in time. The production of such statements in the process of elaborating findings and taking a history appears to be a remnant of the art of medicine that can never be taken over by the universal rules of the sciences.

Here we are concerned with a problem that is traditionally known as the "subsumption problem of the power of judgment". This problem has to do with the circumstances under which we can subsume an individual thing or event under a concept. The request that we should let our judgment depend on the presence or absence of the characteristic corresponding to the concept hardly helps us further because whether a certain individual does in fact exhibit a particular characteristic is often disputed. One will always reach a point at which one can only appeal to the evidence of experience or of the power of judgment when rendering a particular diagnosis. For this reason, we require that the physician have practical training in addition to a theoretical scientific education. Even the well-prepared physician will encounter situations in which he requires not so much information about the state of medical science, but rather the judgment and advice of experienced colleagues. The art of medicine is in this sense a result of experience: experience underlies the very possibility of applying the universal rules of science to the care of the individual patient.

The concept of 'experience' is indeed ambiguous. Medical experience differs not only in content but also in form from experience obtained in the experimental sciences. The experimental sciences are concerned with supporting or rejecting general laws. The data of experience that contribute to this process are ideally simple, verifiable, and repeatable. In contrast, medical experience does not aim at general principles; it manifests itself in the physi-

cian's ability to evaluate correctly difficult and problematic individual facts and events. It is such experience that enables the physician to frame appropriate basic statements. It correlates with a disposition that is closely bound to the person of the physician. It cannot be separated from that person and transmitted directly. Thus we have arrived at quite another point of difference from experience gained within the experimental sciences. In the experimental sciences the result is abstract knowledge, not knowledge bound to a particular person. Experience in the experimental sciences can be recorded in writing and transmitted in that form. When acquiring this kind of experience, one may continue working from the point at which another leaves off. One is not forced to start over at the very beginning as one is when acquiring medical experience.

Nevertheless, medical experience is not inscrutably irrational. Its acquisition can be taught and learned through training. Such training takes time that cannot be substantially reduced. Still, we may observe that in the course of medicine's development, the area reserved for the art of medicine and understood on the basis of a specifically medical experience has been decreasing. This becomes clear if we subsume the various concepts found in the basic statements under various types of concepts, such as classificatory, comparative, and metrical. With classificatory concepts, the subsumption problem presents itself in its purest form. Medicine works with such concepts, for instance, when it deals with evaluating an exanthema, the results of auscultation, or a histological preparation, because these concepts are indispensable when one is concerned with morphological observations and methods. Here one is dealing with simple alternatives, such as yes/no decisions about whether an individual condition may be subsumed under a particular concept.

Leaving aside comparative concepts (as in evaluating the seriousness of coronary insufficiency), I will proceed to consider metrical concepts. Their use allows one to assign particular numerical values to objects under study. It must, of course, be established from the very start what kind of magnitude is to be measured in particular cases. Thus, the concern here is not whether certain objects are found to be present, as in the case of alternative classificatory decisions. Rather, it is the magnitude of a certain blood chemistry level (the existence of which is presupposed) that must be investigated in a certain patient.

Everyone knows that the development of medicine is characterized by metrical concepts taking precedence over classificatory ones. This has resulted in a replacement of morphological by functional analysis. Despite all declarations to the contrary, the modern physician has greater confidence in an exact

laboratory value than in a classification gained through clinical bedside investigation. This shift of emphasis in the evaluation of clinical basic data is at least equally characteristic of medicine's scientification as is the progress of research in theoretical medicine.

For our present subject, it is important that this scientification of medicine occurs at the expense of the decreased significance of the 'medical art'. To be sure, the significance of individual basic statements that are themselves irreducible will not disappear as long as medicine continues to deal with and act on individual patients. However, one cannot determine *a priori* what kinds of statements these basic statements belong to. After all, the tendency in the development of medicine to replace classificatory concepts by metrical ones has rendered the problem of how to attain medical basic statements ever more trivial. The fixing of a numerical value on the basis of proper experimental and technical methods does not require the sort of experience that is indispensable for qualitative classification. In addition, the employment of metrical concepts brings with it more reliable results. Different diagnosticians can expect a higher likelihood of observer agreement. Thus it is no accident that basic statements employing metrical concepts are usually no longer acquired by the physician himself, but by his staff.

To be sure, this obvious trivialization of the "medical art" of evaluating individual cases is at present still limited. Nobody can predict with certainty whether in the future all basic statements will be gained in ways comparable to those of present-day clinical chemistry. For the moment, we are very far from this goal. Especially when taking a patient's history, classificatory concepts prevail, quite regardless of the introduction of questionnaires. The process of taking a history is thus still a refuge for the art of medicine. Nevertheless, we cannot be sure whether this state of affairs will not be altered one day by the introduction of ever more technical means of investigation.

On the other hand, one must not overlook the fact that a new kind of medical experience accompanies this development. I mean here an experience and an art of the sort needed when one wishes to apply prudently the new forms of technological and methodological assistance. It is the sort of experience that is required in deciding which measurements should be taken in any individual case and in evaluating the data obtained.

Thus a new field of action for the art of medicine has opened up. The issue is here not how to gain basic statements, but how adequately to interpret the information contained in them and how to utilize it in medical action. Neither the interpretation nor the utilization is sufficiently determined by the diagnos-

tic or therapeutic rules medical science provides. After all, practicing physicians rarely, if ever, possess enough information about their patients' condition to render the application of such rules a simple matter. To be sure, progress in medical science has opened up the possibility of obtaining even greater quantities of verifiable data together with an increased understanding of their connections with one another. However, in comparison with these possibilities, the amount of data one actually obtains and uses becomes even smaller. The reasons are generally known: they range from the ethical to the economical. While medical progress has generally increased the amount of data actually used by the practicing physician as well as that of data potentially available, the quotient between both has beome even smaller. Up to the middle of the last century a physician could presume that all medically relevant data pertaining to each patient were really available to him. By contrast, today he is faced with the question of which information must, should, or may be sought in each particular case.

There is yet another aspect to the condition of insufficient knowledge: Even if a physician would want to, and was economically and ethically able to realize the potential of the theoretically available data, he would lack the time required for such a task. In this sense, not just the progress of medical science, but even more so this constraint is responsible for the irremediably insufficient information on the basis of which the physician must act. Thus, whenever one must act under conditions of insufficient information and scarcity of time, it, appears as though the art of medicine could claim a position of its own vis-à-vis medical science. Such conditions are more prevalent among general practitioners than among specialists.

In view of these conditions, an appeal is often made to the role played by intuition in medicine. Such appeals are favored wherever compensation must be made for a vexing lack of information. Yet some caution is in order. The concept of intuition is notoriously ambiguous and very likely covers up unclarities of thought. To be sure, no one denies that there are ways of gaining and utilizing information that remain below the threshold of consciousness. This is what is usually meant when one speaks of intuition in medicine. So long as one remains critical of the conclusions arrived at by the intuitive process, and as long as one resists the temptation of appealing to supposed undeniable evidence, nothing can be brought to bear against the claim that intuition plays an important role in medicine.

But even then the situation of having to act under conditions of insufficient information will not in the long run support the view that medicine remains in part an art. In the search for rational orientation when acting, given any

amount of available information, medical science offers "normative decision theory" to replace the opaque notion of intuition.[3] Normative decision theory presents the physician and others with a formal instrument determining in individual cases, and under conditions of insufficient information, the probabilities of diagnostic alternatives as well as the values for risk assignment and risk assessment for particular treatment options. The usefulness of this instrument in medicine derives not only from its ability to make up for any actual lack of relevant information, but also from the fact that almost all laws discovered by medical science are statistical laws. This is reason enough for physicians' inability to guarantee the success of their measures. Thus in two ways physicians have to make their decisions under a risk in a sense relevant for decision theory. Normative decision theory presents a formal device for optimizing medical interventions in the face of such risks.

Does this mean, then, that this device can replace the art of medicine with sophisticated, accurate, and efficient calculations? Perhaps in the far distant future it may, but at present medical theoreticians and practitioners have much work to accomplish. To begin with, most areas of medicine have not been analyzed in terms of sufficiently reliable statistical laws. But even if medical science will have solved this problem one day, a difficulty of quite a different kind will remain. After all, each probability value must refer back to a scale that allows one to determine unambiguously the probable utility achievable through each possible action. Such kinds of utility scales have successfully been devised in the area in which normative decision theory was first used, namely, in games of chance and betting. Even in economics, this may work without problems. Devising utility scales in the diverse areas of medicine presupposes, however, a general consensus concerning how to solve the basic issues in medical ethics. The achievement of such a consensus presents a new set of difficulties. I cannot go into this matter here. But it becomes clear that decision theory has so far been utilized in medicine only for very small, circumscribed issues.

In conclusion, I have argued that the concept of art in contemporary medicine accounts for the fact that medicine cannot be reduced to the theoretical science of medicine. Art refers to the actions of the physician who is assigned the responsibility of performing manual tasks and of making decisions regarding patients in particular situations on the basis of limited information and within temporary contraints. This state of affairs uniquely structures the practical and personal relationship between physician and patient and is older than any application of science in medicine.

With the increasing scientification of medicine, this relationship has been

considerably modified. It has to a large extent been pushed aside by anonymous, institutional ways of health administration — a tendency that will without doubt continue. Will patients in the long run accept their being deprived of a personal physician? Or will they force a change? If we consider the general tendency of modern society toward depersonalization, the former cannot be excluded. But this is a different problem.

What I hope to have made clear is that a medicine without art would be a medicine without a physician. This should be kept in mind by those who choose to claim that medicine is other than a science.

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NOTES

[1] Mendelsohn's work is notable for the distinction it draws between doctor (*Arzt*) and medical man (*Mediziner*). The distinction is still made in the German language.
[2] See Feinstein for a critique of the concept 'application' ([10], pp. 27–28) and for a discussion of the physician's 'art' ([10], pp. 14ff, 37ff, 291ff).
[3] For a discussion of the foundation of normative decision theory, see Stegmüller [26]; for a consideration of its application in medicine, see Gross [12].

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Goals of Medicine

9

Thomas Schramme

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Abstract

This chapter discusses different philosophical theories regarding the goals of medicine and places this debate within the context of the moral limits of the proper use of medical means. Two approaches are distinguished: first, a teleological approach, which sees medicine as a practice with an inherent telos and second, a consensual approach, which aims at assembling a list of goals of medicine that are identified in a deliberative process. This chapter also discusses the concept of medicine and scrutinizes whether it has any bearing on the debate regarding the goals of medicine. It is argued that the goals of medicine are still contested and will probably remain so. They cannot be used in a direct way to solve normative questions regarding the proper use of medicine.

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T. Schramme, S. Edwards (eds.), *Handbook of the Philosophy of Medicine*,
DOI 10.1007/978-94-017-8688-1_5

Introduction

Medicine is both a theoretical and a practical endeavor. Occasionally, medicine is referred to as a science and an art. Considered as a practical endeavor, or art, medicine apparently aims at particular goals, briefly the treatment of disease and restoration of health. In addition, medicine has become a service institution in many countries. Medical means are used for ends other than just treatment of disease or restoration of health. Enhancements of specific desired features, improvements of fitness, and so on, as well as treatment of non-pathological conditions, such as short stature or normal deterioration of performance due to aging, have become targets of medical intervention. For some philosophers of medicine, but also for many practitioners and citizens, this expansion of the remit of medicine is a worrying development, sometimes called medicalization. The term is usually used with a negative connotation and refers to an undesirable use of medical means to tackle social and individual problems or desires. Medicalization may even involve an usurpation of traditional ways of solving problems in living, for instance, when people experiencing unbearable working conditions take antidepressants instead of challenging their environment. On the other hand, medicine does not seem to have an imbedded scope of proper use, which would speak against, or even disallow, its employment for other than individual diseases.

Some philosophers of medicine have criticized medicalization and the use of medical means for aiming at desired conditions by arguing that medicine has particular intrinsic goals, which restrict the proper use of medical means to the pursuit of these goals (Pellegrino 2001; cf. Arras 2001; Veatch 2001). According to such a view, the goals of medicine, such as treatment of disease and relief of suffering, are intrinsic goals insofar as they are implied by the practice itself. This is partly a traditional argumentation, going back as far as ancient philosophical ideas about actions and practices. Every action seems to aim at a goal; otherwise, we would perhaps not even call it an action. Practices are iterated actions and also seem goal oriented. They have, in philosophical terms, a telos, or a telic structure. For the argument about the goals of medicine, this general idea is important, as it paves the ground for assuming particular goals of the practice of medicine. It is more difficult, though, to establish these goals as intrinsic to the practice of medicine itself. Such reasoning seems to rely on an assumption of a particular nature or essence of medicine.

A prominent philosopher of medicine, who has argued the case for intrinsic goals of medicine, is Edmund Pellegrino. Alternatively, a task force at the Hastings Center, which is a leading bioethics academic institution, published a report in 1996 and determined such goals of medicine in a process of identifying an international consensus. Although there might not be huge differences in terms of the mentioned goals of medicine between a teleological and a consensual approach – prevention of disease and avoidance of premature death were indeed items on the Hastings Center list – there are notable methodological differences. A consensual approach allows for the goals of medicine to change historically and socially, whereas a teleological approach aims at a universal and nonrelative determination of the proper goals of

medicine. In the following, a closer analysis of these two approaches will be pursued.

The Concept of Medicine

Discussion of the goals of medicine relies on a particular conception of medicine. But it is not quite clear what medicine encompasses or how to define the nature of medicine (Pellegrino and Thomasma 1981; Nordenfelt 1998). At the beginning of this chapter, it was stated that medicine is considered to be a science and an art. In other words, medicine has a theoretical part, which has mostly to do with gaining knowledge about the functions and dysfunctions of the organism. Medicine, understood as an art, is the application of such knowledge in specific contexts, such as diagnosis, treatment, or prognosis. So the extension of the concept of medicine seems to be fairly broad, as many scientific endeavors and also quite a few practices seem to be aspects of medicine. In addition, there are other terms, which are occasionally used synonymously with the concept of medicine, such as "health care." Health care includes practices such as nursing or rehabilitation. Finally, there is the discipline of public health which includes practices that aim at the health of the population. It uses the science of epidemiology, and different practical means, such as information or health education, policies, or the intentional shaping of the circumstances of people's choices. One might wonder whether public health is part of medicine or whether it has a broader remit. In any event, it seems that there are indeed many practices that aim at health and the prevention of disease, including medicine, health care, and public health. Even if some of these practices are not to be counted as medicine proper, it seems obvious that the goals of aiming at health and preventing disease are not restricted to medicine. So there is a problem for determining the concept of medicine by reference to its alleged goals (Nordin 1999). "Medicine" does not have clear-cut boundaries, and it is impossible to conceptually separate medicine from other practices by referring to its alleged goals, because these goals are shared with several other disciplines.

Another way to discuss the goals of medicine in relation to the concept of medicine might be to focus on the means of the practice. It might be said, for instance, that public health, in contrast to medicine properly conceived, uses political and pedagogical means, whereas medicine uses certain skills of doctors, communication, and diagnostic tools. In general, one might want to restrict medicine to the clinical encounter between a patient and a doctor (Cassell 1991). The goals of medicine, according to this point of view, are identical to the goals of treatment or care (Marcum 2008; Kaldjian 2014). As will be seen, especially the philosophical approach that aims at extracting goals of medicine from its practice, or rather application, is prone to such a view. Yet, again, it is not clear why the concept of medicine should be restricted to the clinical encounter. At least historically, there have been examples of other conceptualizations. For instance, Galen defined medicine by its aspect of gaining knowledge about the organism. There were also attempts to explicitly exclude any therapeutic intervention from medicine, as it

was deemed to do more harm than nonintervention (Temkin 1966). Accordingly, the group of people called "medical nihilists" by the historian Owsei Temkin, saw medicine as essentially including science. Medicine therefore was not the exclusive domain of physicians.

Altogether, the discussion of this section undermines a straightforward definition of the concept of medicine. Since the nature of medicine is hence underdetermined, it cannot simply be assumed that medicine is a specific discipline or practice with clear-cut goals.

A Teleological Approach

One way to determine goals of medicine is by interpreting it as a practice, which is structured by aiming in a certain direction. This is a traditional idea that goes back at least to ancient philosophy. It has followers especially in modern virtue theory. Here, the aims of practices also specify certain excellences or virtues. It should be noted that the concept of practice here refers quite generally to types of actions, not necessarily to the use of tools or something similar. Gaining knowledge in a scientific endeavor can be a practice, according to this understanding. In a teleological approach, the telos, or end, of a practice determines the good it aims at. Virtues are accordingly the excellent ways to perform such practices. When discussing the goals of medicine, such an account requires some idea of the specific goods which medicine aims at. An obvious goal of medicine is health.

A well-known defender of such a teleological account of the goals of medicine is Edmund Pellegrino. He claims: "[W]e must assert the obvious: medicine exists because humans become sick. It is an activity conceived to attain the overall end of coping with the individual and social experience of disordered health. Its end is to heal, help, care and cure, to prevent illness, and cultivate health" (Pellegrino 1999, p. 62).

It should be noted that Pellegrino allows for some level of change in using medicine for specific social purposes. Yet these purposes always need to be linked to the inherent ends of medicine (Pellegrino 1999, p. 65 f.). Hence there is no scope for taking medicine outside its proper remit, which is intrinsically set. The ends of medicine are determined by the practice of medicine, and these ends are essentially focused on sick patients.

Similarly, Leon Kass also maintains that there are proper goals of medicine. These set the norm as to how medical means are properly used. "I am rather inclined to the old-fashioned view that health – or if you prefer, the healthy human being – is the end of the physician's art. That health is *a* goal of medicine few would deny. The trouble is, so I am told, that health is not the only possible and reasonable goal of medicine, since there are other prizes for which medical technique can be put in harness. Yet I regard these other goals – even where I accept their goodness as goals – as false goals for medicine, and their pursuit as perversions of the art" (Kass 1985, p. 159).

As has been discussed earlier, it is not quite obvious that Pellegrino and Kass can make good their claim regarding proper goals of medicine. It is not even clear how exactly to draw the boundaries of the practice called medicine. In addition one might wonder in what way the specific goals of medicine and with it the assumption of a teleological structure of the practice can be philosophically justified, especially given historical variations.

As has been explained in the introduction of this chapter, reference to the alleged goals of medicine can often be found in contexts where certain contested ways of using medical means are being discussed. However, it does not seem easy, and perhaps impossible, to circumvent the normative debate about the proper use of medical means by a philosophical account of the proper goals of medicine. Indeed, it might not even be altogether obvious that within Pellegrino's approach all real developments in modern societies that can be summarized under the label of medicalization would be identified as improper uses of medical means. After all, the cultivation of health, for instance, might be understood as to imply an increasing societal demand for fitness and capacity to perform, which, again, could well be fostered by medical means. Yet it is clear that Pellegrino and Kass see their approach as a bulwark against modern developments of using medical means for purposes, which are alien to medicine proper according to their point of view. Still, despite the debatable real-life repercussions of such a teleological approach, there is a need for discussing the philosophical virtues and vices of their methodology. The general philosophical issue is whether practices really have intrinsic goals. Although some critical considerations have been raised in this chapter, this methodological discussion has not reached a final decision. Hence a teleological approach regarding the goals of medicine can still be defended.

A Consensual Approach

A less metaphysically charged approach was put forward by a group of scholars that discussed the goals of medicine at the Hastings Center. Here the idea was to use philosophical argument and empirical evidence to assemble a list of plausible goals of medicine, without assuming that it collects the only proper items of such a list. The methodology of such an approach can be called consensual, as it aims at an international consensus regarding the goals of medicine. Such a consensus requires deliberation and exchange of philosophical argument.

The group drafted the following list of four core goals of medicine (Hastings Center 1996, Executive Summary):

- The prevention of disease and injury and promotion and maintenance of health
- The relief of pain and suffering caused by maladies
- The care and cure of those with a malady and the care of those who cannot be cured
- The avoidance of premature death and the pursuit of a peaceful death

These goals are obviously not too different from the ones put forward by the defenders of the teleological approach. One pertinent difference, though, might be implied by the final goal of avoidance of premature death. Depending on what exactly is meant by "premature" death, there might be medical interventions, which Pellegrino and Kass would probably not see within the remit of medicine proper, for instance, the treatment of biologically normal deteriorations of fitness. In other words, the goal of avoiding premature death might justify enhancements – as opposed to treatment of disease.

Methodologically, the Hastings Center group seems to allow for revisions of their list, should there be considerable changes in social value judgments. After all, they assert "crucial points of contact between medical goals and social goals" (ibid., p. S6). Hence it is not quite clear as to how the setting of goals can establish an independent norm of the proper use of medicine when using the methodology of consensus. Even what many of us today regard as an instance of medicalization might change its status if the viewpoints within society change accordingly. To be sure, reasonable exchange would still be needed within such methodology, not just a majority vote or the like. But be that as it may, it seems that the key issues would still be found in the normative debate. There would be no external standard of the proper use of medical means, set by particular goals. This is to be expected within a consensual approach. It necessarily involves an element of conventionalism.

Alternative lists of goals of medicine have been proposed in the relevant literature (Miller and Brody 1998; Brülde 2001; Boorse 2016). These are fairly similar to the mentioned list, though they include additional aspects such as the improvement of healthy conditions in the environment, i.e., tackling the social determinants of health and reassuring the "worried well." Still, such similarity suggests a widespread convergence in normative assessments of the point of medicine and its remit – at least within a certain shared cultural background and at a particular point in time. It seems adequate to expect an ongoing debate about the goals of medicine in philosophy of medicine. This is at least partly due to the continuing dispute regarding the moral limits of the use of medical means to treat undesired ailments and to enhance desired conditions.

Conclusion

The main target of the debate on the goals of medicine has been to establish normative conclusions about the moral limits of the use of medicine for individual or social purposes. It has been claimed that the proper goals of medicine exclude certain medical practices, for instance, enhancements of fitness, the pursuit of aesthetic goals, the use of medicine in hastening death, or other contested aims. It has been shown in this chapter, however, that it is neither methodologically nor substantively straightforward that such a conclusion can be reached via an exploration of the goals of medicine. The debate on such goals is philosophically significant in its own right, but it is doubtful that the ethical issues can be solved on its basis.

Definition of Key Terms

Medicine	For the purposes of this chapter, medicine is understood both as a science and an art. It is a practice that contains numerous means in relation to the advancement of health. An exact definition of the concept of medicine is not forthcoming.
Medicalization	The use of medical means for improper purposes.
Teleology	An attempt to explain features or things by reference to purposes or goals.
Consensus	An attempt to find a coherent solution by means of deliberation in a group.

Summary Points

- The debate on the goals of medicine is usually concerned with the proper scope of medicine.
- A debate on the concept of medicine, and hence on its nature, might provide for a list of the goals of medicine.
- However, the concept of medicine has contested boundaries.
- Some scholars assume medicine to have a teleological structure and hence to aim at specific goals.
- Others have attempted to draft a list of the goals of medicine in a consensual approach.
- The philosophical debate on the goals of medicine is unlikely to disappear.
- An account of the goals of medicine will probably not solve the normative debate on the proper moral limits of the use of medicine.

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منابع کمکی

25

On the Nature of Medicine

25.0 Introduction

The quality of medical practice, research, and education depends considerably on the image medical professionals, researchers, and teachers have of their discipline because that image determines the modes of their professional, scientific, and educational conduct. This image refers to what they usually term 'the nature of medicine'. Accordingly, the nature of medicine is often a central theme in metamedical discussions about the question "what is medicine?". Is it a natural science? Is it an applied science? Is it an A or a B or a C or ...? The preceding chapters revealed many new and interesting features of medicine, casting a new light on that question.

We outlined on pages 115–117 that due to the polysemy of the particles "what" and "is", a what-is-X question such as "what is medicine?" is usually misunderstood. It gives the impression that an answer to it in the form of "X is_a P", e.g., "medicine is_a practical science", provides a *definition* of X as if X were nothing else than P. However, the particle *"is_a"* in an answer of the form "medicine is_a practical science" is a descriptive, taxonomic subsumption predicate (see pages 72 and 74). It only characterizes X as having the feature P among its features such as "melanoma is_a skin disease" or "Einstein is_a physicist".

Every object has a practically infinite number of features, and thus, it *is_a* member of a practically infinite number of categories. For instance, Einstein is a human being; he is an amateur violinist; he is a Nobel Prize laureate; he was born in Ulm, Germany; he is married; he is a believer; he has a mistress; and so on. That is, Einstein is a member of the categories *A, B, C, D,* etc. That means that an answer to a what-is-X question never *defines X*. It only *describes X,* rightly or wrongly, adequately or inadequately.

What has just been said in general, also holds for medicine. Depending on what feature *A, B, C, D, ...* of medicine one is highlighting, one will assert that "medicine is an *A"* or "medicine is a *B"* or "medicine is a *C",* and so on such as, for example:

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K. Sadegh-Zadeh, *Handbook of Analytic Philosophy of Medicine*,
Philosophy and Medicine 119, DOI 10.1007/978-94-017-9579-1_25

medicine is a healing profession,
medicine is a biological science,
medicine is an art,
medicine is a moral enterprise,
medicine is a service business,
medicine is a social science,
medicine is a biophysical science,
medicine is a biochemical science,

etc. The proponents of such judgments are often in a permanent state of feud with one another because each of them believes that only she is right and the other ones err, although all of them are right. The odd belief that medicine may belong *to only one* class also brought with it the debate about the popular either-or question whether medicine is a science *or* an art. The question ignores that science and art are not mutually exclusive. Medicine might indeed be a science as well as an art. Most importantly, in order that the question "is *medicine* a *science* or an *art?*" can be taken seriously, the questioner ought to clearly specify what the three italicized terms mean. The latter term, "art", is one of the extremely vague, and thus semantically trivial, elements of our languages. Every human activity, including medicine, can be interpreted as an art. Therefore, such categorizations are uninformative. Regarding the term "science", there is as yet no acceptable concept of it to examine whether medicine is or is not a science. The third term, "medicine", similarly needs clarification. In the present chapter, we will inquire into such issues to understand what scientific, non-scientific, and extra-scientific features medicine may have. Our discussion consists of the following seven sections:

25.1 The Subject and Goal of Medicine
25.2 Is Medicine a Natural Science?
25.3 Is Medicine an Applied Science?
25.4 Does Medicine Belong to the Humanities?
25.5 Is Medicine a Practical Science?
25.6 Medicine is Practiced Morality as well as Ethics
25.7 Quo Vadis Medicina?

25.1 The Subject and Goal of Medicine

The first step in inquiring into the nature of medicine is to clarify its subject and goal. As pointed out above, however, in the effort to be clear about its subject and goal one must be aware of the vagueness of the term "medicine" itself. Many different activities fall under the purview of this term, making it difficult to form a judgment covering all of them. Examples with decreasing medical affiliation are: pediatrics, orthopedic surgery, bone research, muscle physiology, physiotherapy, cosmetic surgery, hygiene, water pollution research, cell research, blood research, virology, genetics, DNA research, protein research,

psychopathology, dream analysis, social psychiatry, and so on. Since many of these activities can also be conducted outside medicine, e.g., in biology and mineralogy, the question arises as to what kind of activity inherently does or does not belong to medicine. We shall not attempt to explicate the term "medicine" and delimit its scope here. However, we may recall what was emphasized several times in our earlier discussions:

Medicine is characterized by its subject and goal. Its subject is the *Homo patiens*. Its goal is to promote, protect, and restore health through the prevention of maladies in individuals and communities, curing sick people, and caring for sick people. To this end, medicine involves the investigation of the nature, genesis, diagnostics, therapy, and prevention of maladies. It has become common to distinguish between clinical medicine and non-clinical medicine in the following fashion:

- Clinical medicine deals with patients and patient-related issues. It encompasses diverse sub-fields from surgery to internal medicine to psychiatry to obstetrics to reconstructive orthopedics. They are concerned with diagnosing and treating patients' maladies. And their task is both *clinical practice* and *clinical research* (and education).
- Non-clinical or preclinical medicine does not deal with patients. It investigates the structures and functions of the body and body parts, and comprises many different disciplines such as anatomy, histology, cytology, physiology, neurophysiology, biochemistry, biophysics, and so on. Non-clinical medicine is concerned exclusively with research (and education).

In the landscape sketched above, it is difficult to determine where *medicine* begins and where it ends. For our purposes, then, we will understand by "medicine" primarily the core of medicine consisting of clinical practice and research, or *clinical medicine* for short. Issues in the periphery, not directly related to this core, i.e., non-clinical medicine, can be undertaken equally well in zoology, botany, chemistry, physics, etc. The disciplines concerned with these issues have come to be known as medical biosciences, biomedical sciences, or *biomedicine* for short. Biomedicine is by no means identical with medicine. Biomedical sciences are auxiliaries and do not necessarily belong to medicine proper. In our discussion of the nature of medicine below, we shall therefore clearly distinguish between these two areas, *clinical medicine* and *biomedicine*. We shall see that regarding their 'nature' they significantly differ from one another.

When someone argues that "medicine is_a *P*", for example, "medicine is an art" or "medicine is concerned with Homo patiens", it is important to know whether she uses the particle "is" (i) in a *descriptive* sense to say that real-world medicine has the property of being a *P*, or rather (ii) in a *prescriptive* sense to require that medicine has to be a *P*. A description can easily be falsified when it is wrong. However, many stubborn conflicts and fruitless debates arise from pseudo-descriptive utterances that are implicitly

intended to be prescriptive. In the present chapter, we shall be explicit about our judgments on the nature of medicine when we argue that "medicine is such and such". For instance, what was stated above about the subject and goal of medicine was meant in the prescriptive sense to say that "medicine has to concern itself with Homo patiens ... and so on". It must not concern itself with cells, proteins, DNA, and the like for their own sake.

25.2 Is Medicine a Natural Science?

Disciplines such as physics, chemistry, biology, and geology are referred to as *natural sciences* because they are concerned with nature, i.e., with natural phenomena, objects, and processes. The class of entities with which biomedical disciplines such as anatomy, physiology, and biochemistry are concerned also include natural entities such as organisms, cells, genes, and DNA. Hence, biomedicine may also be viewed as natural science. As we emphasized in the preceding section, however, biomedicine is not identical with medicine. Medicine proper is clinical medicine, the rest is zoology, botany, physics, and chemistry. By overlooking this fact one may erroneously judge that medicine is_a natural science ("is_a" in what sense: descriptive or prescriptive?).

From the descriptive point of view, the characterization of *medicine* as natural science is wrong for the following simple reason. The knowledge gained by natural-scientific investigations consists of declarative sentences, specifically, of constatives (see page 24), that describe nature, such as "most cells have a nucleus". It does not contain deontic sentences of the form "you ought to tell the truth" and the like. However, we saw previously that clinical-medical knowledge almost exclusively consists of deontic sentences, for example, "if you observe symptoms $A_1, \ldots, A_m$ in the patient, then you ought to do $B_1, \ldots, B_n$". Natural sciences merely describe how things are. Clinical-medical knowledge prescribes how the physician *ought to act*. Thus, clinical medicine is not a natural science. See Chapter 16 (p. 597 ff.).

Interpreted in a prescriptive sense, it would be meaningless to require that "medicine has to be a natural science". As shown in Chapter 15, maladies are not natural entities independent of human mind, intentions, and values. They are deontic constructs. On this account, the investigation into maladies and their etiology, diagnostics, and therapy is investigation into deontic constructs, and as such, cannot be natural-scientific research. More importantly, we shall see below that clinical-medical research inquires into the efficacy of diagnostic and therapeutic rules of action and evaluates them. They are deontic rules and represent complex human action rules to be followed in clinical settings by physicians and other care providers. The search for, and the evaluation of, human action rules is not natural-scientific research because action rules are not natural entities to be found 'in the world out there' (see Chapter 16). To be clear, even though medicine has natural-scientific sub-disciplines, i.e., biomedicine, clinical medicine as its core is not a natural science.

25.3 Is Medicine an Applied Science?

The commonly used term "applied science" is ambiguous. On the one hand, a scientific discipline such as archeology or mineralogy in which knowledge and methods from other disciplines are applied, is called an *applied science* or discipline. On the other hand, an applied science is understood as the application of some basic science, such as physics or chemistry, to solve practical problems. For example, an engineering science is considered an applied science in this sense. However, the latter meaning of the term is inappropriate. It is better captured by the concept of "practical science" that will be discussed below.

We often encounter the view which says that medicine is an applied science. Specifically, we are told that medicine is an *applied natural science* because natural-scientific knowledge and methods are applied to solve medical problems. For example, cardiological diagnostics and therapy employ chemical and physical knowledge to record and analyze cardiological parameters of the organism and to collect and interpret patient data. Nevertheless, medicine cannot be considered an applied natural science for the following reasons:

First, the knowledge and methods applied in medicine come not only from the natural sciences, but also from a wide variety of other disciplines, e.g., mathematics, psychology, sociology, history, engineering sciences, and others. Does the use of knowledge from such sources justify viewing medicine as applied mathematics, applied psychology, applied sociology, applied history, applied engineering, and so on? If it does not, what is it that justifies viewing medicine as applied *natural science?* Even the natural sciences themselves, e.g., physics and chemistry, extensively apply mathematics. Does this justify viewing physics and chemistry as applied mathematics? If it does, would the transitivity of the application relation:

A is applied B and B is applied C, therefore, A is applied C

not justify the strange view that medicine is applied mathematics? The idea of viewing some particular discipline as an applied science is based on the understanding that applied sciences are those fields in which some basic or foundational sciences are applied. Specifically, some logical empiricists have claimed that every empirical science can be reduced to physics, a doctrine known as physicalism. This doctrine, however, is false (see footnote 155 on page 786).

Second, supposing that a particular discipline were an applied natural science, we must then ask what this science is doing in *applying* natural-scientific knowledge or methods? It is of course not the mere application for its own sake. Nor is the research task of the discipline exhausted by the application of natural-scientific knowledge or methods. Generally there is something else to achieve thereby, for example, solving particular problems such as how to accurately diagnose myocardial infarction, AIDS, or another disease. *Such* problems, however, are genuinely practical ones. The pursuit of solutions for

practical problems in a discipline A such as cardiology by means of auxiliary knowledge from another discipline B such as physics does not render A an applied B. Discipline A still remains, as we shall see below, a practical discipline sui generis which, among other things, *also* uses knowledge from discipline B.

Third, as we have already mentioned and as will be shown below, clinical-medical research establishes diagnostic and therapeutic rules of action and evaluates them by comparative inquiries into their efficacy. As *deontic rules,* they cannot be the subject of natural sciences. The act of establishing or evaluating an action rule takes place in a system of human values that is something social and cultural, but not physical, chemical, or biological. It may supervene on the physical, chemical, and biological, but there is no identity between them.

25.4 Does Medicine Belong to the Humanities?

The humanities are concerned with the study of man's intellect, spirituality, works, culture, and history. Examples are language studies, literature, history, philosophy, and theology. There are scholars who argue that medicine belongs to the humanities. For instance, Edmund Pellegrino (1920–2013) says: "But medicine is equally well one of the humanities because its concerns are for all dimensions of the life of man which in any way impinge on his well-being" (Pellegrino, 2008, 326). Note, however, that along the same line of reasoning one could also maintain that medicine is chemistry, physics, psychology, mathematics, ornithology, ethnology, theology, and the like. It is obvious that we do not gain anything reasonable by such arbitrariness in dealing with the subsumption predicate *"is_a"* to categorize medicine according to our liking.

25.5 Is Medicine a Practical Science?

The answer to this question is a plain Yes. But it requires an explanation of its philosophical consequences. To this end, we shall distinguish between theoretical and practical sciences and shall demonstrate that medicine is an instance of both types of science. Our discussion divides into the following four parts:

25.5.1 Practical *vs.* Theoretical Sciences
25.5.2 Means-End Research
25.5.3 Clinical Research is a Practical Science
25.5.4 Relationships Between Biomedicine and Clinical Medicine.

25.5.1 Practical *vs.* Theoretical Sciences

Traditionally, scientific fields are divided into two categories, *theoretical* sciences and *practical* sciences. It is said, for example, that physics, chemistry,

biology, genetics, and similar disciplines are theoretical sciences, whereas pedagogy, surgery, gynecology, and pediatrics are practical disciplines. But there are two problems associated with this dichotomy. First, as pointed out on page 470, the contrasting pair "theoretical" and "practical" is ambiguous because the adjective "theoretical" in this pair has nothing to do with theories and theoretical terms as discussed in Section 10.4. Second, most people, including scientists, believe that a practical science is so called because practical scientists *practice something,* e.g., clinicians treat patients, whereas a theoretical science such as physics and chemistry is void of any practice. But this belief is wrong. First, theoretical scientists practice scientific research. And second, the practicality of a practical science does not refer to any kind of practice in that science. In line with our definition of the terms "theoretical knowledge" and "practical knowledge" on page 470 ff., a theoretical science is one that produces theoretical knowledge, whereas a practical science produces practical knowledge. This production of practical knowledge is accomplished by *means-end research* in order to find out optimal means of achieving an end.

25.5.2 Means-End Research

An *end,* or goal, is a condition that some agent may desire and intend to achieve. For instance, a physician's goal may be to achieve a correct diagnosis of a patient's token disease who is suffering from upper abdominal pain. The patient's recovery, which both she and her physician desire, is also a goal.

A *means* is not a tool, but a method, i.e., a more or less complex mode of action the performance of which may help someone achieve some goal. For instance, gastroscopy is a means of inspecting the cavity and mucous membrane of the stomach. Aspirin use is a means to reduce the risk of, and to prevent, myocardial infarction.

There may be no or a number of $n \geq 1$ means by each of which a goal may be attained. In the latter case, the means are said to be associated with the goals, or to point to them. For instance, gastroscopy is associated with the visualization of the cavity and mucous membrane of the stomach. Aspirin use is associated with reductions in the risk, and prevention, of myocardial infarction. Such an association between a means and an end has come to be termed a *means-end relation.* Means-end relations are *interventional-causal* relations between *actions* as interventions, and *goals.* That is, a means includes at least one action to bring about the associated end.

The set of distinct means that point to the same goal defines the *equifinality* set. And the set of distinct goals associated with a given means constitutes the *multifinality* set (Kruglanski et al., 2002). For instance, the set of different diagnostic measures which enable the diagnosis of Helicobacter gastritis yields an equifinality set, while the set of different goals that are attainable by aspirin use is a multifinality set, e.g., {alleviation of fever, pain relief, thrombosis prevention, reduction in the risk of myocardial infarction, ...}. With respect to the effectiveness of their means, there are three types of means-end relations:

1. those with sufficient means,
2. those with weakly sufficient means, and
3. those with necessary means.

A sufficient means is one that is always effective; a weakly sufficient means is one that is only sometimes, but not always, effective; and a necessary means is one without which the goal cannot be achieved. Thus, means-end relations of the type 1 and 3 are deterministic interventional-causal relations between means and ends, while those of the type 2 are probabilistic interventional-causal relations sketched in the following schemes in turn:

- $C \,\&\, A \rightarrow G$ reads: if under circumstances C action A is conducted, then goal G will be attained;
- $p(G \mid C \cap A) = r$ the probability of attaining goal G by conducting action A under circumstances C, is r.

Means-end research is the investigation into such means-end relationships in order to find or construct novel means of achieving a particular goal as well as to enhance their efficacy. A practical science is a *means-end research* field with the aim of optimizing certain means-end relationships. Thus, it constitutes a *science of practicing* or a science of praxis (see p. 121). Specifically, it inquires into purposeful human actions, their consequences, efficiency, and planning. A typical example is clinical research as will be shown in the next section.

25.5.3 Clinical Research is a Practical Science

On page 831 we distinguished between clinical medicine and biomedicine. Clinical medicine, referred to as the core of medicine, comprises clinical disciplines such as internal medicine, pediatrics, surgery, and others. Biomedicine includes the so-called medical biosciences such as anatomy, physiology, biochemistry, medical physics, and similar ones. They are auxiliaries to clinical medicine. We saw that they are best characterized as interventional-causal research fields insofar as they conduct experimental research (see page 465).

Clinical medicine, however, is something different. To explain, we need an additional differentiation. Clinical medicine unites two not sharply separable endeavors, i.e., clinical practice and clinical research. The former was extensively analyzed in Chapter 9 (pp. 293–398) and will be further discussed in Section 25.6.1 below (p. 843 f.). Therefore, we shall here be concerned with *clinical research* only.

By systematically inquiring into all clinical issues from suffering to disease to diagnostics to therapy and prevention, *clinical research* serves clinical practice to enhance its knowledge-base, efficiency, and quality. To put it concisely, clinical research is a science, not a practice, of optimal clinical decision-making. Because of the epistemological and metaphysical significance of this understanding, we will now carefully demonstrate that clinical research

represents a *practical science* par excellence. Our analyses will enable us to uncover how this peculiar practicality turns clinical medicine into both practiced morality and ethics.[160]

One will easily discern what type of science clinical research is, by considering the type of studies it undertakes and the type of knowledge it acquires thereby. To begin with the former point, clinical research may be categorized as a practical science for the following three reasons: (i) the central subject of its investigations is the *goal-driven praxis* (p. 121), i.e., goal-driven doing and acting, of physicians and other health personnel in diagnostic, therapeutic, and preventive contexts who are concerned with:

- the *construction* of methods of diagnostics, treatment, and prevention of a new malady, or
- the *improvement* of available methods of diagnostics, treatment, and prevention of a known malady;

(ii) its primary aim is to analyze *means-end relationships* in diagnostics, treatment, and prevention to find out the optimal strategies of clinical decision-making that enable more accurate diagnoses and more efficacious treatments and prevention than currently possible; and (iii) to establish clinical action rules that guide the goal-driven doing and acting of physicians and other health personnel. To accomplish these tasks requires (a) structured research group activities that take place in special, more or less complex social environments, e.g., in long-term departmental, national, or international collaborative studies of the diagnostics, treatment, and prevention of a malady such as myocardial infarction, AIDS, or leukemia; and (b) practical reasoning in contrast the theoretical reasoning in theoretical sciences, i.e., logic. See Section 26.3 on page 866.

To illustrate the ideas above, we shall extend the notion of a *conditional action sentence,* introduced in Definition 155 on page 583, to obtain the notion of a *conditional, goal-driven action sentence*. If C denotes some circumstances under which a goal G is pursued, then a statement of the form:

If condition C obtains and goal G is pursued, then action A is performed,

represents a *conditional, goal-driven action sentence.* It may conveniently be formalized as follows:

$$C \,\&\, G \rightarrow A. \tag{209}$$

A simple example is: If a patient complains of upper abdominal pain (condition C) and the physician wants to explore whether she has gastritis (desired

[160] The inspiration for my view of medicine as a practical science came indirectly from Wolfgang Wieland (1975, 1986). Likewise, the inspiration for my view of medicine as a moral enterprise came indirectly from Edmund Pellegrino and David Thomasma (1981) and Thomasma and Pellegrino (1981). In both cases, however, our concepts, methods, reasoning, and results are very different from one another.

goal G), then she performs gastroscopy (action A). Clinical-medical research consists in inquiring into conditional, goal-driven actions of the type (209) to analyze their effects, side-effects, efficacy, benefits, harms, and costs in order to identify what action is optimal under circumstances C to attain the desired goal G. For instance, when:

condition C	$\equiv$	the patient complains of upper abdominal pain,
desired goal G	$\equiv$	explore whether the patient has gastritis or peptic ulcer disease,
possible actions	$\equiv$	{gastroscopy, computed tomography, ^{13}C-urea breath test, ELISA} $= \{A_1, A_2, A_3, A_4\}$,

then by testing each of these possible four actions $A_1, \ldots, A_4$ in a sample of patients and comparing the results we may eventually obtain a statement of the form:

> IF a patient complains of upper abdominal pain AND you want to explore whether she has gastritis or peptic ulcer disease, THEN *the optimal action* is gastroscopy.

That is:

> A patient complains of upper abdominal pain $\wedge$ you want to explore whether she has gastritis or peptic ulcer disease $\rightarrow$ the optimal action is gastroscopy.

This is, according to Exportation and Importation Rules of deduction in Table 38 on page 965, classical-logically equivalent to:

> A patient complains of upper abdominal pain $\rightarrow$ (you want to explore whether she has gastritis or peptic ulcer disease $\rightarrow$ the optimal action is gastroscopy). (210)

That means in a generalized form:

> Condition C obtains $\rightarrow$ (goal G is desired $\rightarrow$ the optimal action is A),

or equivalently:

$$C \rightarrow \big(G \rightarrow \mathit{is_optimal}(A)\big), \tag{211}$$

where action A in the present example is one of the four alternative actions $\{A_1, A_2, A_3, A_4\}$ mentioned above, e.g., gastroscopy. Note that (211) is an empirical proposition, i.e., a *declarative statement* that reports on the result of a comparative action research. The emphasis is important. We shall see below that on the basis of empirical, *propositional knowledge* of the type (211) clinical action rules are advanced as *imperatives*.

Generalizing the above observation, a clinical research program may be reconstructed as a branching project such that under more or less complex

circumstances of the type $C \equiv C_1 \,\&\, \ldots \,\&\, C_h$ with $h \geq 1$, many possible goals $G_1, \ldots, G_n$ may come into consideration each of which, G_i, is attainable by performing any of the alternative actions $A_{i_1}, A_{i_2}, \ldots, A_{i_m}$ with $i, m \geq 1$:

$$C \rightarrow \begin{cases} G_1 \rightarrow \text{ possible actions are } A_{1_1}, A_{1_2}, \ldots, A_{1_k} \\ \vdots \\ G_n \rightarrow \text{ possible actions are } A_{n_1}, A_{n_2}, \ldots, A_{n_p} \end{cases} \tag{212}$$

with $i, k, n, p \geq 1$. For instance, there are patients complaining of upper abdominal pain. This is the condition, or circumstance, C. But there are many different causes of this type of suffering. How are we to track down which of these possible causes is, or has been, effective in a particular patient such as Elroy Fox who is complaining of upper abdominal pain? To this end, we need to know the optimal *methods* of diagnostics to be used in such a situation. The knowledge required for making this diagnostic decision is acquired in *prior clinical research*. Specifically, the clinical research under discussion concerns itself with clinical circumstances of the type:

- the patient complains of upper abdominal pain $\equiv$ C

where many different goals come into consideration, e.g., the goals to examine whether the patient has:

- gastritis or peptic ulcer disease $\equiv G_1$
- stomach carcinoma $\equiv G_2$
- gallstones $\equiv G_3$
- gallbladder inflammation $\equiv G_4$
- acute pancreatitis $\equiv G_5$
- liver cirrhosis $\equiv G_6$
- and so on,

while according to (212) each of these goals, G_i, is attainable by a number of $m \geq 1$ alternative diagnostic actions $A_{i_1}, A_{i_2}, \ldots, A_{i_m}$ with $1 \leq i \leq 6$. The aim of *clinical research* (not of single case diagnostics in the practice!) is to identify which one of these alternative actions is the optimal one to attain the corresponding goal G_i. The alternative actions are performed in different samples of patients, and their effects are evaluated according to particular, agreed-upon criteria. Depending on their respective values, the actions are ranked in the order of their preferability such that eventually we obtain a highest-ranked assertion of the type $C \rightarrow \big(G_i \rightarrow \mathit{is_optimal}(A_{i_j})\big)$ with $i, j \geq 1$. The statements (210–211) above are just such assertions without indices. On the basis of such final, empirical assertions a *conditional imperative* of the following form is advanced by research groups, medical communities, or even health authorities:

$$C \rightarrow (G \rightarrow \mathit{do}\ A). \tag{213}$$

An example is:

> IF a patient complains of upper abdominal pain, THEN (IF you want to explore whether she has gastritis or peptic ulcer disease, THEN do gastroscopy). (214)

Recall that (210–211) on page 838 are empirical statements and assert "what is the case". Thus, they have a truth value. By contrast, (214) is not a statement and does not assert anything. It is an imperative, specifically a *conditional action rule* of the form (213) that commands: "Under circumstances *C,* if goal *G* is desired, do *A!*". Therefore, it is not true or false, but more or less efficacious. That is, it has no truth value, it has an *efficacy value*. Let there be two competing conditional action rules of the form:

$$C \rightarrow (G \rightarrow do\ A),$$
$$C \rightarrow (G \rightarrow do\ B),$$

each of which recommends, under the same circumstances *C,* a different action to attain the same goal *G,* then they can be compared with each other with respect to their efficacy values so as to execute the one with the higher efficacy. That means that we choose a conditional action rule because of its efficacy value and not of its truth value. This is so simply because it has no truth value. The efficacy of a conditional action rule can be defined as follows:[161]

Regarding a conditional action rule $C \rightarrow (G \rightarrow do\ A)$, it may be asked in how many situations of the type C the goal G is attained by performing an action of the type A. And in how many situations of the same type C the same goal G is attained without doing anything? The difference between the two we call the efficacy value or *degree of efficacy* of the action rule $C \rightarrow (G \rightarrow do\ A)$. This idea may be conceptualized as follows by using the notion of probabilistic relevance introduced in Definition 65 on page 257.

The probability that under circumstances C the goal event G occurs if action A is performed, is expressed by sentence 1 below. The probability that under circumstances of the same type C a goal event of the same type G occurs if *no* action is performed at all, is expressed by sentence 2 below. The arithmetical difference $r_1 - r_2$ between both probabilities yields the degree of probabilistic relevance of action A to attaining goal G under circumstances of the type C. This degree of probabilistic relevance, expressed in sentence 3, we refer to in sentence 4 as the *degree of efficacy* of the conditional action rule $C \rightarrow (G \rightarrow do\ A)$, written $\mathit{eff}\big(C \rightarrow (G \rightarrow do\ A)\big)$:

1. $p(G \mid C \cap A) = r_1$
2. $p(G \mid C) = r_2$

[161] The inspiration for my ideas on the efficacy of what I have termed *conditional action rules* (Sadegh-Zadeh, 1978b) came from Mario Bunge's pragmatics (Bunge, 1967, 121–150). Bunge, however, uses another framework and approach that cannot be discussed here.

3. *probabilistic_relevance_of*$(A$ *to* G *under* $C) = r_1 - r_2$
4. *eff*$\big(C \to (G \to do\ A)\big)$ = *probabilistic_relevance_of*$(A$ *to* G *under* $C)$ $= r_1 - r_2$.

The degree of efficacy of a conditional action rule is a real number in the interval $[-1, 1]$, i.e., positive, zero, or negative. Only in the first case is action A efficacious. In the second case it is useless. And in the third case, it has a negative effect. Two or more different, equifinal action rules of the type:

$$\begin{aligned} &C \to (G \to do\ A_1), \\ &C \to (G \to do\ A_2), \\ &C \to (G \to do\ A_3), \\ &\text{and so on,} \end{aligned} \tag{215}$$

which under circumstances of the same type recommend different actions to attain the same goal, may be compared in terms of their efficacy values so as to determine the most efficacious, the best, one. By so doing, clinical research enhances the efficacy and quality of clinical practice. See also Sections 9.5.2 and 26.3.2 on pages 397 and 867, respectively.

More generally, a conditional action rule $C \to (G \to do\ A)$ may recommend an action A that consists in several alternative options, i.e., $A \equiv A_1 \vee A_2 \vee \ldots \vee A_q$ with $q \geq 1$, such that the physician is encouraged to choose among the alternatives $A_1, A_2, \ldots, A_q$ depending on which one of them is most appropriate in an individual situation. Thus, a single conditional clinical action rule advanced by clinical research assumes the following general structure:

$$C \to (G \to do\ A_1 \vee A_2 \vee \ldots \vee A_q) \tag{216}$$

which says: Under circumstances C do any of the actions $A_1 \vee A_2 \vee \ldots \vee A_q$ if goal G is desired. A quick look at our previous reconstruction (132) of *practical knowledge* on page 474 will demonstrate that the present conditional action rule (216) is exactly the basic form of that type of practical knowledge whose sentential constituents were represented as follows:

$$\begin{aligned} &\textit{If}\ \alpha_1 \wedge \ldots \wedge \alpha_k,\ \textit{then}\ \Big(\textit{if}\ \beta_1 \wedge \ldots \wedge \beta_m,\ \textit{then} \\ &\qquad\qquad do\ \big((\gamma_1 \wedge \ldots \wedge \gamma_n)_1 \vee \ldots \vee (\delta_1 \wedge \ldots \wedge \delta_p)_q\big)\Big) \end{aligned}$$

with $k, m, n, p, q \geq 1$ such that:

- $\alpha_1 \wedge \ldots \wedge \alpha_k$ are $k \geq 1$ sentences describing the condition C,
- $\beta_1 \wedge \ldots \wedge \beta_m$ are $m \geq 1$ sentences describing the goal G pursued,
- $(\gamma_1 \wedge \ldots \wedge \gamma_n)_1 \vee \ldots \vee (\delta_1 \wedge \ldots \wedge \delta_p)_q$ are sentences describing the recommended, alternative actions $A_1 \vee A_2 \vee \ldots \vee A_q$ with $(\gamma_1 \wedge \ldots \wedge \gamma_j)_i = A_i$ and $i, q \geq 1$.

Medicine is a practical science as it seeks and acquires practical knowledge of the form above through *clinical research*. That medicine turns out a practical science, has two interesting consequences that can easily be recognized on the basis of our reconstructions. Concisely put, it renders medicine practiced morality and ethics as well as an engineering science. These three issues will be discussed in Sections 25.6 and 25.7.1 below (pp. 843 and 846, respectively).

25.5.4 Relationships Between Biomedicine and Clinical Medicine

We saw that the subject of inquiry in clinical research primarily includes intentional, goal-driven human actions, action rules, and their efficacy. Intentions, goals, actions, action rules, and rule efficacies are not natural objects, phenomena, or processes. Rather, they are man-made, cultural artifacts, and human values. Hence, the categorization of clinical research as a natural science or as an applied natural science is incorrect (Sadegh-Zadeh, 1983).

A considerable amount of discourse in clinical research is concerned with analyzing, criticizing, reconstructing, and constructing different types of intentions, goals, and actions of health care professionals such as, for example, assistance in dying, xenotrasplantation, stem cell research and technology, therapeutic cloning, and others. In dealing with these and similar subjects, value systems and considerations are indispensable. The reasoning proceeds not causalistically, but consequentialistically and teleologically by asking questions of the following type: *What are the consequences of our conduct in this or that way and what is good for patients as human beings?* The same holds true for the relationships between the theoretical knowledge of biomedicine and the practical knowledge of clinical medicine. It is important to emphasize that the theoretical knowledge provided by biomedicine *does not imply* any clinical-conditional action rules. For example, when the following item of knowledge:

Streptomycin inhibits the growth of strains of tubercle bacilli (217)

is put forward by bacteriology as an experimental science, we cannot logically infer from this statement (217) a clinical-conditional action rule of the type:

If a patient suffers from lung tuberculosis, then (if you want to cure her, then administer streptomycin!). (218)

The reason is that there is no logic that allows for an inference from (217) to (218). Before streptomycin is tested on human subjects, we cannot know whether it will cure or kill. Empirical knowledge acquired by experimentation with micro-organisms does not imply *what we should do* in the human sphere. But it is capable of guiding our imaginations and value considerations and decisions. So, before we are able to advance the conditional action rule (218) for use in clinical practice, specific clinical research is needed to find out whether the following assertion of an optimal action can be justified:

If a patient suffers from lung tuberculosis, then (if you want to cure her, then the optimal action is administration of streptomycin). (219)

Only on the basis of such investigations and results can a conditional action rule of the form (218) be advanced, even though behind the transition from (219) to (218) lies no system of theoretical logic, but of *practical reasoning* discussed in Section 26.3 below (p. 866 ff.). It establishes value axioms of the type "An action A is to be preferred to an action B if it is better than B" based on the axiom "An action rule is to be preferred to another one if it is more efficacious than the latter". Thus, the advancement of the conditional imperative (218) is a practical value decision based on the medical-moral axioms of beneficence and non-maleficence (Sadegh-Zadeh, 1978b).

25.6 Medicine is Practiced Morality as well as Ethics

So far we have represented clinical action rules as conditional imperatives of the form $C \rightarrow (G \rightarrow do\ A_1 \vee A_2 \vee \ldots \vee A_q)$ with $q \geq 1$ (page 841). We will now go one step further to discern that they are in fact conditional ought-do-do rules, i.e., conditional obligations, of the structure $C \rightarrow \big(G \rightarrow OB(A_1 \vee A_2 \vee \ldots \vee A_q)\big)$ where the predicate *"OB"* is the deontic obligation operator "it is obligatory that" and replaces the imperative "do!". Thus, the social origin and authority of clinical action rules will be shown in the following two sections:

25.6.1 Clinical Practice is Practiced Morality
25.6.2 Clinical Research is Normative Ethics.

25.6.1 Clinical Practice is Practiced Morality

Malpractice suits demonstrate that there are clinical actions which violate the standards of clinical practice and thereby give rise to litigation. We discussed this issue on page 599. In the example given there, the failure of the physician to perform at least one of the following two alternative diagnostic actions prevented her from diagnosing the patient's lethal myocardial infarction:

a. record an ECG in the patient, or
b. determine the concentration of heart-relevant enzymes in her blood.

The physician's omission was interpreted as clinical malpractice. That a particular type of physician conduct counts as a violation of some standards of practice and thereby gives rise to a malpractice suit, is proof that those 'standards of practice' are obligatory doings and are thus based on deontic rules. More specifically, they are clinical ought-to-do rules of the form:

$$C \rightarrow \big(G \rightarrow OB(A_1 \vee A_2 \vee \ldots \vee A_q)\big)$$

whose micro-logical structure was outlined in (150) on page 599. As conditional obligations, they regulate physician conduct in the diagnostics, therapy, and prevention of maladies. If physicians were allowed to act according to what they deem right, there would be no offence, and hence, no malpractice suits. In Chapter 16 on page 597 we concluded from this fact that clinical practice is a deontic domain. A deontic domain is either a legal or a moral domain. Clinical ought-to-do rules, as clinical standards, are not prescribed by legal authorities. They are advanced by medicine itself. So, we may conclude that they are domain-specific moral rules. That is, the modal operator "it is obligatory that" contained in a conditional clinical action rule such as the following one is to be interpreted as expressing a moral obligation:

- If a patient complains of acute chest pain that radiates to her left arm, then
- if you want to know whether she has myocardial infarction, then
- *it is obligatory that* you record an ECG or determine the concentration of heart-relevant enzymes in her blood.

The obligation prescribes what type of clinical *actions* are right and good under certain clinical circumstances. In a nutshell, clinical practice as a historical and social institution – and not as a praxis and conduct of individual doctors – is *practiced morality* because it is devoted to the execution of such rules. Its moral norms are codified into clinical ought-to-do rules like above usually called clinical knowledge, specifically, diagnostic-therapeutic knowledge. See Section 11.7 on page 476 ff. Clinical knowledge at a particular time represents the *practical-moral corpus* of medicine at that time (Sadegh-Zadeh, 1983, 14).

25.6.2 Clinical Research is Normative Ethics

Recall that the conditional clinical ought-to-do rules referred to above are exactly the clinical indication and contra-indication rules that we studied in indication structures and contra-indication structures in Sections 9.2.3 and 9.2.4 (pp. 326 and 328, respectively). By advancing such action rules as *clinical knowledge* for use in clinical decision-making, clinical research and the medical community regulate physicians' conduct in that physicians are bound to obey those rules. In medical education the rules are taught as medical knowledge. And they are disseminated as knowledge in textbooks and other medical literature. Since the totality of this practical-medical knowledge provides a practical-moral corpus for physician conduct in clinical practice, the pursuit thereof in medicine and the continuing effort to improve and justify it by practical-medical research and practical-medical reasoning are *normative ethics*. The characteristics and quality of the moral corpus reflect the nature and quality of that normative ethics.

Our view of clinical research as normative ethics is based on the following observation. Conditional clinical obligations regulate, as indication and

contra-indication rules, the physician's clinical decision-making and are thus her local, i.e., domain-specific, rules of conduct. The search for such rules by clinical investigations and practical reasoning constitutes an ethical inquiry because their subject consists of *rules* of morally relevant conduct. The ethical reasoning we are supposing is comparative reasoning in that the clinical efficacy values of at least two different, competing rules of the following form:

$$\mathit{eff}\Big(C \to \big(G \to OB(A_1 \vee A_2 \vee \ldots \vee A_p)\big)\Big)$$
$$\mathit{eff}\Big(C \to \big(G \to OB(B_1 \vee B_2 \vee \ldots \vee B_q)\big)\Big) \qquad \text{with } p, q \geq 1$$

each of which prescribes particular actions, are compared so as to prefer and advance the one with the higher efficacy. For example, comparative clinical research may result in the decision to give the following rule preference over all other, competing rules: "If a patient complains of upper abdominal pain, then, if you want to know whether she has gastritis or peptic ulcer disease, then it is obligatory that gastroscopy is performed and a biopsy is taken". The comparative character of clinical research as ethics may evolve in the future by employing the methodology of *fuzzy deontics* that we proposed in Section 17.5.5 (p. 683 ff.), and advancing clinical indication and contra-indication rules in terms of what we called *comparative conditional norms* on page 687. It will then be justified to view clinical research as a *comparative normative ethics* (Sadegh-Zadeh, 1983, 13).

25.7 Quo Vadis Medicina?

There are numerous moralities on earth. For example, the morality of German Catholics is different from that of Tutsi and Mormons. Correspondingly, there are a large number of ethics concerned with these distinct moralities. For instance, the normative Catholic ethics deviates from Tutsi and Mormon normative ethics. Thus, there is not only one ethics on earth, but many. The same holds true for medicine interpreted as ethics. Medicine as ethics changes through time. Convincing evidence for this is the impact on medicine that biosciences and technology have developed since the 1950s. Artificial insemination and designing babies, genetic manipulation of the embryo, termination of life and physician-assisted suicide, transplantation of organs and tissues, nanomedicine, and many other innovations demonstrate that medicine is continuously redefining man, health care, life, and death through changes to its moral corpus. The emergence of bioethics in the 1960s was a reaction to this increasing moral and ethical hegemony of medicine in life and death matters (Jonsen, 1998; Jecker et al., 2007; Engelhardt, 2012; Garrett et al., 2013).[162]

[162] Whoever has difficulty understanding medicine as ethics, may distinguish between implicit and explicit ethics and reinterpret clinical research as an implicit ethics that does not explicitly regard itself as ethics because clinical researchers do not sufficiently reflect about, or know, what ethics might be.

Although bioethics, including medical ethics, has since been very successful, it is highly unlikely that it will take precedence over medicine as an implicit ethics of human life before and after birth. The reasons for this skepticism are briefly outlined in the following two sections:

25.7.1 Medicine is in Transition to an Engineering Science
25.7.2 Medicine Toward Anthropotechnology and Posthumanity.

25.7.1 Medicine is in Transition to an Engineering Science

The picture painted of medicine in preceding chapters as a deontic, rule-based healing profession represents the social-historical institution of medicine up to this point in time. But states of affairs are in rapid transition, and medicine is increasingly assuming the role of an engineering science. In the next five sections, the nature of engineering sciences will be analyzed so as to explore how medicine is going to engineer its knowledge and modes of action:

- What is an engineering science?
- The engineering of medical knowledge
- The engineering of therapeutica
- Clinical decision-engineering
- Health engineering.

What is an engineering science?

We must first distinguish between engineering as practice, on the one hand; and engineering research or science, on the other. (i) Engineering practice is the act of *designing* a material or device, by means of which a specified goal may be attained, using engineering knowledge. Such knowledge is provided by engineering sciences. (ii) An engineering science is a research field that investigates *methods of designing* materials and devices by means of which specified goals may be attained more efficiently than by alternative actions. Otherwise put, an engineering science inquires into efficient means-end relations whose means are materials or devices. Thus, it is *means efficiency research*. The efficiency knowledge that it produces has the structure of practical knowledge sketched in (216) on page 841. On this account, engineering sciences are practical sciences. The actions that they recommend for achieving goals under certain circumstances, are *applications* of materials or devices.

In preceding chapters and on page 834, we categorized medicine as a practical science because, by means of clinical and biomedical research, it inquires into means-end relations to advance efficient *clinical-practical knowledge*. The alternative actions $A_1 \vee \ldots \vee A_q$ prescribed in an item of clinical-practical knowledge $C \rightarrow \big(G \rightarrow OB(A_1 \vee \ldots \vee A_q)\big)$ are *invented,* and in most cases novel, types of action such as particular diagnostic or therapeutic methods, e.g., the diagnostics of Alzheimer's disease, AIDS, or any other malady. In

contrast to theoretical sciences, a practical science such as clinical research not only investigates the efficacy of *modes of praxis.* It even imagines and invents goals, e.g., therapeutic use of stem cells, as well as appropriate modes of action to achieve those goals and is for that matter, in addition, a poietic science in the Aristotelian sense. (The adjective "poietic" derives from the term "poiesis" meaning *making, producing,* and *creating.* For their Greek origin, see page 125.)

Examples of poietic acts in medicine are the invention and design of diagnostic, therapeutic, and preventive measures. Such measures employ more or less sophisticated algorithms and devices, including machines, or are accomplishments of such devices that work automatically and without human assistance. Consider, for instance, the human-machine complex in an intensive care unit, cardiologic-diagnostic laboratory, or neurosurgical operating theater. The measures as well as the devices are created, designed, and engineered. For instance, insulin is synthesized by genetically engineered bacteria and is injected by an insulin pump as a fuzzy controller (see page 629 ff.). It is only this poietic aspect of medicine that justifies viewing it as an *art.* But why call this type of creativity an art and not *technology* or *engineering science?*

Medical poiesis is strongly represented by *biomedical engineering,* including medical biotechnology, that has become a major and influential source of both research and technology in medicine. Without it no health care would be possible today. It is therefore no exaggeration to state that by virtue of biomedical engineering health care is becoming, or has already become, health engineering science and health engineering practice. That means, in the light of our observations above, that the moral acts that clinical research as normative ethics prescribes, are health engineering acts.

Medicine is well on the way to designing and engineering all of its relevant subject areas, from knowledge to remedies to devices to clinical decision-making. This transition to an engineering science and practice, or technology for short, is caused by pervasive economization of our life affairs to the effect that medical services and health care have been increasingly commodified. The emergence of information technologies and the Internet in the end of the twentieth century has only accelerated this process.

The engineering of medical knowledge

A cursory glance at the current philosophy of science journals shows that philosophers of science to this day take delight in theorizing about the truth, truthlikeness, or probability of the entities that science in general and experimental sciences in particular present as *knowledge.* However, viewed from another perspective, concepts and theories of truth, truthlikeness, and probability seem to be unsuitable for analyzing and evaluating experimental knowledge. The reason is that this type of knowledge is increasingly being engineered as a commodity in epistemic factories. A commodity, be it an automobile or

experimental-scientific knowledge, is not true, truthlike, or false, but more or less profitable for its producer and more or less valuable to its users. We will explain this perspective below, taking the medical-experimental sciences as our examples.

In Chapter 13 on page 551 ff., we reconstructed scientific experiments as epistemic machines that engineer knowledge, and an experimental research laboratory as an epistemic factory housing such machines. As the main sources of knowledge in medicine, biomedical and clinical research laboratories are such factories equipped with different types of devices and networked with other laboratories via intranets and the Internet. Their product, i.e., medical-experimental knowledge, plays the role of a blueprint for the production of commodities such as vaccines, antibodies, receptor blockers, pacemakers, in vitro embryos, stem cells, and so on. As a blueprint, it has become a commodity itself, even a basic commodity that is considered worth having at any price. To ascertain the validity and consequences of this image, one must look beyond the momentary state of a particular research program, e.g., a series of experiments on DNA, tubercle bacilli, stem cells, or a single publication on a particular topic. One needs instead survey its entire history, from its inception until its productive end, in order to see its final product or products materialize step by step. Consider, for example, the following:

- genetic engineering, gene chips, and gene-diagnostic devices arising from decades-long DNA research,
- cervical cancer vaccine (= human papilloma virus vaccine) arising from 30 years of research (1976–2006) on human papilloma virus.

Let X be the subject of a particular research project such as the human papilloma virus. Over the course of the project, a number of publications on this subject X are produced by the research team, or by generations of such teams; and the successful conclusion of the project yields a final commodity Y, e.g., cervical cancer vaccine. Now, the message of our epistemic engineering thesis is twofold. It says, first, that the content of publications on the subject X is engineered in epistemic factories, and second, that these publications are not knowledge about X, but a successively evolving blueprint for the production of the final commodity Y. More specifically, the central sentences in an item of experimental knowledge are *interventional-causal,* or *operational, sentences* talking about what occurs when a particular material is subjected to specific operations, say actions, methods, or techniques. They are either deterministic sentences of the structure:

If M is some material, then, if it is subjected to action A, then R will result, (220)

or probabilistic sentences of the form:

If M is some material, then the probability that R will result on the condition that M is subjected to action A, is r. (221)

Here, M is any material of arbitrary complexity, e.g., a bunch of human papilloma viruses, stem cells, other types of cells or molecules, an organ or organism, etc.; while action $A = \{A_1, \ldots, A_m\}$ is composed of $m \geq 1$ operations; and the result $R = \{R_1, \ldots, R_n\}$ consists of $n \geq 1$ components, all of which yields the following structure:

$$M \to (A \to R)$$
$$M \to p(R \,|\, A) = r \qquad \text{or} \quad p(R \,|\, M \cap A) = r.$$

Both sentences are conditional-operational sentences and formalize sentences (220–221) above. See also the concept of operational definition on page 103. The material M is what is analyzed in an experiment; R is the experimental result; and the operation A is the entirety of experimental methods, techniques, and devices applied to M to yield R. To illustrate, we will return to an example used in our discussion of epistemic machines in Section 13.2 on page 555:

> Let M be a set of some epileptic hippocampal neurons, then the probability that their spikes are reduced if they are treated with GABA (Gamma Amino Butyric Acid), is 0.8.

That means:

> M is a set of epileptic hippocampal neurons $\to p$(their_spikes_is_reduced | GABA_is_administered) $= 0.8$

or equivalently:

> p(their_spikes_is_reduced | M is a set of epileptic hippocampal neurons $\cap$ GABA_is_administered) $= 0.8$.

Action A in conditional-operational sentences of this type is always a machine-aided action or conducted by machines. It demonstrates the central role technology plays in medical-experimental knowledge. It also demonstrates the production of the result R by the technological transformation of the material M. In other words, experimental findings of the type above ensure the technological producibility of the component R from material M. Thus, they are technological production rules, i.e., *methods of engineering of something*. This explains, first, why experimental researchers patent their findings; and second, why medical-experimental research is mostly carried out in industrial laboratories where the commodities are directly manufactured. Examples are pharmaceutical factories and biotech companies. Even research projects at medical schools today are funded by the production industry, a relationship that has come to be termed research transfer, cooperation, or sponsoring.

In this context, the following philosophical question arises: Does medical-experimental *knowledge* contribute to the engineering of health commodities, or is it a gratuitous by-product of the engineering history of these commodities? (See page 571.)

The engineering of therapeutica

Any professional intervention that aims to ameliorate the health condition of a patient we call therapy. Correspondingly, we introduced the term "therapeuticum" on page 384 as a general label to denote any substance, device, or procedure, including surgical techniques, that is a constituent part of an efficacious therapy. Drugs and prosthetics are typical examples. Nowadays all therapeutica are engineered. For example, drugs and vaccines are products of chemical, biotechnological, and pharmaceutical engineering. The production of devices such as blood pressure monitors, insulin pumps, pacemakers, defibrillators, and neurochips would be impossible without highly sophisticated engineering theory and practice behind them. As pointed out above, biomedical engineering has become a major and influential source of research as well as technology in medicine, without which no health care would be possible today. There would exist no invasive diagnostics and therapy, no surgery, emergency medicine, intensive care units, prevention, and so on.

Clinical decision-engineering

In the past, clinical judgment was considered the expert task of the physician. But the advent of computer technology and artificial intelligence changed this situation. In the 1960s, a new discipline emerged that has come to be termed medical informatics, including clinical informatics. The latter is in the long-term process of taking over clinical judgment in the future. This development is closely associated with the publication of a short article in the journal *Science* in 1959 by the engineer Robert Steven Ledley and the physician Lee B. Lusted about the reasoning foundations of medical diagnosis (Ledley and Lusted, 1959a). These two pioneers explained how the "digital electronic computer" could assist physicians and medical students in learning methods of clinical reasoning. "But to use the computer thus we must understand how the physician makes a medical diagnosis", they said (ibid, 9). To this end, they started with an elementary application of sentential logic, Bayes's Theorem, and some decision-theoretic concepts. They thereby paved the way for a probabilization of clinical judgment and founded a new discipline termed *medical decision-making* (Lusted, 1968). For details of this development, see Part VI on pages 709–743.

During about fifteen years of enthusiastic clinical probabilism that followed (Sadegh-Zadeh, 1980b), a new field of clinical computing developed that contributed to an intense application of information sciences to clinical reasoning. As a result, special computer programs emerged that have come to be termed 'computer-aided medical decision support systems', 'medical expert systems', 'medical knowledge-based systems', and the like. Initially, they were mostly based on one-sided probabilistic approaches and Bayes's Theorem. However, a variety of additional approaches have been introduced since about 1975, especially the application of fuzzy logic and hybrid decision support systems

(see p. 729). Under the umbrella name "artificial intelligence in medicine", AIM for short, the software products of this new research and technology are more and more being used in clinical decision-making and patient management. A new subdiscipline of medical informatics has come into being that is exclusively concerned with AIM. As pointed out on page 341 and in Part VI, this subdiscipline is increasingly becoming an *engineering science of clinical practice*. The whole process of clinical decision-making is being computerized and based on clinical decision support systems and the World Wide Web, from history-taking to the interpretation of recordings and patient data to the making of diagnostic-therapeutic decisions to follow-ups. Since the programs are engineered, their WWW-integrated use in individual clinical settings must be viewed as *clinical decision-engineering*. That is, clinical judgment is more and more being engineered today. Future generations of physicians will probably constitute only dependent parts within a distributed, global health care machine and will play mere auxiliary roles as some sort of mobile peripherals for collecting patient data requested by the machine to engineer clinical decisions (Sadegh-Zadeh, 2001b, IX).

Health engineering

Medical knowledge, therapeutica, and clinical decisions are essential constituents of health care. Now that all of them are being engineered, what has traditionally been called health care is increasingly becoming health engineering.

25.7.2 Medicine Toward Anthropotechnology and Posthumanity

We tried above to sketch part of the way that contemporary medicine has taken toward technology. The beginning of this transition of health care to health engineering cannot be placed exactly. However, the obvious transformation indicates that a new mode of medical worldmaking is emerging behind which lies a new concept of man. The concept seems to amount to the view of the human being as a modular system consisting of exchangeable modules, from organ systems to organs to tissues to cells to molecules to atoms. This type of medical anthropology is a product of the field of medicine that followed the German pathologist Rudolf Virchow's cellular pathology propounded in 1855 (Virchow, 1955, 1958). Only on the basis of such a *modular anthropology* is it possible to transplant body parts, organs, tissues, and cells; to implant pacemakers and chips; to conduct in vitro fertilization and genetic interventions; to screen embryos for the sake of designing babies; to pursue human enhancement by chemistry and nanotechnology; and to exchange or insert many other modules in the future. There is no doubt that this new medicine as technology will develop a remarkable evolutionary impact on man. A new man is being made by medicine. That this anthropotechnology is only a part of the imminent Grand Biotechnology need not be stressed. Inspired by the

belief that science and technology can be used to transcend the natural limitations of human body and mind, medical anthropotechnology is on the best way even to transcend the Homo sapiens and to contribute, in collaboration with other technological branches, to posthumanity that is characterized by the supremacy of machine over man. In an elaborate theory published elsewhere, we have interpreted this prospect as a Darwin-Lamarckian autoevolution of life on earth. But this is not the right place to propound that theory. The interested reader is referred to (Sadegh-Zadeh, 2000d).

25.8 Summary

Like other entities, medicine has numerous properties. Characterizing it by limiting its 'nature' to only one of these properties, e.g., "medicine is an art", is prone to dogmatism. In our analysis of this issue we found that clinical research is, among many other things, a practical science, while biomedical-experimental disciplines ("biomedicine") represent theoretical sciences. By virtue of its practicality, clinical *research* belongs to the discipline of normative ethics, for it seeks and establishes deontic-clinical rules of action usually called clinical-practical knowledge. The execution of these deontic rules in clinical *practice* turns this practice – as a historical-social institution – into a moral activity and tradition. *The good old medicine* characterized as practiced morality and normative ethics is currently in transition to an engineering discipline. Medical knowledge, therapeutica, clinical decisions, organs, tissues, cells, genes, molecules, and even health are being engineered today to the effect that medicine is on the way toward anthropotechnology as a branch of biotechnology.

CHAPTER 1

The Goals of Medicine

THE GOALS OF TREATMENT

Medicine is a profession of action—physicians do things. The stunning achievements of science and technology have provided unparalleled diagnostic and therapeutic power, but understanding what to do and why has not kept pace with its development. Clinical medicine, as a *thinking* discipline, is concerned not only with what clinicians do but why, and how their actions might be honed to be both more appropriate and effective.

Every time physicians act in medicine, they have some purpose in mind. What they actually do (including doing nothing) and how they go about doing it is in the service of their purposes. Of course, physicians are not always consciously aware of their goals, but I believe that if we were to query them at any point, they could tell us what they were trying to accomplish and how they meant it to happen. I also think that everything we want to know about how clinicians decide on their actions in clinical medicine we will be able arrive at if we start with the clinician's goals.

There are, of course, aspects of clinical medicine that are more basic than the choice of goals in patient care. Some would argue that the scientific basis of medicine is primary; for others, ethical considerations come first; while a few might make a case for societal determinants being most important. It is also true that physicians who are not clinicians or even non-physician observers of medicine have educated opinions about first principles. This book, however, is about how

clinicians think about and make decisions about what to do for sick patients, so naturally ideas about goals are prominent. It is reasonable to ask what clinicians are making decisions about. Historically, there has been a tension between attention to the patient and attention to the "thing" making the patient sick. In all eras that thing has been called a disease, but what is meant by that word has differed widely through medicine's history. In the last half of the 20th century there was a shift from structural definitions of disease—what the pathologist sees—to increased emphasis on pathophysiology where functional impairments are primary—physiological, biochemical, or molecular functions. Contemporary medical science and technology have made it possible to demonstrate such alterations with exquisite sensitivity. There are still diseases defined in the old-fashioned way, for example, carcinoma of the breast, while "diseases" defined in new ways spring into being, for example, gastroesophageal reflux disease, which involves the malfunction of the physical and physiological barrier between the esophagus and the stomach and is usually defined by chronic heartburn. Currently, attention is directed at genetic determinants. (It is humorous that medical geneticists call that "personalized medicine," as though persons were their genomes.) Physicians in the past have sometimes focused their attention almost exclusively on the disease, with seemingly scant concern for the patient. Despite an almost universal acceptance at this time of the concept of patient-centered medicine, the same thing is true today—in medicine as practiced, the disease and its manifestations remain a major concern, while less heed is paid to patients. Not only currently, but truly through the decades before and after World War II, there were important, but largely impotent, attempts to make medicine more holistic, concerned with the patient as person. I have written extensively in the past about the problem—why concern for the person of the patient does not make it to the center of clinical medicine's stage—from the nature of scientific thought to the nature of medical training (Cassell, 1991, 1997). Sometimes I phrase it as a question: "Why does reductionism always win?" No matter why, that is the way it is.

The central function of doctors is the care of sick patients and the relief of suffering. It has always been thus and it is true today. What entitles people to visit a doctor? A self-described healer in New Orleans,

Louisiana, had a sign above the door that said that she could. "Treat solve many problems such as: *Bewitched p'iple, swollen body, lost lover, insanity, diarrhea, madness, to make mens penis strong, women with pregnancy problems, misfortunes,*" and so on. She would, it seems, take all comers. Doctors do not do that. In this culture, to see a doctor you must be sick, think you are sick, fear sickness, be attempting to prevent sickness, or have administrative needs related to sickness. In the preface I introduced a new and different definition of sickness—the definition developed for McGill University's medical school curriculum—but at this stage in understanding clinicians it is useful to start with the traditional definition. *Sickness* is traditionally defined as physical symptoms or other problems caused by disease. If persons think they are sick but no disease or disease-related problems are found, doubt is cast on the claim of sickness. This idea dates back millennia, but the current definition of *disease*—pathoanatomy, pathophysiology, abnormal human biology—started in the beginning of the 19th century. The difficulty is that this definition of sickness involves only the body, and the effects of sickness may be found in any aspect of a person. In this book the words *sickness* and *illness* are synonymous.

This chapter will form the basis for the discussions in the remainder of the book. I would like to end the chapter with consensus about clinicians' goals of action—a list of goals that most working doctors could agree with. To arrive at this list I presented a number of consultants with written descriptions of the same group of cases and asked them what *all* their goals were for each of the examples. The 11 consultants were of varying degrees of expertise, from second-year medical students to notable professors and emeritus professors of medicine. Some were academics and others full-time practitioners. They had differing special interests but I asked each of them to discuss their goals as internists rather than as subspecialists. From their answers we will try and find the commonalities of opinions in order to agree on what questions or issues clinicians must address to arrive at the kind of knowledge and skills apart from medical science that are required by doctors caring for patients.

In this book you will never be more than a few pages away from a specific case—an instance of the problems of clinical medicine exemplified by a specific sick person at a particular time and in a

particular place. The great majority of cases will be real, the actual problem of an actual patient. When the case is different from how it actually happened it will usually be because I am employing one of the experimental methods of clinical medicine: varying a case in a specific detail to see how that would affect thinking about the case. The object in every instance is to get at the principles. As with all of our patients, the sick persons of these cases will have names rather than initials or just first names. The names will be fictitious, however, to maintain essential confidentiality. Sometimes I have altered the case descriptions to bring the technology up to date or so that the case can be accepted as contemporary. This is necessary, since I have been working on this book for many years, putting it down and then later picking it back up over a long period of time.

You will quickly notice something else about these cases: They are not just descriptions of the onset, presentation, or course of a disease. The case descriptions that most doctors grew up on, like those presented in the *New England Journal of Medicine's* publication of the *Weekly Clinicopathological Exercises* from the *Case Records of the Massachusetts General Hospital*, are themselves the result of a theory of medicine—the disease theory. In this theory, dating in the form we know it from the 1830s, the salient facts of a case have been presented when the physical manifestations of the patient's pathophysiology (including laboratory, X-ray, and other special studies) have been made known. But it is apparent now that there are other determinates of the illness that the physician sees and other information is necessary to make the sick person better. Just what these are and how they bear on our problem will become clear in this and the succeeding chapters. The immediate result of the decision to go beyond classical disease descriptions of cases is that the patients you read about here will be immediately familiar—*au natur*, so to speak.

One further note about the cases: Our clinicians will be asked what their goals are at the point in the course of the illness that they first see the patient. In most teaching circumstances the entire case is presented, and the discussant is asked to make a diagnosis. In such conferences it is as though there was no time involved in the evolution of the illness, as though a disease was an event rather than a process.

THE CASES

> Laurraine Dantuano has come into the office because 2 days earlier she noticed a thick, greenish-brown-black discharge from her left nipple that has continued into today, although to a lesser extent. She says there has been no trauma to the breast—sexual or otherwise. It has never previously occurred. She is a 21-year-old, single, nulliparous white woman who has just returned home after finishing college. The patient has had asthma since infancy, although in the last few years attacks have been rare. She takes no regular medication. She is otherwise healthy.
>
> She came to the office with her father. She is a healthy-appearing woman. She was jumpy and fidgety during the examination and said that she was scared that she had cancer. Examination of the breasts revealed no masses or tenderness. The skin is normal. There are no axillary nodes. Translucent dark greenish viscous material can be expressed from the left nipple.

The consultants were unanimous in wanting to be sure that she did not have carcinoma of the breasts. Most had not had experience with this kind of discharge from the nipple. Two thought she might have mastitis. One wondered whether the fluid was guaiac positive and another wanted to look at a stained smear. The oncologist was familiar with the fluid and believed that she had emptied a benign cyst of the breast through the ducts of the nipple. They were all pretty sure that she did not have cancer, but they all agreed about the importance of *being sure*. Thus, three of them wanted her seen promptly by a breast surgeon while two others believed cytology of the fluid and mammogram should both be done, with referral to a surgeon only if these studies demonstrated evidence of tumor.

They were all interested in the fluid—what it looked like, what it actually was. But their curiosity was blunted because of the diagnostic urgency imposed by the danger of the disease, as we might expect, but not that alone. "I do not want to tolerate even a small level of uncertainty in a woman of her age," said one. "If she was 71 years old or 81, maybe, but I wouldn't take a chance with her." He did not mean that he did not care about making a correct diagnosis in an older woman; rather, the *speed* of diagnosis was on his mind for Laurraine Dantuano.

The consultants who suggested prompt referral to a surgeon did so because they had estimated that their knowledge was not adequate to the degree of certainty required here.

Several goals emerged in this brief case. Initially there was the desire to know what the fluid was—particularly by those consultants who had not previously encountered the blackish green, viscous, acellular fluid found in benign breast cysts. This may seem the same as wanting to know what the diagnosis was, but it is different. Physicians come to know much about what happens in the body in health and disease. They become familiar with the look, feel, smell, sound, and interrelationships of all sorts of bodily things from bumps on the skin to sounds from within. As the years go by, this familiarity increases so that very few things are manifest on or in their patients that they have not previously encountered. This knowledge is somewhat different than the knowledge of diseases, although, of course, they are related. Thus, physicians are forever brushing aside skin lesions whose names and origins are completely unknown to them, because they know from having experience with them (with reasonable certainty) that they pose no danger to the patient. When a physician encounters something unfamiliar, it is not possible to either dismiss it as unimportant (as the oncologist did who knew about this kind of nipple discharge) or know what should be done. In such situations they cannot know what actions to take to protect their patients—a goal that emerges from this case and which is of no surprise. But they have also, in the face of the strange finding, come across something that reveals the incompleteness of their knowledge. Here is yet another goal—developing comprehensive knowledge. We know, of course, that physicians (like everyone else) want to know as much as possible. But we do not yet know why.

The need to diagnose Laurraine Dantuano's disease cannot be simply the finding of the disease itself. There is something about this patient that modifies the diagnostic process. The consultant was quite clear that he would not tolerate even a small amount of uncertainty (whether he has that choice is another matter) in this instance because of her age, whereas the matter would be different if she was "71 years old or 81." This implies that the establishment of diagnostic goals is dependent upon circumstances within the patient herself. At first glance this difference may arise because of the known effect of young age on worsening

prognosis in carcinoma of the breast. But it is also possible that he believes that younger woman are more to be protected—that an age bias has entered his thinking. Or that to be younger is to be less able to tolerate diagnostic uncertainty. In this regard it is important that several consultants believed that her fears required speeding the diagnostic process. The fact that her father accompanied her emphasized the significance of her fears in their planning. After they were told that her mammogram and fluid cytology were negative, all the consultants agreed that she should not be re-examined in a few months, for fear of making her a "breast cripple," as one of them put it.

As we have seen, one of the first goals to emerge was the desire for certainty about her diagnosis. The reasons seem clear enough. If this young woman has a carcinoma of the breast that is not promptly diagnosed, it is believed that her life will be endangered by her tumor—more so than if it is quickly diagnosed and treated. However, the increased risk will have arisen because of the action (or inaction) of the physician, not merely as a result of the disease. The consequences of failure to make a timely diagnosis will spread out from the event like ripples in water. The patient will feel (they believed) that the physicians betrayed her trust and the physician–patient relationship will be destroyed. The specter of malpractice litigation will also arise. It is fair to say that the physician who makes such an error will feel terrible. But it is not uncertainty in some general way that haunts the clinicians in this case; it is doubt that arises because of the threat to Laurraine Dantuano. It follows that the clinicians must also have as one of their goals knowing the threat to the particular patient. Here, it is obvious. In other circumstances, as we shall see, it is not so clear.

Laurraine's case introduces us to the seeking of goals. It is brief and simple and had a happy outcome. The goals of our physicians in even this easy case turn out to be not only the making of a diagnosis but also to have other aims related to their knowledge, their values in relation to (at least) age, and ideas about what is good or bad for their patients.

Let's go on to the next case.

Mr. Lautenberg is 70 years old. He is a controller for a corporation. He has been married 47 years to Jennie, age 66, and is healthy. They have two healthy children, ages 42 and 38. His wife also works. He is a

New Yorker by birth and is college educated. His father died at age 65 of an "embolus." His mother died in her 80s of pneumonia. He has one brother who has myasthenia gravis.

He has been well except for minor surgical procedures. He served in the Air Force in Vietnam even though he "could have ducked the draft."

His first visit was in October 2008 for a routine physical.

The current visit (April 2009) was prompted by a call from the ophthalmologist to you, his attending physician. The ophthalmologist, whose specialty is neuro-ophthalmology, also sent the following letter.

"I examined Mr. Lautenberg on February 22, 2009. He developed diplopia 1 year ago and was given prism glasses which relieved the symptom. He believes that the diplopia actually went away but I think it was due to his use of the prism. This spring the diplopia recurred and he was given an additional prism, which failed to relieve his symptoms. He has had a neurological evaluation in Florida including acetylcholine antibodies which did not yield a diagnosis.

On examination, the pattern of motility disturbance is compatible with left inferior rectus palsy. There is no proptosis or ptosis and the other extraocular muscles are normal functionally. The remainder of the ocular exam is normal.

I have asked him to have an MRI scan because this could be an unusual manifestation of partial third nerve palsy, and I asked him to see you for an examination with particular regard to the possibility that this is a manifestation of thyroid ophthalmopathy.

This is the point at which you pick up the case. In this case, you are providing ongoing care.

The consultants' first goal was to decide what the goals were—what diagnostic question the ophthalmologist was asking and what they should *do* for Mr. Lautenberg. The names of two diseases were raised immediately, myasthenia gravis and Graves's disease. But even though the ophthalmologist specifically asked whether the patient had thyroid ophthalmopathy, the most experienced clinicians were not content to simply do some thyroid tests. They were more interested in what was specifically producing Mr. Lautenberg's diplopia. Palsy of the inferior rectus muscle produces visual difficulty by impeding the downward

deflection of the eyeball. Diplopia is present primarily on looking down, as in reading, but not when looking up. (Diplopia may be present in all fields to some degree, but is most prominently manifest on downward gaze.) They did not doubt the ophthalmologist, especially since he is a neuro-ophthalmologist, because for all of the experienced consultants, a major source of their continuing education is the opinion of colleagues. Rather, they all had the need to make sense of Mr. Lautenberg's symptoms—*anatomical sense*. Given the maneuver that brings out the diplopia, three things seemed possible: The inferior rectus *muscle* was afflicted, the CN III (oculomotor) *nerve* was disturbed, or the superior rectus muscle was bound down. Each in his or her own way was interested in what might cause isolated third nerve palsy. In the old days, some would have checked the library, others would have called friendly experts, and still others would have gone to the bibliographic search programs of their computers—now they would all head for Google first, then PubMed (the computer search site for biomedical literature MEDLINE of the U.S. National Library of Medicine). Several said they would call their ophthalmologist friend after they knew something because there was "always stuff that wasn't in the literature yet."

Because of their interest, the case as given was not satisfactory because of the lack of specific information about the physical examination. The precise finding on physical examination is needed here to know whether the case, as presented, is correct. The accomplished clinicians who reviewed this case had all had experiences where they were consulted about a patient's disease only to find on more careful questioning or physical examination that what they had been told about the case had been in error. This precision seemed necessary to them because after they had made *anatomical sense* of the case they needed to make *pathophysiological sense*. One of the consultants is an endocrinologist, and he knew more than the others about the oculomotor palsies. But even he, like the others, wanted more knowledge.

The need to know more, which surfaced with each of these patients, was not merely a general desire for knowledge but for that which would make a difference to Mr. Lautenberg. For example, if thyroid ophthalmopathy confined to one extraocular muscle seemed a remote possibility, then the diagnostic search should not be pushed too far. Blood levels of thyroid hormones and thyroid-stimulating hormone are

simple enough and would provide information. But radioactive uptake and scan, or imaging of the neck would not add anything essential to Mr. Lautenberg's care beyond what the examining hand might reveal. If, on the other hand, isolated third nerve palsy is found in serious diseases whose early diagnosis and treatment are both feasible and important, then the diagnostic search assumes greater importance and greater certainty is necessary. In other words, as one consultant put the matter, "I would address myself to the question of the treatable conditions, and if there aren't any treatable conditions, I would do very little investigation. It's easy to go too far and end up hurting a patient like this." In part, his concern was met by the MRI of the brain, which showed nothing that might be a source of partial third nerve palsy.

The fact that Mr. Lautenberg's brother had myasthenia gravis was important to all the consultants. None of them thought that he had the disease or even that a Tensilon test should be done, although it is a simple office procedure. Here, as in the other cases, their goals included attention to the patient's concerns, spoken or unspoken. It is necessary, as one of the consultants said, "to defuse the anxiety that must be present in such a patient. Everybody," he said, "has seen enough television and read enough in the media, or knows how to search a computer so that no patient arrives with a symptom such as this without very active worries." One of the second-year students commented that she immediately thought about how fearful this patient must be. In this regard, one consultant brought out the importance of Mr. Lautenberg comprehending what his physician thought about the situation, both the diplopia itself and the possibility of myasthenia gravis—it would not do to simply brush aside the myasthenia—and that therefore the physician must be clear about what Mr. Lautenberg's understood.

[Addendum: One year later Mr. Lautenberg was seen by an ophthalmologists in Florida who did a Tensilon test. It was positive. To everybody's surprise, the patient had myasthenia. The referring ophthalmologist was particularly chagrinned. "It was easy enough to do a Tensilon test," he said, "I wonder why I didn't do it?"]

On to the next case.

Mr. Brechner is a 73-year-old retired salesman who came for a consultation in April 2009, referred by his daughter. He was accompanied by a

woman of 54 who has been his partner for the last 2 years. She spontaneously offered the fact that they always walk holding hands and that he is a very affectionate man. He concurred that she was special and very supportive. Partly, he thought, because they both love to dance.

He had scarlet fever at the age of 14 and has known of a heart murmur since then. He had no difficulty with his heart until 2001. At that time, living in Florida, he developed pneumonia, during which he is said to have developed congestive heart failure and was digitalized (his first cardiac medication). Cardiac catheterization in Florida showed mitral valvular disease as well as three-vessel coronary artery disease. He refused surgery at that time. He started to have mild dyspnea on exertion 5 years ago which has progressed very slowly. About 2 years ago it became more noticeable. He is in no way disabled, but he does notice shortness of breath when he dances or walks uphill. In ordinary activity, having intercourse, or walking on the level he is not bothered by his breathing. In the last few months he has begun to notice that he is not quite himself and he attributes this to his heart. His present medications include Lanoxin (digoxin) .125 mg o.d., diltiazem SR 90 mg o.d., atenelol 100 mg o.d., Slow-K (potassium chloride), and Lasix (furosemide) 40 mg daily. He is also taking aspirin, iron supplements, and vitamins.

He has had heartburn for more than a dozen years. Two GI series demonstrated a hiatus hernia. His heartburn bothers him more than his cardiac symptoms.

He does not smoke and he drinks a minimal amount of alcohol. He was born in Poland and came to the United States in 1970. He was widowed in 1982. He has three children—a fourth died in an auto accident.

His father died at age 52 of heart disease and his mother died at age 56. Two brothers have coronary heart disease. His mother had diabetes.

His height is 5'7", he weighs 136 pounds, and his blood pressure is 115/62.

The electrocardiogram revealed abnormalities secondary to the digoxin and P-pulmonale. The chest X-ray showed a large left and right cardiac silhouette. Pulmonary function studies revealed decreased vital capacity.

The questions he has are first whether he should he have the cardiac catheterization that was recommended. If things are as the cardiologist has suggested, should he be operated on? If so, where should that be done; what should he do after the operation; and where should he live?

The following is the letter he received from his cardiologist (dated July 13, 2008):

"Dear Mr. Brechner:

I've had the opportunity to review your Doppler echo study of June 27, 2008, which finally arrived on my desk. It basically shows severe disease localized to the mitral valve, which both is obstructing and at the same time has a significant leakage. In addition, the left ventricle of the heart appears weaker than it should be and somewhat dilated. The above is of interest in that it suggests the possibility that mitral valve replacement should not be excluded despite your age of 72. Again, should your symptoms appear to be progressive, one should not exclude the opportunity to do a cardiac catheterization with consideration for operative repair. As risky as you seemed to feel this is, it may be the conservative approach at this time.

Sincerely,"

Doppler Echo was enclosed.

In this instance the difference between "making a diagnosis" and understanding the chain of events that would cause Mr. Brechner to be sitting in front of you asking whether he should have a cardiac catheterization and surgery is clear. Part of the sequence is related to his heart disease and some of it to the particular person of Irving Brechner. But which is which, and how can they be teased out so that the physician's judgment is most helpful to the patient?

In all of the cases presented thus far the physicians were concerned with what the patient wanted, but in none is it as crucial to their purpose as here. While cardiac surgery in a patient such as this poses some threat to life, the danger from his heart disease seems greater. These risks threaten the patient, so the risk–benefit calculation is his. Most people in these circumstances have not made themselves aware of all the factors that enter into the decisions. As a result, the

consultants were unanimous in their desire to know Mr. Brechner's goals and purposes, not only as a basis for their own judgment, but so that they might clarify them for Mr. Brechner. One of consultants thought this was one of the cases for which the axiom "above all, do no harm" was written.

Why had Mr. Brechner sought the consultation? He had seen the cardiologist in June 2008 and it was now April 2009; why did he wait so long? No one questioned the diagnosis—he has rheumatic heart disease and coronary heart disease with mitral stenosis and compensated congestive heart failure. Has he come because he has progression of his heart disease? If so, is it primarily further progression of the valvular abnormality or failure of the cardiac muscle? If it is the former, surgery would be of greater benefit than if the latter. Is he not feeling well because of his medications? The geriatric consultant pointed out how commonly what appears to be disease progression is in reality toxicity from medications. "I'd give him a trial off medication before I concluded that his symptoms were primarily from his heart." Has he been pushed by his family or even his girlfriend, or is he the prime mover? These are important questions in deciding whether *he* wants to be operated on and whether benefit will follow from the surgery. Essential to the physicians' goals will be detailed questioning to allow them to separate out the contribution of all these factors—the exact state of his heart disease, Brechner's desires and purposes, the place of medication, the role of others (family and girlfriend), and age or other illness. All of these enter into the prediction about surgery—whether his heart will improve and whether he will be better off—and whether it is worth the risk. One of the consultants pointed out that no matter how detailed the interrogation, there would be irresolvable uncertainties. He said, "I want to prolong life. I would hate the thought that I held him back from being catheterized and operated on only to have him die of his valvular disease when that could have been repaired." This must be paired with the opposite concern expressed, that he not be injured by the surgery.

Physicians also have political goals, which surfaced in this case. They must survive in their own institutions, they must maintain bonds with other physicians, but they want to remain in control of the care of their patients. In most institutions good relations exist between the

cardiologists who do invasive procedures, such as a cardiac catheterization, and the cardiac surgeons. Several of the more experienced consultants, therefore, were not happy with the possibility that once Irving Brechner entered the catheterization laboratory he was as good as on his way to the operating room. Staying in charge of a case in which so many other physicians (cardiologists, cardiac procedurists, surgeons, intensivists and multiple house officers) would play important roles would require considerable diplomacy—the exercise of power in a tactful yet forceful manner. At the very least a good relationship with the patient and his family, the aim in every patient encounter, would be especially important here to help navigate the political shoals.

One of the consultants was particularly interested in maintaining control of Mr. Brechner's care, because he felt that the patient's rehabilitation would be critical to meeting Mr. Brechner's goals. He believed he could do the job better than most. For this reason he felt it crucial that he maintain closeness with the patient and family during the parts of the treatment that were not his direct responsibility. Pressed as to what goal this represented, he said that his ultimate goal was to make the patient better in the patient's terms.

Irving Brechner was operated on successfully. Postoperatively, however, he had a cardiac arrest but was resuscitated. He developed postoperative brain failure which cleared over a 10-day period, leaving him cognitively intact and functioning as well as previously. His rehabilitation was also productive, and he returned to Florida with his friend to resume his previous activities. He considered his operation to have been an excellent choice. In this case, it is easy to see the importance of making decisions with the patient's goals and purposes in mind.

Here is the next case.

> Sol Levinson is a 72-year-old married white businessman. He had a three-vessel coronary artery bypass done 2 months ago. The angina that led to his surgery is no longer present. After his surgery he developed a cough that has gotten gradually but progressively worse. At the present time he coughs so much that he is hardly able to sleep day or night and is exhausted. He cannot talk without coughing. He brings up no phlegm

and he has had no fever. He has received no treatment for his cough except cough medicine, which has been ineffective.

He saw his cardiologist 2 weeks ago, who told him that his chest X-ray showed some fluid in his chest. Taking a history is difficult because of his cough. His wife accompanied him and attempted to tell his story but he repeatedly waved her away.

On examination he is not febrile and his blood pressure is 110/70. He is a short, slight man who weighs 134 pounds. There is flatness to percussion at the lower 1/2 of his left chest posteriorly. There are a few rales above the dullness. A chest X-ray revealed a markedly elevated left diaphragm and an effusion reaching half-way up on the left. A CT scan added no further important information.

A chest surgeon (but not his surgeon) was called who knew about the case and stated that the intubation during surgery had been "extremely traumatic."

Discussion by the consultants centered on two different subjects. First was providing symptomatic relief for this man, whose predicament seemed intolerable. Experienced and inexperienced alike, they wanted to act rapidly. They felt that his pleural fluid should be removed and that bronchoscopy should probably follow because they did not see why the fluid alone would cause this degree of cough. The second subject that provoked considerable discussion was what to do about his cardiologist. Everyone believed that Mr. Levinson's care had probably been mismanaged—the cardiologist knew about the cough and the pleural effusion but had not acted on it. At the very least, one of them said, the cardiologist had not been paying attention. The gossip offered by the second cardiac surgeon suggested that something had gone wrong during his surgery or his anesthesia—enough wrong so that the story had spread in the hospital. The relationship of what might have transpired to his subsequent cough, paralyzed left diaphragm, and pleural effusion was unclear.

The younger physicians and the students believed that Mr. Levinson should be told to get a new cardiologist—they believed that sometimes patients have to be protected against physicians. A consultant who suggested a change of cardiologists said that one of goals of physicians had

to be to uphold the standards of medicine—that medicine itself needed protection. It was necessary, he said, to see that things were done right for the good of medicine as well as for the sake of patients. Older physicians did not agree that the cardiologist should go. "We were not there and we do not really know what happened. We all know of cases where the right thing was done, but things turned out badly. It is too easy for others to judge." The split in opinion was along age lines. It was difficult to know whether this represented a different allegiance to medicine among young physicians or merely that greater experience provided examples where a physician's actions looked bad from a distance despite being correct at the time.

The next day (Friday) an attempt was made to reach the cardiologist, but he was away until Monday. The patient was advised to see the second cardiac surgeon so that his fluid could be removed promptly, but he wanted to wait until the cardiologist returned. "Too many cooks," he said. Subsequently, one and a half liters of clear pleural fluid was removed. He was bronchoscoped and found to have a large amounted of inspissated (thickened) mucus partially obstructing a bronchus. The cough subsided.

Next case:

> Taibe Beqaj is an 80-year-old Albanian woman who has come to the office because of abdominal pain and blood in her bowel movements. She was widowed 20 years ago. She came to the United States in 1976 but still speaks virtually no English. She lives with her sister-in-law, who is also widowed. Her first visit was in 1993 when she developed symptoms from obstructive pulmonary disease. The family had accepted her illness as related to being old. She responded well to antibiotics and bronchodilators and remained well in the interim. She was seen also in 2006 for a routine physical at her sister-in-law's urging.
>
> During the current visit her sister and adult nephew acted as her interpreters. For 2 months she has been having cramping lower abdominal pain associated with the urge to stool and relieved by moving her bowels. Her bowel movements have become more frequent than usual and are often associated with blood that stains the water but not the

toilet paper. Her appetite is poor and she has lost about 5 pounds. The pain is what prompted the visit.

She is a short, slight woman who does not appear ill. Her weight is 93 pounds. The entire examination was normal except for abdomen, rectal, and pelvic examination. There was mild tenderness in both lower quadrants of the abdomen without peritoneal signs. Rectal examination revealed a hard mass against the anterior wall that felt like a fixed cervix. The rectal mucosa was smooth. There was blood on the examining finger. A one-finger pelvic revealed the cervix to be freely movable.

Her hematocrit is 33% with a low mean corpuscular volume. Routine chemistries and the remainder of her CBC are normal. Her chest X-ray shows only the evidence of the pulmonary disease.

Considerable divergence of opinion among the consultants emerged in their discussion of Taibe Beqaj. There was agreement that the she probably had either a carcinoma of the large bowel or of the cervix with local extension—"a socked-in pelvis," as one of them put it. It was in the approach to diagnosis where there were varied opinions. For some the first goal was the classical one of making a specific disease diagnosis—sigmoidoscopy, perhaps barium enema, CT scan, and biopsy until the nature and extent of disease was clear. Others thought she should be referred to a surgeon initially. I also believed that the patient would be found to have an inoperable carcinoma and that planning from the very first should be directed toward the best death possible should death be inevitable. I started with the CT scan of the abdomen to see how bad things were before starting a standard diagnostic workup, much of which might be obviated if the disease was sufficiently extensive. The CT scan revealed considerable local neoplastic disease apparently arising from the rectum. In agreement with all the consultants that a tissue diagnosis was an absolute necessity, I asked a surgical colleague to sigmoidoscope her and biopsy the lesion in the bowel wall (which was the source of the blood on the examining finger). It was an adenocarcinoma of the rectum. Planning her care with this goal in mind—best possible death in view of the disease—from the beginning represented a change in my goals over the last number of years. It seemed that if ensuring a comfortable death to the terminally ill had begun to be a stated goal for medicine, that this idea should

permeate planning from the first contact with patients with incurable disease as well as those for whom death might threaten. This kind of planning does not replace the aim of relieving pain and other symptoms but actually elevates it and includes it in the more central goal, which is the prevention and relief of suffering.

One consultant was not so quick to foreclose the patient's options. She had had a similar case she believed could not be definitively treated but for whom the oncologists were successful in extending functional life. The oncologist who discussed this patient did not think that chemotherapy would be useful, although, he pointed out, "We're the ones who always have *something* to do when we're pushed to it." He suggested that she be referred to the surgeons at Memorial-Sloan Kettering to see what they might have to suggest. He used cases such as this to find out what was new. The surgeon who did the biopsy believed that she should have a diverting colostomy prior to the development of bowel obstruction. He sent a letter to the patient suggesting that she come to see him about surgery, but she did not respond.

I asked that the patient and the family come to my office to discuss the findings on the CT scan and the biopsy. The nephews already knew what I believed would be found. The nephews came but not the patient or her sister-in-law (their mother). I said that I believed that their aunt should be told what her disease was and what the options were. They politely but firmly disagreed. They also did not want their mother told. I pointed out that the patient and their mother must already know what the problem was and that it would be much easier to talk if the truth was out in the open. They agreed with my supposition but not my conclusion. "We don't talk about some things," the older one said, "the way everybody here talks about everything." The issue was closed. All of the consultants shared my viewpoint and were uncomfortable about not telling the truth. Some of them, of course, remembered that 40 years ago we very rarely told patients about diseases like this. Times change and so do some of medicine's goals. Everybody agreed, however, that cultural differences had to be respected. It is what patients want to know that counts, not what we want to tell them.

The next case is as follows:

> William Ganley is 67 years old and has seen no physician since his hydrocele surgery in 2007. He is a retired water department laborer who is married with three grown children who live in other states. He came in without an appointment, accompanied by his wife. One week ago he developed right flank pain and fever and began to feel not well. Five days ago he lost his appetite. Three days ago he began to have shaking chills. Today he feels much weaker.
>
> In 2007 at the time of his hydrocelectomy he was found to have an enlarged prostate but no renal stones were present.
>
> His temperature is 101° F by mouth. His blood pressure is 70/?. He has several days' growth of beard and appears ill. There is marked right costovertebral angle tenderness. His urine shows some pus and blood. His WBC is 39,000 with a marked shift to the left.
>
> He was sent directly to the hospital from the office and admitted to the Urology service. The Urology resident called to say that the chest X-ray revealed an infiltrate in the right lower lobe.

This case makes one final point in relationship to physicians' goals. The consultants with clinical experience were unanimous. Mr. Ganley is mortally ill. He does not have pneumonia, he is septic, probably from the urinary tract. The dire urgency of the problem and the requirements for treatment must be immediately communicated and acted on. Saving his life comes before everything else, including being polite to the resident. The diagnosis of sepsis was correct, the source was not. He had an abscess of the liver, which was drained by catheter with CT guidance. Subsequent studies revealed extensive diverticulitis as the probable origin of the abscess.

THE GOALS OF MEDICINE

We have discovered in the discussion of these few ordinary cases that physicians have many different and sometimes even conflicting goals when they take care of patients. As you read the cases and

their comments, it would not be surprising if still other goals came to mind.

There were the classic, expected goals relating to the patient—save the patient's life, prolong the patient's life, cure the disease, prevent or relieve suffering, do not do what is unnecessary (or more than necessary), do not harm the patient, protect the patient from danger, do not frighten the patient, relieve the patient's fears, make the patient better in the patient's terms. Perhaps all of these aims could be seen as aspects of the general dictum that the patient's needs come first. Perhaps one classic phrase summarizes these—do good and avoid harm. Or, as said in another aphorism from medicine's history, to cure sometimes, relieve often and comfort always. But I believe that we lose important understandings of the process of clinical medicine by such simple distillations of patient-centered goals.

There were goals that pertain to the relationship between physician and patient—develop and maintain a good relationship with the patient, be trustworthy, tell the truth, be constant, be reliable, be there when needed, make a difference. These are listed as separate goals because if they are not met, then it would be difficult to meet the goals of the previous paragraph. For example, Mr. Ganley's life could not have been saved if he did not trust his physician sufficiently to do what he was told to do when he was told to do it—after all we know from the history that he was not generally given to going to physicians. Sometimes these aspects of medicine are subsumed under the art of medicine and are differentiated from the science of medicine. In this book, which is about clinical medicine, I will not make that distinction. Part of the clinician's knowledge comes from medical and other sciences and is of varying reliability depending on the state of knowledge of the sciences themselves. Some of the knowledge might better be called skills and has been directly taught or learned from experience. Its reliability depends on how well-taught, learned, and practiced the skills are. Other knowledge about, as examples, the life history of diseases, the behavior of patients and physicians, medical politics, medical etiquette, and the physician's self-knowledge has generally been learned from experience. Its reliability depends on the experience, acuteness, and interest of the clinician. No effective medical care can take place in the absence of all of these kinds of knowing.

The importance of all of these types of knowledge surfaced again and again in the discussions of these cases. They are part of the goals of deciding what the problem is, making a diagnosis, making physiological or pathophysiological sense of the case, making anatomical sense of a case, seeking more knowledge in order to develop comprehensive knowledge, obtaining information, and deciding on the correct treatment and its timing. There were goals that related to the fact of being both a person and a physician who works with other physicians in hospitals—trying to look good and gain praise from peers and patients, avoiding error, avoiding blame, surviving in the institution, and maintaining good relationships with other physicians. Finally, some of the goals related to medicine as the profession of which each of these consultants is a part—whether student or emeritus professor—and aside from which the care of even an individual instance of illness would not be understandable: maintaining the standards of medicine, seeing that things are done right, protecting patients from bad medicine and incompetent physicians, and living the life of a physician among other physicians and in the surrounding community and society.

THE PRINCIPLES OF CLINICAL MEDICINE

The remainder of this book will develop the principles of medicine necessary to achieve the goals I have identified with the help of the consultants. All of these purposes and perhaps others that may turn up along the route must be met or the discussion will not be true to medicine.

You and I know that textbooks of medicine are generally devoted to discussions of disease or pathophysiological states; they do not primarily concern themselves with the purposes captured in the previous section. That is appropriate where the compendium of disease knowledge must be recorded. But this is a book about clinical medicine, written for working clinicians or those in training to become practicing clinicians. If it did not deal with these issues, it would not be true to clinical medicine. Another way of saying this is that clinical medicine is about a real world in which real people get sick and are taken care of by other real people. The knowledge required by clinicians must be about sick people, diseases, physicians, and their world.

A Summary of the Goals of Medicine

A. Patient-centered goals
   1. Save life.
   2. Prolong life.
   3. Cure disease.
   4. Prevent suffering.
   5. Relieve suffering.
   6. Do no harm.
   7. Protect the patient from danger.
   8. Do not frighten the patient.
   9. Relieve the patient's fears.
   10. Make the patient better in the patient's terms.
   11. Do nothing unnecessary (or more than necessary).

B. Goals related to the physician–patient relationship
   12. Develop and maintain a good relationship.
   13. Be trustworthy.
   14. Tell the truth.
   15. Be reliable.
   16. Be constant.
   17. Be there when needed.
   18. Make a difference.

C. Goals related directly to doctoring the patient
   19. Make a diagnosis (where pertinent make a tissue diagnosis).
   20. Decide what the problem is.
   21. Obtain the necessary information.
   22. Make sense of the case (in pathophysiological, anatomical, psychological, and social terms).
   23. Decide the correct treatment and its timing.

D. Goals related to being a physician among other physicians
   24. Seek and maintain comprehensive knowledge.
   25. Maintain the standards of medicine.
   26. See that things are done right.
   27. Protect the patient from bad medicine and incompetent physicians.
   28. Behave in a proper, doctorly manner.
   29. Look good to other physicians and the patient and family.

30. Avoid error.
31. Avoid blame.
32. Maintain relationships with peers.
33. Stay alive in the institution (hospital or medical school) and community.

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