**Round table Discussion**

*Scientific Thinking, Medical Thinking and Medical Education: Questions derived from their Evolution in the 20th Century*

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In the past forty years a great number of plans for educational reforms has been conceived in Western Medicine. The prominent features of those which have been realized were primarily changes in the situation of the learners, their pedagogic and didactic context, the HOW of medical education. Emphasis on learning rather than on teaching and more effective personal interactions with patients—outside of lecture halls—importantly upgraded the validity of these reformed curricula for subsequent professional practice. In full appreciation of this progress, this essay is more concerned with the WHAT of medical education, with its content and the concepts, on which they are based. Educational content undoubtedly has been more influenced by the growth and proliferation of the medical disciplines and specialties than by the vision of an overall proliferation competence at the end of undergraduate study (Pauli 1990). In taking up the question of concepts one must ask, however, whether it can be answered by “philosophizing” medicine. Indeed, the working physician going about her or his practice, must take the dominant philosophy for granted, and can seldom afford to question it. Our analysis therefore has to start at the level of practice.

In what, then, does this practice consist? One of its preconditions was the “discovery” of the eye as an *instrument* to register the color of the skin, the facial expression, or other visual impressions of the patient, the discovery of the ear to listen to sounds and murmurs from the chest and of many other ways of sensory perception. There followed the inventions of the stethoscope, of imaging using the principles from x-ray to nuclear magnetic resonance, of chemical and physical procedures to analyze body fluids and tissues and of all the other technical devices of increasing sophistication. To this statistics were added to validate the data derived from these methods and to assess the health of groups. The breathtaking development of technical instruments has in good part superseded the earlier instruments of primary perception, i.e. what is directly registered by the sensory organs. All this was meant to diagnose derangements of health more and more subtly and then to treat, to repair, occasionally to prevent, and rarely to maintain preexisting good health.

At the level of concepts today’s traditional natural sciences were consequences of the revival of a rationalist and materialist thinking founded at the time of Enlightenment in the 17th century, with Descartes as its central figure (Engel 1997). In the 19th century its one-dimensional, linear, cause-and-effect models and its predominantly technological constructs began to dominate scientific thinking. The representatives of the medical sciences were in the forefront to upgrade these latter scientific concepts to a world view. A biomechanical or biotechnical paradigm, highly appropriate to an era of industrial
development, had emerged. There can be no question of the extraordinary success of this paradigm, whose cornerstone was positivism. The introduction of autopsy as a clinical routine, early in the 19th century in France by establishing the subject of morbid anatomy, supported this materialistic model (Cassell 1979). The possibility to categorize diseases according to stable, visible, and describable phenomena promised to, and indeed did, deliver physicians of the incoherent and inconsistent nosologies of the 17th and 18th century (Faber 1932, Foucault 1973). Later, the spectacular discoveries in physiology, biochemistry, microbiology and genetics increasingly furnished explanations for the phenomena found in the dead body.

From this, a seemingly rational line of operational sequences was deduced, at the core of which was the idea of a reified “disease”: somatic (mechanistic) cause → somatic lesion → diagnosis (classification of disease) → disease → therapy → on-disease. At the heart of this model is the concept of a linear monocausality (a given physical cause, or in some cases an interactive cluster of causes, result in a specific disease). This doctrine of specific etiology is biased in favor of mechanistic phenomena, laying the ground for the subsequent tremendous development of technology in medicine and its dissociation from the psychic and social domains, considered to be a matter of intuition. The patient, then, scientifically speaking, becomes a machine; the focus of attention becomes that part of the mechanism which functions or—in the case of disease—does not function according to engineering prescriptions.

This dominance of the Newtonian paradigm and the institutional resistance (Bloom 1988) to change thinking about manifestations of life has been maintained up to these days. This is confirmed among many others by Arthur Kornberg who, as a Nobel price laureate represents the inner circle of today’s hierarchy of scientists. He postulates (1987) under a “reductionistic approach that I am espousing .... acceptance without reservation that the form and function of the brain and nervous system are simply chemistry, ... that mind, as part of life, is matter and only matter”.

At best, psychological and social phenomena are then characterized by such restrictive terms as “risk factors”, often placed outside of the domain defined as scientific, and seen as correlating with observed signs and symptoms at an exclusively statistical/probabilistic level. Causality in the “scientific” sense of the term may then still be associated with such correlations, but only under the condition that these ‘risk factors” have been conjoined to a mechanism or a nosology, that corroborates this correlation on physical terms. Such a methodologically based discrimination in the context of the 19th century scientific paradigm has led to a differentiation between “hard” (and seen as useful in the sense of mechanistic relationships) and “soft” (= not useful) data and corresponding insights.

Such views constitute abstractions which generalize, organize, potentially transform, and indeed to a considerable extent enable the perception of phenomena. There is a two-way process between the observations and the concepts (Fleck 1935, 1979, Kuhn 1962).

One central abstraction is the concept of diagnosis as exemplified by the International classification of Diseases (WHO 1994). We come to think that diagnoses are the only possible “philosophy”, the only way of perceiving and organizing our data.
However, diseased individuals rather than diseases are realities. The term diagnosis represents not statements of facts but of medical concepts. As such it is an *instrument of thinking*, in the sense that its use, non-use or alternative use will lead to different actions and effects. For example, to use the diagnostic term either of angina pectoris or coronary occlusion in an identical situation will set the minds of those making diagnostic or therapeutic decisions in different directions. In one case the orientation will be more towards a patient’s subjective perception, towards the person as a whole; in the other more towards an underlying substratum or mechanism, involving the vessels of the heart. At this point one might argue that experienced clinicians will hardly change their views by exchanging one term for another. In accepting this argument the importance of an early phase (in this case undergraduate medical education) in an individual’s development of a paradigmatic view has to be emphasized. Such a view and a behavior related to such a view have a tendency to become fixed and hardened for a whole professional lifetime. Under these circumstances skepticism concerning a philosophy in medicine has to be confronted with the fact, that *medicine is already “philosophized”*. The task before us is to evaluate how appropriate is the philosophy which currently guides us, to investigate into alternative or extended ways of thinking and to develop ideas concerning the practical implications thereof.

As a consequence questions arise at four levels. The following section will deal with 20th century general developments in the sciences. A second question concerns the implications of this general development for medical scientific reasoning. Thirdly, the need for terms and concepts upon which Western medical practice is supposed to be based, will be investigated in the light of current developments in medicine and health. Finally, the fourth question will seek answers as to how alternative and extended ways of thinking could affect our health care system. In view of the importance of the early phase of socialization of physicians mentioned above, conclusions for undergraduate medical education will be emphasized.

**Fist question: Is there any particularly urgent reason to engage in a discussion of terms and concepts in the context of today’s world views?**

Since the era of Enlightenment probably no more fundamental reorientation of general scientific concepts has occurred than during the preceding twentieth century. This period could well be named the second Enlightenment. The process started with the introduction of quantum mechanics by Bohr and Heisenberg and of the theory of relativity by Einstein among others. It has evolved with the proposition of cybernetics by Wiener, information theory by Shannon, systems theory by von Bertalanffy, non-equilibrium thermodynamics by Prigogine, and theory of chaos by Prigogine and Bohm.

Three main features characterize this reorientation:

1. The fundamental insight that scientific perception, and indeed perception in general, cannot be considered as the “objective” projection within the observer’s or investigator’s mind of a so-called “reality” or “truth”. The perception is always codetermined by the perceiver. The inseparability of the observer and the observed are the key elements of the Copenhagen concept (Heisenberg 1985).
2. Both the living and inanimate components of the universe must be seen as systems in which all that is perceived by humans is inseparably integrated
within a more extended suprasystem on the one hand, and is composed of many subsystems, on the other. Systems have properties that emerge at each higher level of organization and these emerging properties cannot be explained by the sum of the properties of their subsystems (von Bertalanffy 1968). Independently of this systemic view, the insight derived from quantum mechanics of a holistic structure of matter (Primas 1992, Atmanspacher 1994) has to be emphasized here.

3. At a functional level, there is emphasis on the phenomena of self-organization (Jantsch 1979, Maturana and Varela 1987) and, as mentioned above, of emergence of new qualities in the course of evolution, especially characteristic of biosystems.

These surprising reorientations emanating from an empirical reevaluation of the basic matter of the entire universe, began to uncover more and more data which could not be adequately explained by the regnant paradigm. The truly revolutionary feature of the development of the new concepts is their origin and acceptance within physics, the core and pivotal domain of all modern sciences, especially of medicine. A number of time-honored intuitive experiences have thus become elevated to the level of scientific explicable.

Thus as an answer to the first question, it must be considered as imperative that the revolutionary transformation in the scientific paradigm which underlies medicine can no longer be ignored.

Second question: How is medical thinking affected by the general reorientation in science and by the data which can no longer be explained with the current paradigm?

For centuries philosophers, observers of nature, poets and endowed physicians have, consciously or not, been familiar with the concepts of subjectivity, systems orientation, self-organization and emergence. This “second track” in the historical evolution of world views started-along with the rationalistic one-in the lifetime of Descartes with the physicist and philosopher Blaise Pascal. It was carried on by Antony Ashley Cooper of Shaftsbury, Jean Jaques Rousseau and by physicians and scientists of the German Romantic Age (Meier-Seethaler 1997).

In all these historic approaches, however, a scientific explanation, in today’s sense of the term, was lacking. Rather, these more intuitively grown fundamental concepts were swept away by the perceived explanatory power generated in the Enlightenment and the post-Newtonian era. Romanticism became an invective.

The concept of causality, biosemiotics, mindbody and health will serve as examples to demonstrate the directions, going beyond these constraints which are about to shape a new paradigm for the 21st century:

1. A model based on systems theory includes a concept of causality fundamentally different from that developed within the Cartesian natural sciences, based as it is on a mechanistic world view. Prior to its rise to general acceptance, a founding father of the subject of physiology in the German speaking area, Johannes Müller (1801-1856) had developed the concept of specific sensory energy. With this concept, which
can be considered as a precursor of the concept of self-organization, the basis was established for a biology in which interactions between organisms and their environment were not seen as linear and mechanistic. Müller conceived of an intrinsic internal activity of the organism which is not directly and physically related to the factors acting on it from the outside. His successors in the development of modern (i.e. still representing today’s mainstream of science) physiology considered this concept to be vitalistic and thus “non-scientific” preferring the stimulus-response model which can be reduced to the classic natural laws. The aim was to explain life on physical grounds and thereby to reveal well-defined and remediable causes of health derangements.

The limitations of the biomechanical line of reasoning is made evident by the seemingly trivial fact that the corpse is not identical with the living body. The living organism differs from the corpse by its inherent autonomy and capacity for self-organization. Living structures are able to “specify their individual lawfulness” (Maturana and Varela 1987). The corpse may respond to a physical or chemical stimulus in a specific mechanistic and predictable manner. The living organism responds to such stimuli as well as to psychological stimuli as a whole and non-deterministically by changing (adapting) its process of self-organization. The relative importance of these external “stimuli” (the use of this term thus becomes somewhat questionable) has to be qualified. Maturana and Varela (1987) describe them as “perturbations”. Or, rejecting objectivity of perception entirely, they speak of organisms, of individuals as systems which “bring forth their own world”.

2. At this point it might be argued that molecular and genetic biology has identified, or is on the way to identify the agents of life processes and of their disturbances. Without minimizing the tremendous insights into biological structures and functions which have been achieved in these fields, it has to be stressed that molecular or genetic entities are not the messages (signs, information) but the chemical structures of messages (= messengers) maintaining life processes. Likewise, functional phenomena, such as the interaction of transmitter substances with the receptors on cellular surfaces or the flow along neural and transmembrane potential gradients allow no conclusion concerning the content (the meaning) of the information (sign, message) flow. They are merely phenomena of transmission without evidence of their significance for life processes in general.

Moreover, the relations between these observed molecular and genetic entities on the one hand and the structure and functions of the whole organism on the other, are far from simple and linear. Concerning the genome Barbara McClintock (1984) has brilliantly demonstrated its actions but more importantly its reactions to a multitude of challenges coming from in-and outside of the organism. In her words the genome is “a highly sensitive organ of the cell that monitors genomic activities and corrects common errors, senses unusual and unexpected events, and responds to them, often by restructuring the genome. We know about the components of the genome that could be made available for such restructuring. We know nothing, however, about how the cell senses the danger and instigates responses to it that often are remarkable”. Genetic expression (the transformation of genetic messages into structures and functions of biological systems) thus has been shown to be a highly complex (“epigenetic”) process, incompatible with spectacular hopes and predictions of advocates of genetic technology. To quote the molecular biologist Richard C. Strohman (1997), who doesn’t underwrite these hopes, “the Watson Crick era, which began as a narrowly defined and proper
theory of the gene, has mistakenly evolved into a theory and paradigm of life: That is, into a revived and thoroughly molecular form of genetic determinism”.

Contemporary science, by reducing all life phenomena to their biochemical or cellular mechanism and its aspects of communication to the carriers of communication, thus limits the understanding of disease and even more so of health (see below). Simpler and more convincing explanatory models will emerge from first line emphasis on the flow of information and not primarily and exclusively on material elements such as structures and signals (Foss 1987, 1989, Weiner, 1989). At the level of scientific understanding this stresses the importance of a biosemiotic way of thinking, that is: the interpretation of (the assignment of meaning to) signals.

Two short case reports may serve as a metaphor:

I. (Situation of a married couple, residents of West Berlin in 1962:) The husband was surprised by the erection of the Berlin wall in 1961 while visiting his parents in Eastern Germany. There was no legal way for him to return. During several months he prepared to cross the wall illegally, thereby risking his life. Through secret channels the wife was informed of the plan and of the night of its attempted execution. A phone call was promised for the time immediately after the successful crossing.

During the much expected and dreaded night the exhausted wife falls asleep. At 3 a.m. the phone rings...

II. (Assuming the same couple in a different situation:) The wife has come back at midnight from the hospital where her husband is under intensive care in a state of prolonged shock after being struck by an extended myocardial infarction on the previous day. After anxiously staying at bedside of the slightly improving, but still critically ill patient, the physicians recommend to the wife to return home for rest. She is assured that the condition is under control and that no news will mean good news.

At home, the wife immediately falls into deep sleep. At 3 a.m. the phone rings...

In both cases initially comparable processes at a material level can be described. The immediate reaction to the ringing phone will be symptoms connected, among others, with an incretion of Adrenaline, such as elevation of heart rate and blood pressure. The further course in case I and II will be different: One can assume the occurrence of thousands of different observable patterns of neural activity and endocrine or neurotransmitter metabolism. This will accompany emotions of joy and relief on the one hand and despair and mourning on the other. Furthermore bodily symptoms of well-being as compared with “psychosomatic” organ dysfunction will be observed.

Yet how can this be? How can two different immaterial and interpretative activities of mind, a res cogitans (according to Descartes) in each case, causally interact with a-to begin with-similar condition concerning the “extended” substance of the body, the res extensa? Can meaning override chemistry? The question is a stumbling block for Western medicine. The short answer is: in the vocabulary of the traditional model it cannot.

3. The preceding arguments concerned with causality and semiotics thus conceptualize health and disease as due in part not just to our material circumstances
(genes, germs) but also to our dispositions, the meanings we assign to these and other-immaterial-circumstances. A psychosomatosemiotic model seeks to explain why this is so: in a living, self-regulating system informational inputs are essential regulators of biological processes. They activate system receptors which convert them into messages that initiate physiological changes. In this way the messages sent through our systems are themselves etiologic factors; belief impacts biology. Furthermore, the category of structures of messengers (instead of messages or signs), e.g. molecular or genetic entities as mentioned above, is strictly limited to an area within the confines of the “body” (including the dead one). However, these confines are transgressed by life processes. The body, then, in the context of the living organism, becomes a scientifically questionable concept. *Mindbody* (or the mindbody-environment system) appears to be a much more realistic framework for the study of life processes. One is reminded of the relativistic space-time concept in modern physics; a scientific model must include all rationally founded views of a given phenomenon.

These conclusions contravene the physicalistic patient and disease concept of the traditional scientific model. Evidently, the patient is not a “silent” biological organism, nor disease a deviation from the norm of biological parameters alone.

4. The fourth major reservation to the core concepts of the established medical sciences refers to the production of health. The term, production of health, is an unusual notion in today’s medical thinking. Health is traditionally considered as an unexamined, preexisting statistical norm, a selection of physical and chemical nominal values, which potentially are exceeded or not attained in ill health. However, close examination of empirically-founded circular (systemic) models for the living organism and its environment such as the functional circle (J. von Uexküll 1957, 1982) or the situational circle (Th. von Uexküll 1997), concerning the human-environment system makes the production of health a strikingly fruitful model. It introduces the post-biomechanical concept of meaning (an informational or semiotic-as distinct from the material/energetic or somatic-modality). This model proposes that the living organism makes use of selected items in its environment by assigning meaning to them. Survival, including the avoidance of harmful influences, is then the result of utilizing this meaning. The everyday terms of utilization and survival have to be specified. The first should be understood in the sense of assimilation (Piaget 1975), i.e. the building-up of structure by utilization of the elements available in the environment. Survival denotes accommodation (Piaget 1975) of nominal values of a living system to a changing environment. When accommodative power is exhausted, phenomena of damage or of deficiency will set in. Living systems thus have to be produced out of the environment available to them (assimilation). As this environment is constantly changing, processes of accommodation are a precondition for the maintenance of the systems. Their impairment and destruction sets in when these vital processes are overtaxed. The models of the functional and situational circles thus represent the development and maintenance of living structures, that is the phenomenon of dynamic self-organization of living systems. In a medical perspective, this can be seen as the production and maintenance of health.

Aaron Antonovsky (1987), a medical sociologist coming from outside the domain of medical professional culture, has, in a parallel but independent development, followed this line of thought. He was among the first in our era to criticize the shortcomings of
today’s exclusive fascination of the medical sciences with pathogenesis. In order to deal
with the hitherto uncharted areas on the medical scientific map concerned which the
production and the maintenance of health, he proposed a new term: salutogenesis.
Antonovsky has integrated some central preconditions for salutogenic phenomena and
processes in his concept of the sense of coherence. Its main features are the
comprehensibility, the manageability and the meaningfulness of the environment which a
person-or a living system generally-perceives as its own. As assignment and utilization
of meaning are a precondition for these features, Antonovsky’s salutogenic model is in
agreement with the circular models of Jakob and Thure von Uexküll mentioned above.
Although such systemic views are supported by empirical data, their acceptance among
medical scientists is marginal. Meanwhile pathogenic models of thinking have extended
into a gigantic field of knowledge, experience and production.

As a consequence of a health-oriented expanded model of medicine, illness and
disease, then, can be seen, in part, as a persons or organism’s failure to find or to generate
meaning in her, his or its experiences and opportunities. This is well in line with the
literature on stress theory: not the stressor as such in the first place, but what meaning is
assigned to it, is the relevant etiologic factor. Not just the intrinsic and independent (e.g.
molecular) nature of an agent but the meaning which the living system attaches to this
agent (conditions of coarse mechanical destruction excepted) is a co-determinant of
disease-and health.

We have here, by close examination of the concepts of causality, of biosemiotics,
of mindbody and of health, answered the second question: Historically grown
experiences with living systems can be elevated to the level of scientific explicability.

Third question: Is there any particular urgent reason within the realm of medicine
and health care itself, to engage in such a discussion of terms and concepts now?

Perhaps the most urgent theoretical reasons for such a discussion is that the
International Classification of Diseases, the operational definition of medicine’s
paradigm, has become a Procustes bed. The data show that up to 60 percent of the
problems that patients bring to practicing physicians cannot be fitted into this
classification system (White 1988). These are patients with ill-defined conditions or
symptoms without physical markers, and patients who have well-defined diseases, but
whose needs are for rehabilitation or palliation, rather than cure. New movements and
discipline have emerged to help some of these groups: the hospice and palliative care
movement, multidisciplinary pain clinics and rehabilitation programs, family medicine
and geriatric medicine. The fact that they often involve several health professions
working as a team is significant, since disciplines like physiotherapy and occupational
therapy think naturally in terms of function rather than pathology.

The dominant paradigm’s monocausal model of disease, so successful in the past,
have become less and less applicable with the growing importance of social life situations
(e.g. alcoholism, malnutrition, AIDS, drug addiction, family violence) and chronic illness
(degenerative, arteriosclerotic and neoplastic). The conceptual separation of mental from
physical disorders has become more and more anomalous, as evidence for their inter-
relationship has accumulated. The detachment of the physician, increased by the
alienating effects of technology, seems to have produced a generation of physicians who
cannot communicate effectively with patients.
Some recent development can be viewed as symptoms of the crisis that confront us:

- Every Western society has now raised the issue of the costs of technological medicine to the forefront of its agenda. Physicians have seldom been trained to think in terms of financial cost-benefit analysis. But governments are more compelled to confront the issue when health costs mount to more than ten percent of the GNP. An increasing rate of malpractice litigation in some countries is another symptom of this dissatisfaction.
- The increasing emergence of what has been complementary medicine expresses a growing dissatisfaction of patients with what in Western societies has become traditional medicine.
- The data in all Western societies indicate an epidemiological trend, in the past generation, toward an increasing social class gap in levels of health, a trend in conflict with the underlying moral premise of health equality for all persons—not to mention the even more important gap between Western and development world regions.

Our answer to the third question, then is: Given that a growing body of data directly confronting the practicing physician can no longer be explained by the traditional paradigm, there are very serious “internal” reasons for a fundamental reexamination of the paradigm.

Forth question: Will a change of medical paradigm affect medical practice, education, and research?

In the interest of brevity in dealing with this question, we may—in an exemplary way consider some core issues in medical research and practice: what kind of data are to be sought.

Thus, what role in the course and severity of a disease (breast cancer) do sociocultural attitudes towards breast disfigurement play (Edelstyn et. al., 1975)? What influence has separation whether from a family member, neighbor, even a pet dog on the incidence of cardiac failure (White et. al., 1959)? What levels of mortality correlate with the existence or non-existence of supportive social nets in ones immediate environment (Berkman and Syme, 1979)? How does the psychosocial situation at work relate to the incidence of myocardial infarction (Siegrist et. al., 1988, Marmot et. al., 1977)?

These are examples of research questions which at the time of emergence of today’s biomechanical model, were neither relevant for the then prevailing psychosocial conditions, nor-if they were-researchable with the methods then available. Obviously, once the power of the biomechanical model was established, this type of questions did not, for a long period of time rise to the level of awareness of the research communities. Yet, such questions, the available methodology to tackle them and the type of data generated by these methods, reaching across the mind-body borderline, will be most important for the understanding of today’s panorama of health and disease. The root issue concerning the development of new scientific views and instruments, concerns the question what are the causal mechanisms, the salutology or nosology, that explain their
reported correlation of such data with maintenance of health or with disease susceptibility in today’s societies?”

The problem of the observe, that is, the reconsideration of the relation between subject and object, calls for a fundamental revision of the relations between physicians and their patients. This follows from the insight, that the “objects” perceived by an observed individual rooted in her or his proper subjective environment, are not identical with the “objects” of the observer. The relationship between the two individuals is therefore not linear and static, but circular and dynamic. Part of the “environment” of an individual (physician or patient) is his or her partner. The objective will then be the creation of a common reality between physician and patient (Th. Uexküll and Wesiack 1997). This interaction is to be considered as an act of purposeful scientifically-founded endeavor and not only and expression of a humanistic attitude. Whilst traditional biomechanically oriented physicians cannot be accused of being inhuman, the need to train physicians in specific medical interpersonal skills and to control its quality is a concrete part of the medical task. Important as they are, however, skills alone are not enough. The control exerted by the physician in the traditional clinical method protected him or her from having some very disturbing feelings. Sharing this control with the patient, renouncing power, and encouraging the expression of feelings, removes this protective barrier. This requires much greater insight into relationships and, above all, self-knowledge (Lipkin 1995).

There are major implications for medical education. We will need to restore the idea of medical education as amoral education, i.e. attention to personal development of each student in the moral sense: the cultivation of true sentiments, of habits of reflection, of the imagination, of capacities for self-knowledge. It will involve also the correction of false sentiments. What we are dealing with here is a different paradigm of knowledge-a paradigm which has virtually disappeared from medical education: the personal, particular, intuitive, affective understanding of experience. This tacit knowledge is transmitted mainly by the informal curriculum: the environment of learning, the moral climate of the medical school, and the belief and actions of its teachers (McWhinney, 1991, Schüffel and Pauli 1997). Even recent developments in the teaching of ethics do not fill the need for this kind of knowledge. Courses in bioethics usually deal with ethical issues on the level of discursive logic. This enables students to see the issues as external to themselves and absolves them from the task to understand themselves.

Under these circumstances, at a more basic level, medical care, as an important fraction of overall health care, delivered by state supported and private institutions and systems, has to be considered as a social good. Consequently, a medical school’s responsibility to the public assumes the form of a social contract which extends beyond the autonomy of the medical profession-or, even more evidently, of its academic fraction.

The need to consider an ecological context of health, including all facets of communication, is part of the more general requirement to view phenomena as components of the systems (see feature 2 under the first question) into which they are integrated at a higher level of organization. At a somatic level, it will be difficult to understand the immune system without notion of the environmental (ecological) factors which determine its function. In the sociocultural domain, physicians cannot successfully care for patients of a cultural background different from their own without some
familiarity with this culture. These examples, out of innumerable similar ones which
could be given, illustrate the constant challenge to the physician’s “context sensitivity”.
Physicians are required to “think big”, possibly in order to “act small”. While workers in
many other fields have more freedom to choose between pursuing either extremely
specialized or very general interests, physicians with front line responsibility for their
patients-and this is the level at which medical education has to aim, do not have this
choice.

In her book, Philosophy in a New Key, Suzanne langer (1942) says that when the
springs of philosophical thought have run dry, leaving questions that are unanswerable in
terms of Weltanschauung, the succeeding age does not answer the questions but reframes
them. We are, in her view, at the end of a philosophical epoch, when the generative ideas
of the 17th century (Whitehead’s century of genius) have served their term. If we should
have new knowledge, “we must get a whole world of new questions”. A new generative
idea has dawned, Langer argues: the power of symbolism. “In the fundamental notion of
symbolization...we have the keynote of all humanistic problems”. Thus we may have in
our hands the key to the seemingly insoluble problems of our time-the separation of
subject and object, and the split between head and heart, the physical and the spiritual.

In many ways the healing of this split is also an objective of gender studies. Feminist critique of an objectivistic male culture of science questions its aims, its
premises and its methods (Meier-Seethaler 1997). They are seen as the expression of an
historical evolution which considers man the hunter as the downright generator of
culture, while woman the gatherer, at a lower level of social power, remains responsible
for the more personal part of human existence (Slocum 1975). Feminist science strives
for a systemic restoration of this established imbalance of scientific culture.

Systemic views and concepts, crucial to practice, emerging from these
development, will have very major implications for Educational Policy and Development.
The predominant role of Family Medicine, as compared with more specialized
disciplines, in this future development is quite obvious (McWhinney 1975, Pauli 1990).
Clearly a new paradigm will also shape Medical Research. Highly specialistic
disciplinary research will continue to be needed, but it will no longer continue to be
preeminent, and will have to share resources with interdisciplinary research, e.g. the new
filed of psychoneuroimmunology. But above all, and perhaps least clearly evident, a new
paradigm will shape Health planning and Policy at the family, community, regional,
national and international levels. Systemic and integrated thinking of those, who make
the basic decisions, should help to diminish some of the inefficiency, ineffectiveness and
waste characteristic to today’s Western health systems. Within health care institutions,
the nature of relations between physicians and other workers will come under basic
scrutiny (White 1991).

With a renewed interest in the production and maintenance of health the focus of
the professional task in the field of health will turn to what in everyday language is called
a healthy person. A person as contrasted with the term patient, so far favored in a
professional medical context, should balance out the traditional asymmetry between him
or her and a traditionally dominant (mostly male) physician. Healthiness, then, can be
seen as a dynamic state, not some abstract ideal. It includes well-being and function
under the condition of sense of coherence, possible in spite of the presence of disease, impairment, pestilence, imprisonment, et cetera.

Finally, the vision of a true change of paradigm in medicine must also include the use of words and terms. The term Basic sciences may serve as an example. It denotes, in medical schools, the point of departure, upon which all the more applied sciences and areas of practice are founded. It ranges from time honored Anatomy and Physiology to more recently introduced fields such as Molecular Biology. Characteristically, they are aimed at parts-organs, cells, molecules, numerically describable functions-rather than at organisms, persons, or even individual-environment contexts. After trying to answer three questions concerning ways of thinking in medicine, we have to reflect, whether these “parts” are truly basic. No doubt, they are important; we need many of them, when we practice medicine. However, future practitioners will never need an increasing number of them. They have emerged in the course of the evolution of the scientific subjects and disciplines, rather than of the evolution of our view of relevance for health and disease and of competence to practice medicine. The answer to the problem is, how to find it at the time of need, a question of information retrieval. Fortunately information technology facilitates the search for such eventually needed “parts” - another reason for abandoning an outdated encyclopedic model of medical education. If the enormous catalogue of scientific facts and data, produced while medical disciplines evolve and split up, can no more be called “basic” what, then is basic to medicine in general (and therefore to medical education)? To find answers to this question is a precondition for reforms at the levels of medical education, science and research as well as delivery of health care.

To pick up one example, a vision of a reformed curriculum of medical education: Why shouldn’t students not be introduced to medicine at its truly basic level, envisaging a somatopsychosociocultural model, drawing on already existing systemic (in the sense of individual-environment) sciences like the Neuro-and Immunosciences, Psychology and Sociology? In such a model the former “basic sciences” in the context of problem based learning would become instrumental sciences, systemic ones could then be considered as basic (Pauli and Schöffel 1998).

Our answer to the forth question, then, is that a change in medical paradigm will inevitably reverberate throughout all of medicine and health care.

It goes without saying that the change of medical paradigm on which the preceding questions and answers were centered are, in most areas of the world, a vision far away from reality. For reforms along this line problems of sociopolitical power will arise. To take again medical education as an example: The established power of the present curricular decisionmakers, the highly specialized academic elite, would have to be taken over by generalist practitioners in cooperation with representatives of other health professions (e.g. nursing). Specialized disciplines would have to render their services where needed-a bottoms-up situation! Countries with less entrenched academic hierarchies than those in Europe and North America might well take the lead in such an overdue development.

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T.von Uexküll (Freiburg, Germany)

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**Discussion:**

**Kenneth Cox  M.D. FRCS, FRACS.**  
*Emeritus Professor of Surgery,  
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Thoughtful papers that challenge our assumptions enrich medicine as a scholarly profession. But such a conceptual feast can be difficult to digest. I am familiar with only a limited number of the references. I shall follow the sequence of the paper, which begins with clinical practice. This response is idiosyncratic, rather than handling all the arguments posed in the paper.

As a simple surgeon, I see one to one illness care as the original and continuing task of ‘medicine’. Illness is explained as manifestations of disease. Which forces exploration of disease pathogenesis in body fluids, tissue samples and organ images. Treating the disease fixes up what’s gone wrong, reversing the pathological process, removing the bad bits, and restoring the body to ‘normal’. ‘Body as mechanism’ needs expert body mechanics to wash out the accumulated filth from weak kidneys, adjust the timing of the heart with a pacemaker, reline creaky joints, and replace worn-out parts.

But some activities become enthusiastically excessive. Investigational data are sought ‘because they’re there’ – the Everest motive. Positive feedback from successes and from fresh opportunities sustain a ‘technological imperative’ – “The invention is the mother of necessity”. The ‘system’ is self-reinforcing (while the external flow of money lasts). But not necessarily effective, and frequently not cost-effective. And often not what the patient wanted!

We begin to see some uncertainties in whether the direction of medical care matches the variety of needs in illness care (before we even ask about ‘health care’).

Look back to see how this has happened. Exponential growth of knowledge (and consequent technology) has shortened its doubling time from about twenty years early in the century to about eight years today. As in biology, growth is followed by differentiation. Professional differentiation into specialties based around organs or procedures has engendered organizational differentiation to house and staff the attendant technology – hospital as ‘body shop’. For patients, this ‘dis-integrates’ care, separating investigation from consultation, treatment from convalescence and rehabilitation, prevention from cure.

Where doctors work, what clinical work they do, and what is expected of them separates clinical subcultures of specialists and generalists. Their daily tasks differ. So do their criteria of what’s important, and what constitutes success. Some specialist tasks are ‘instrumental’ or ‘procedural’ in doing things on or for the patient. Some generalist tasks are more ‘management’ activities, noting the many characteristics of the patient, fostering their adaptation to their illness, and linking their care into community facilities.

These differences are the consequence of the subdivision of work, not primarily of the philosophy and ideology of each professional group. Specialists face a high prevalence of serious, life-threatening, organic diseases among their patients. These diseases need pharmacological or procedural, interventionist treatments focused on organs and diseases, and undertaken within hospitals. To do this well, the specialist seeks maximal control over the situation by pursuing full knowledge of the disease through extensive investigations, and by mobilizing many different human and technical resources for joint attack on the disease.

But within those allocated tasks, specialists are not dealing with the whole patient. Specialists are not rewarded, and often not admired, for tackling areas outside the specialty for which they are paid. Specialists may become so focused that they are less able to recognize non-organic states or their patients’ other needs. And because they
know more than anyone else about the diseases they manage, they are often unwilling to negotiate management options.

Look more closely at the separate subcultures of specialist and generalist. Specialists deal with an episode of disease in a Patient as Stranger, free of their context, unless it affects management decisions. Generalists deal with the on-going life and maladies of Patient as Neighbour, with all their personal contexts of family, work and community resources. Specialists see ‘illness as disease’ requiring treatment, while many generalists can see ‘illness as part of life’ requiring management. The disease model is not ‘wrong’, but incomplete.

Outside hospital, the patient’s local and personal circumstances (psychological, social, occupational, community, income and culture) are central to management options. The person is not simply a ‘case’ of a particular disease, but a fellow human being with a range of needs to be fitted somehow into the resources of that local health system. The complexity of the patient’s multiple problems often requires management to be ‘titrated’, rather than being identical from one patient to the next.

Specialists work at many levels from organs down to molecules. Their disease models largely fit linear, cause-effect reasoning within logical positivism. Specialization rewards tunnel vision. Generalists work at many levels, from organs up to society, which require systems or web thinking in an ecological model of health.

To end this beginning portion, I see increasing specialization as inevitable and inexorable. The task for practice is to mitigate its unintended consequences, such as mutual ignorance of what each other knows and can do, and disintegration of patient care. The ‘unit of study’ ought to be the ‘health team’.

First and second questions:

Shifts in world view outside medicine are slow to affect its self-contained thinking. Even explanations of disease as malleable or even replaceable genes can be accommodated. Three findings within medicine are forcing some re-thinking, however.

First, what patients think about their disease can affect morbidity and mortality. The meanings (expressed in ‘internal conversations’ or self talk) can stress the immune system, a reversal of Cartesian separation.

Second, qualitative research turns up multiple, weak, non-deterministic factors entering the judgment and decision calculus of clinicians. Treatment does not automatically follow diagnosis. In parallel, many voices may enter debates on management policy (with abortion, pollution, mental illness, substance abuse) – ethical and moral, legal, public interest, cost. Not only do these transcend science, they demonstrate the absence of ‘one true answer’ in this ecology of illness and decision making. Easy science works with hard data. Hard science works with soft data.

Third, not only is the brain recognized as a hormonal organ, but the limitations of its cognitive functions demonstrate how reductionist science has been forced on us. We learn clinical medicine in two ways, inductively from experiences with patients, and deductively from explanations of those clinical experiences from bioscience. These two ‘ways of knowing’, experience and explanation, reflect two distinct ways our brain handles the inputs.

Everyday perceptual and hands-on experience constructs our sensory knowledge of the world around us. Our perceptual brain takes in whole images simultaneously (the Gestalt) from the sensory inputs of seeing, hearing, touching, smelling and tasting. This
'parallel processing' of whole pictures captures rich details and patterns which are 'recognized' (known again) later by this spatial, imaging, 'right' brain.

In contrast, our explaining, language brain absorbs streams of words as we listen, talk and read. This slow 'serial processing' through narrow input channels links the words about the experiences with our store of explanatory science in long term memory. We think and discuss in words. We construct rational arguments to test our scientific explanations within this logical, 'left' brain, which also manipulates abstract, numerical symbols. We learn to think and explain in its sequential, linear frameworks about how causes lead to effects. We work backwards sequentially from effects to causes to explain the beginning of the universe and what God did.

Meantime, on Sunday the perceptual, experiencing brain happily relishes simultaneously the imagery of soaring arches, the smell of incense, the cadences of rich organ music, the joy of singing together, and the spiritual ‘meanings’ of ritual, none of which can be tested logically by the left brain. When we ignore these intangibles, we fail to acknowledge appreciation, judgment, and creative capabilities. We disregard the intangibles of students’ intrapersonal and interpersonal development, then wonder why some do not communicate well with their patients.

As science has grown, its very explanatory power has intimidated any ‘experience’ which cannot prove it is right in those terms. We have become prisoners of the ways our logical, numerical, abstract brain works, and of its pejorative rejection of whatever does not meet its criteria of objective, verifiable evidence. "Legitimacy is given to knowledge that is formal, abstract and general, while devaluing knowledge that is local, specific and based in practice and skill. Paradoxically, knowledge which can be expressed in words seems somehow more accessible and tangible than knowledge which is expressed in performance ... in the 'hands-on' real world." (1)

But that logical brain is forced into reductionist, analytical mode from the limited size of its ‘working memory’ which can handle less than ten chunks of information at a time. That neurophysiological limitation (called ‘bounded rationality’) forces us to ‘close’ open problems because we can handle only one possibility at a time before working memory overflows. We limit the number of our diagnostic guesses ('hypotheses') to narrow the search task. Seeking only a limited set reduces the exploration to what working memory can accommodate.

That same limitation forces scientific method to ask one question at a time about a small area within unifactorial experiments, since multifactorial interactions are beyond its capacity. (2) And forces 'context-stripping' by removing from its simple equation all the contingencies which could affect the single question being asked. Those confounded 'confounding variables' are distributed as neatly as possible on each side of the equation to share their influence between tested and 'controls' (hoping they are not the really powerful variables). (3)

The trap is that we study only what scientific method can cope with, and only in the way scientific method copes. But the world is complex in the number of variables at play, unpredictable as those variables interact (as chaos theory displays), and many-layered (from molecular to societal levels). Scientific method is soon out of its depth. Those taught only about scientific verification do not comprehend its limitations, and their significance. Their fierce defense of their methods is not wrong (in terms of its internal logic). It’s just incomplete, and not up to the task of investigating systems at work in an illness ecology.
Third and fourth questions:

Few clinicians are aware that their diagnostic classifications are not ‘true’, but normatively agreed. And a polyglot mish-mash. Clinicians don’t care, if the diagnostic tag is useful.

Solo specialist work will not perceive any need to shift its paradigm, but team work around the complexity of care (e.g. AIDS, diabetes, asthma) and the range of co-professionals involved, has changed the delivery of health care. What are currently matters of organizational planning within practice will eventually affect medical education, requiring comprehension of multiple causation and multiple contributions to the patient’s health.


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The paper makes essentially three points, namely:

1) The earlier history of modern experimental science, usually called Newtonian or Cartesian, assumed that there is an objective physical world out there governed by laws of nature. Therefore the role of science is to understand these laws so that man, like an engineer, can make use of nature's forces according to his own purposes.

2) With the coming of Einstein's Theory of Relativity and then Quantum Physics by Bohr and company, the scientist realized that scientific investigation is a bit more complicated than what Newton and company first imagined. This time the scientist realized that the questions he poses and the hypothetical concepts he generates in order to put coherence to the raw data are part and parcel of what resultant scientific knowledge is. In other words, the very act of observation transforms the object being observed. There is then a more dynamic relationship between observed and observer, between subject and object, between man and nature. Scientific advances have been driven not so much by the accumulation of more data about the physical world, but by new questions asked and new paradigms used to interpret and put coherence to the data gathered.

3) Given the above developments, the authors propose that Medicine itself needs to shift: from remaining heavily Newtonian and deterministic, with the patient essentially passive and the doctor, like a mechanic, puttering about here and there to retune chemical and physiological processes, to a more dynamic orientation, regarding the patient as a conscious, self-organizing being with an active role in maintaining his health or remedying his illness. Thus the importance of "bio-semiotics," in other words, the importance of concepts by which the patient interprets and puts coherence to what he is experiencing. The patient-doctor relationship, then, departs from that of a machine-mechanic
relationship to one where one subject communicates to another and helps the other interpret and makes sense out of the experienced maladies.

Hence the authors propose that following the shift in modern physics, science and the practice of Medicine should follow suit-in the attitude toward health and disease, in the way doctors regard patients and vice-versa, and in the very structure of medical education and the development of physicians.

The authors then proceed to point out the major implications for medical education, such as the personal and effective understanding of experience; the consideration of medical care as a social good; the need to consider an ecological context of health; and so forth.

I found this paper quite complicate. It could be expressed in a more simple and understandable form which will make it more beneficial in conveying the message across. I also found myself very limit in discussing this paper.

**Professor Aree Valyaseevi, M.D.**  
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In principle, there seems to be a consensus on the concepts of the bio-psycho-social model or holistic health. The WHO’s definition of health, the Alma Atta Declaration and the Ottawa Charter are concrete examples of translation of the concepts into practice.

If one is concerned about how medical education could contribute to society, it is more worthwhile to consider the challenges to medical education and the approaches to meet those challenges, rather than to put efforts on exploring new concepts of health.

What are the challenges facing medical education in this era?

Since medical education is part of the health services system, the goals of health sector reform should be regarded as the challenges of medical education. That is, medical education needs to address the issue of developing a health system which is more efficient, more equitable, more accountable and of higher quality. It should also support the movements to emphasize health promotion and disease prevention as strategies for health development.

The processes of achieving these goals consists of the reform of health financing, health services structure, health services management and human resources for health development. In this regard, the specific question for the role of medical education is how medical education prepares students to share the goals, and understand the processes of, and be willing to participate in, the reform movement.

Without such preparedness, the physician community could be a big a barrier to reform. For instance, the Australian States’ movement to cut intakes to medical schools at the undergraduate and postgraduate levels (specialist training) failed due to so called
“medical specialist/academic push”\textsuperscript{1}. In Thailand, an attempt to reform the professional structure in order to improve efficiency in a medical school during 1970’s was successfully turned down by a group of academics. These two examples are among several concrete evidences testifying the enormous power of the medical profession in shaping health policy. So far there has been a tendency that health care reform in many countries is not fully supported or even opposed by the medical profession.

Hence, to prepare medical graduates to support health care reform, becomes a major challenge for medical education. The integrated approach encompassing various strategies seems to be more promising than any single approach. Evidence-based medicine, the second version of clinical epidemiology, is an approach to promote utilization of scientific evidence in clinical decision making. At the same time, this approach also enhances the understanding of public health perspectives, societal perspectives and economic perspectives in a clinical setting. It helps a clinician to view clinical medicine and public health as a continuum rather than a dichotomy. As a result, evidence-based medicine enhances a clinician’s role in supporting health care reform.

Community-based medical education is another approach which has been adopted by many medical schools throughout the world. In combination with problem-based learning, medical students learn how to systematically identify health needs in the context of a community in which health is an integral part of people’s lives. They also learn to appreciate the potential of the community in handling its own problems.

Given the fact that health needs, health systems and knowledge are changing over time, continuing medical education is a must. Sustaining and updating essential knowledge, skills and attitudes of medical graduates involves both formal and informal education. Formal education involves postgraduate training in various forms such as residency training programs, short course training, and fellowships. The questions are: 1) What is the optimal number of specialists in each field for a given time period? and 2) How to increase the relevance of each training course to the health needs and health services system? Life-time self study is the key issue when taking account of informal education. So far, journal reading seems to be the predominant mode. However, given the advancement of information technology and organizational management, novel approaches to informal education are emerging. Computerized medical records providing diagnostic, therapeutic and outcome data offer an opportunity to systematically learn from aggregated clinical transactions. Total quality management (TQM), a managerial know-how, is increasingly adopted into hospital systems in which organisational learning has been promoted.

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\textit{Past President (1987)}
\textit{American Public Health Association}

The paper by Professors Pauli and White examines the development of the content and approach of modern medical education from the evolution of scientific work over past centuries. Science has made enormous progress through analysis of the human condition in its environment by subdividing it into many parts. From these analyses there emerge many specific diagnoses, classified in the International Classification of Diseases, issued by the World Health Organization.

Patients seeking help from doctors, however, usually present vague or nonspecific or complex complaints, complaints that do not fit neatly into one diagnostic category. The standard paradigm of the doctor-patient relationship does not very well apply. A new paradigm is required because of many forces: the growth of medical technology, the emergence of new scientific knowledge, the multicultural nature of society, and increased recognition of the interdependence of mind and body. Part of this new paradigm is the development of the field of family medicine, which is holistic in its analysis and therapeutic response.

Medical education, the authors contend, must be modified to recognize this new concept. It calls for training medical student to deal with the whole person and his or her environment, for recognition of the implications of new scientific knowledge for medical practice, for incorporation of more instruction in psychology and sociology, and for transformation of instruction to a multi-disciplinary approach. These concepts should permeate instruction throughout the educational years not just in specialized courses. While specialists are needed, the care of every patient should be managed by a practitioner of holistic family medicine.

We comment on four salient points raised by these distinguished authors.

First, the expansion of scientific knowledge, particularly in molecular and genetic biology, creates a daunting challenges to medical educators and medical students. The sheer volume of ever-expanding knowledge in many fields must be communicated by teachers and grasped by students. Moreover, the information must be integrated in the student’s mind so that he or she can translate the scientific facts to clinical practice. Several medical schools in Canada, Australia, and the United States have sought to promote integration of medical information by teaching through case studies involving the various systems of the body rather than by teaching anatomy, physiology, biochemistry, etc. as separate disciplines. While this approach simulates clinical practice, educators have found that bright students integrate this knowledge no matter how it is presented. Regardless of the merits of different pedagogical methods, the preparation of future doctors must give primacy to fostering the integration of vast amounts of information from the various biological and social sciences.

Second, related to the explosion of scientific knowledge is the enormous growth of medical technology. More sophisticated medical technology has made every industrialized country confront the issue of cost containment and has created an ever-
widening gap in resources between the rich and poor countries. The capacity of modern technology to make quantum leaps in diagnosis and treatment of many diseases impels the training of specialists, whereas in both the industrialized and developing countries generalists are essential if holistic medicine is to be practiced. Thus, a major public policy issue for governments in all countries is the proportions of generalists and specialists that should be trained in medical schools.

Third is the nature of communication between physician and patient and the development of shared decision-making. The physician has the scientific knowledge to bring to the decision-making process, but the patient knows his or her own needs and resources. The legal doctrine of informed consent is based on the right of the individual patient to know, to understand, and to agree to the treatment proposed by the physician. This long-honored doctrine is especially important in multicultural societies, where patients and doctors may come from different ethnic and class backgrounds. Effective communication requires time and skill. Time depends on a properly organized health care system. Skill depends on proper training.

Fourth and finally, a public health perspective must be provided to medical students if they are to understand the problems of patients in their environments. Only if physicians understand the problems of populations can they appreciate the importance of measures of health promotion and disease prevention. Study of epidemiology, the basic science of public health, can promote clinical strategies to prevent and control disease. Understanding human behavior can assist health education. Knowledge of health care systems can strengthen the delivery of health care.

The vision of Professors Pauli and White of a “somatopsychosociocultural” model of medical education, as they phrase it, will prepare future physicians well for their important roles as clinicians, researchers, administrators, policy makers, and citizens in their communities and in their nations.

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Professors Pauli and White have presented a powerful and scholarly set of arguments that the traditional paradigm of science, inherited from the 19th century, has changed dramatically in this current century. They further argue that because of this, medical (health) education, research and planning must also change -- particularly as we move into the 21st century.

My comments relate primarily to the fourth question in this paper: Will a change of medical paradigm affect medical practice, education and research? In particular, I want to focus on two statements which appear in the final paragraph, where the authors state:

- that the necessary changes are "a vision far away from reality"; and
- that countries other than those in North America and Europe might "take the lead in such an overdue development".

I will assert that the vision is, in fact, becoming reality, and that countries outside of the established market economies (North America and Europe) are already demonstrating the necessary leadership in education and research in particular.
Medical (health professional) education:

About twenty years ago, there were several "experiments" in medical and health professions education, which had developed independent of each other in various parts of the world. In 1979, these institutions came together to form the Network of Community-Oriented Educational Institutions for Health Sciences - usually called simply "the Network"(1, 2). This Network, with its secretariat at the University of Limburg in the Netherlands, has grown to more than one hundred member institutions, all of which are educating health professionals based on an analysis of the health needs of their countries and constituencies. More than half of these institutions are in countries other than North America and Europe. Another example is the UNI Program in Latin America which brings together 23 projects in 11 countries, all of which represent initiatives in the education of health professionals in "UNION with the community". Similar initiatives are facilitated by the World Health Organization(3). Within these examples, many of the features espoused by Pauli and White can be found: curricula which emphasize social accountability, innovative selection processes, exposure of students to a broad range of "basic sciences" including the social and behavioral sciences, and opportunities for students to understand their own experience as persons.

Health Research:

About ten years ago, a number of funding agencies were concerned that most resources in health research were spent in (and controlled by) the industrialized "north", when the overwhelming majority of health problems which required research were in the "south". An independent commission, consisting mostly of eminent scientists and health leaders from developing countries, was created. After two years of work, the Commission published its landmark report, which urged the world community to view health research as an "essential tool for equity in development"(4). In particular, the report introduced the concept of "essential national health research" (ENHR), recommending that "each developing country, taking account of its own circumstances, make careful plans for and carry out sustained, long-term programs for building research capacity and conducting ENHR". Facilitated by the Geneva-based non-government organization, the Council on Health Research for Development (COHRED), many countries in Asia and Africa in particular, have taken up the challenge of ENHR, determining their own health research priorities and mobilizing the available research capacity to address these priority problems, in order to change policy, action and practice.

More recently, a global mechanism for coordination of health research around global health research priorities has been created to implement the findings of a major analytic report(5). The Global Forum on Health Research, at its most recent (second) Annual Meeting in June 1998, took up the challenge: "Attacking the 10/90 Disequilibrium in Health Research".

This commentary will not include an analysis of changes in the paradigm of medical (health care) practice itself. There are fewer outstanding examples in this domain, in part because of the struggle to balance responsiveness to need with the realities of cost. The encouraging changes in how health professionals are educated, and how health research is conducted, are beginning to contribute to the development of health care which can achieve the dual objectives of meeting health needs, and maintaining cost-effective systems.
References:


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It was convincing from the paper that there has been advanced development in science and scientific thinking. Thus, it is logical to review what implications this general scientific thinking should have on medical scientific thinking internationally and at the country level. Health care communities have the responsibility to ask how the concepts of health science education, research, and the health care system can be modified in the light of these developments to optimize the use of limited resources for equity, efficiency, quality and social accountability of health care systems.

The questions posed on the development of sciences and the implications of the general development for medical scientific thinking are logical. However, in developing countries the changing definition of health, illness, globalization and the desire for achieving the “international standard” as well as the reality of health services and human resource prevails in the translation of these concepts to medical and health sciences education. Since developing societies are “maturing”, the need to resolve conflicts between different powers in the society will shape medical practice, health professional education, research and health care systems.

The perspectives of medical education have changed and have diversified over the years due to the technical and biological development within the medical discipline, the changing country-specific economic and social development situations and changing international relationships. Incentives one can expect from functioning in the health care system have driven health professional education and the career choices of graduates. The current biomedical model prevails because of the rewards associated with providing highly technical services.

Four dimensions can be highlighted to explain the changing perspectives and to prepare for the future: 1) The changing definition of health and ill-health; 2) The changing inter-dependence between nations; 3) The dynamism and specificity of national and local health services; and 4) The changing balance of power between different social groups in the society.
1. The change in the definition of health and health services:
   Pluralism in health care will demand more integration and cross-fertilization of academic disciplines for health, including the biological or physiological model, health behavior, health service environment and infrastructure and the allocation of health resources for the underprivileged of the society. “Alternative medicine” has been widely used worldwide including the US (Eisenberg NEJM’93) and Canada. With the strengths and limitations of the biological model of health and medicine, more focus should be on a systematic evaluation of what works and what does not work, without distinguishing between conventional and alternative medicine. By reducing the emphasis on the biological model, we may not be rejecting the scientific technique. Thus, the social parameter could predict cardiovascular disease no less frequently than the biological marker (CVD in Singapore). Since there are limits to how different disciplines can be integrated within a limited period of time, some core concepts will have to be defined for different stages of education.

2. The changing inter-dependence between nations:
   The issues of globalization and intellectual property rights will have an effect on health care of developing countries if they strive to attain and maintain the “international standard” of care. Reserpine is not available for treatment of hypertension in many developing countries because the treatment guidelines developed from the West do not recommend its use even though the poor cannot bear the cost of the newer recommended drugs. We do not yet know the short-term and long-term consequences on equity and health of the people from globalization and intellectual property rights. This also includes the major powerful forces of industries and foreign governments impinging on countries and affecting them in different ways. Globalization can create the supply-induced demand. This will require high priority and deep analysis. How will medical education respond to this phenomenon?

3. The realities of unique structures, human resources and roles of health personnel in countries:
   There have been changes in approaches to medical education during the last 20-25 years, from an emphasis on technology intensive doctor-patient relationships, to community-based health professionals. Many community based educational institutions located in the rural areas or small urban towns have created the perception of different “classes” of health providers. Moreover, “rural doctors” do not necessary understand the reality of health care systems. The term “community targeted” has been introduced to capture the idea that regardless of where the medical schools are located, they should educate students to understand their responsibilities for the community. The health system in the community includes both the private, public, folk and popular sectors and the interaction among them. The exact picture of the future, resulting from this interaction, may be unclear because the rates of change accelerate. This would require leaders of educational institutions to have multidimensional competencies, visions and virtues to respond to changes. These leaders must have a concern for the collective good and vulnerable groups. Virtue of an education leader will encompass many human values, including trustworthiness, integrity, a passion for justice, a respect for life, people and society, and the courage to remain true to all these. Virtue is crucial in ensuring the continuing morality of our thinking and actions. It produces in us a desire to act for social harmony. Without virtue, educational reforms can become self-serving at the expense of social harmony.
4. The need to interact with the society, empower people and develop accepted methods of conflict resolution between different powers in the society:

Finally, it is the educational institutions that should empower society towards the accepted methods to resolve conflicts between different groups. Democracy in the ideal sense requires that each person in society pay as much attention to the society as to him or herself. In the real world, the society consists of many heterogeneous population groups, each trying to guard their own interests. Therefore, in resolving conflicts for health service and self care, citizens must be encouraged to participate in the decisions for access to service and the quality of health professionals to be produced. NGOs must be actively involved in advocacy. The private sector must be involved in the process of promoting the quality and efficiency of care. The executive branch must establish good mechanisms to ensure increased accountability. Finally, the academics and the research community must strive to make accurate information available and accessible by citizens. Because it is the citizens who should be encouraged to determine the fate and the direction of their society towards social harmony.

The perspectives can differ because different individuals and social groups have various experiences influenced by context, time, place, social structures and economic status. In the future, the context we are in today will also change and what we propose today may not be relevant then. Therefore, let us work towards a constructive dialogue between groups so that all in the society are involved.

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As a matter of fact, it is not new for the criticism that doctors usually view a patient as a piece of material or a machine, not a human being who has not only body but mind, family, relatives, friends and is part of society. The criticism in the past was usually derived from the performance of the doctor toward the patient. This article analyses very deeply the root of the phenomenon, referring to the important role of the evolution of medical science at the time of the Enlightenment in the 17th century when the rationalist and materialist thinking revived, followed by the one-dimentional, linear, cause-and effect models of thinking. At this time the predominantly technological constructs began to dominate scientific thinking.

An important turning point, early in the 19th century in France, was the introduction of autopsy as a clinical routine to search for cause of disease and death. Autopsy was the important foundation for development of anatomy and pathology, which have been important basics of medicine, and have allowed medicine to progress scientifically, instead of through conjecture or magic art. But studying from corpses causes medicine to become more and more materialistic, because the dead body contains no life and mind; and reacts differently to all testing as compared to a living body. The knowledge collected from autopsy is purely materialistic and influences medicine to
develop unconsciously apart from the spiritual dimension. The discoveries in physiology, biochemistry, microbiology and genetics increasingly furnished explanations for the phenomena found in the dead body, and the psychological and social phenomena are characterized only as “risk factors”.

The analysis of the authors demonstrates that they understand clearly not only the evolution of medicine, but also the evolution of other related sciences. They have elucidated the influence of science and philosophical thinking on the development of medical science. One important evidence is the scientific finding that, even at the molecular level, the living thing is “something” more than simple material. This finding provides a strong argument to the conclusion made by Arthur Kernberg, a Nobel prize laureate that said, “I am espousing...acceptance without reservation that the form and function of the brain and nervous system are simply chemistry, ...........that mind, as part of life, is matter and only matter”. Thus, the authors are suitable persons to propose and prophesy the future of medicine, because the one who can predict the future properly must clearly understand both the past and the present.

The article not only analyses the weakness of medicine dominated by materialistic thinking, but also probes deep into the philosophical thinking that dominates medicine by analysing a crucial term used in the medical science. That is the diagnosis of disease. The authors point out the important fact that diseased individuals, rather than diseases, are realities and the method of diagnosis can lead to different approaches by doctors. For example, the diagnosis of “angina pectoris” reflects the feeling of the patient more than the diagnosis of “coronary occlusion” which reflects the thinking of a doctor who perceives the patient more materialistically. The authors make an important conclusion that classification of subjects in medicine, which are conventionally classified as basic sciences, must be reconsidered in the present and future circumstances.

The penetrating consideration of the usage of words or terms that reflect thinking in medicine is an exploration into the apex of thought. This is relevant to the authors’ proposal that medical education reform must be done at the level of paradigm shift.

In Buddhism, the Eight Paths to overcome suffering or for Enlightenment begin with Right Understanding. The proposal of the authors to conduct reform at the level of paradigm shift is interestingly in agreement with the Buddhist way of thinking.

I personally agree with the authors that the new paradigm will lead to change in elements related to medical education, i.e. educational policy and development, increasing role of family medicine, raising importance of interdisciplinary research to the same level as highly specialistic disciplinary research, and changes in health planning and policy at the family, community, regional, national and international levels. I also believe that the new paradigm should help to diminish “some” of the inefficiency, ineffectiveness and waste characteristic to today’s Western health system.

The authors may realize that the problems of Western health systems are not caused solely by the root of philosophy in medicine. The major cause of such problems is from the dominance of a more powerful system, namely capitalism. Thus the authors expect that the new paradigm could help to diminish only “some” of the problems. The case of the United States is a good example, where the President attempted to move to
solve the problems himself, but his success was very limited, because the President himself is part of Capitalism.

The most important challenge for everyone is how to cross this paradigm shift.

The proposal of the authors, which seems to be more idealistic than realistic, is to restore the idea of medical education as moral education, i.e. attention to personal development of each student’s moral sense; the cultivation of true sentiments, of habits of reflection, of the imagination, and of capacity for self-knowledge.

Is it possible to cultivate moral sense only in medical school? How does one establish an idealistic society in medical school? How can moral education in medical school effectively shape the cultivation of students before they actually enter medical school? How do they overcome the power of social circumstances? What is the guarantee that such moral cultivation in medical school will last throughout their whole lives as doctors?

One of the major obstacles is that, all staff in medical school are trained under the circumstances of the old paradigm. It is not easy for anyone to become enlightened and transcend the paradigm shift.

Another obstacle is that the sciences in the mental and social dimensions are less developed when compared to sciences in the physical dimension. The difficulty for mental and social sciences is that, the knowledge acquired in developed countries can not be simply applied to developing countries. Compared with the natural or physical sciences, the differences in race, ethnicity or geography are usually minimal. Moreover, the mental and social dimensions are quite abstract and vague, and very difficult to objectively measure. Reliability and specificity of measurements are questionable. In the circumstances where doctors are always busy, the time contributed to each patient is limited. It is therefore quite difficult for doctors to be concerned more about a patient’s mental and social dimensions, and to accept the importance of these dimensions, unless their paradigms have already shifted.

However, the authors’ proposals may come true, if the paradigm shift begins in a core group and expands to a critical mass. The major disadvantage of this article is the difficulty in presenting both the contents and terms used. I have to confess that I fail to find some terms used in this article, even in the unabridged dictionary or dictionary of new words. The authors may wish to propose their ideas only in the well educated community; thus no footnotes are provided to explain any difficult words. Dissemination of new ideas may start from only a small group of interested persons, but the next step is to make things simpler so as to make creation of the critical mass possible. The authors should elaborate their proposal for further clarity and simplicity.

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This paper undertakes an immense task—that of analyzing the scientific underpinnings of medicine, both historical and contemporary, identifying fundamental fault lines in that science base, formulating corrective perspectives, and calling for major paradigm shifts in both what is understood as the science base for medicine and also in what should be the resultant content of medicine, medical practice and medical education.

The authors are not alone in this Herculean effort. They build on and refer to a substantial background of comparable thinking on the matter, and both have contributed substantially to the growing strength of calls for these critical changes.

The core of their argument is that the traditional biomedical model is based on a narrow perspective of medical science: that disease is a manifestation of molecular and chemical changes in the body, in which cause and effect relationships lead in a linear manner to disease conditions that are measurable, diagnosable, and subject to intervention in similar terms technology focussed on biomedical pathology. This has led the fields of medicine to being organized along the lines of basic sciences and clinical sciences, and also to a pattern of physician-patient relationship that is based on assumptions of health and disease narrowing the biomedical model.

What is missing? What are they aiming at as fault lines in the science base of medicine?

Missing is consideration of the many factors that do not fit the biomedical model—social, cultural, emotional, psychological, biobehavioural—that are known to be associated with ill health. It is well known that such factors commonly accompany disease, but since they do not appear to fit the molecular model, they are often considered outside of the domain of science. Or, they are described by what might be called soft science.

But other fields of science have undergone extensive changes that have carried them far beyond physical and chemical parameters, including such areas as quantum mechanics, relativity, systems theory, cybernetics, theory of chaos, etc. These changes can be seen as parallel to factors that should be acknowledged as having integral involvement in patterns of health and illness. So, what is seen by the authors as necessary inclusions in medicine are not unique challenges to science, but are comparable to a broadening of the boundaries of science more generally. Much of this paper is devoted to describing these advances in other fields of science which are applicable to medicine.

I now offer a brief and supportive commentary on these positions.

There is no doubting the basic position of Pauli and White. This first came to my attention through the excellent volume edited by White: The Task of Medicine-Dialogue at Wickenbury (1988). It was here that leadership of medicine urged attention to the importance of widespread acceptance of the biobehavioural aspects of health and disease.

How firm is the reluctance of medicine to accept the need for a change in paradigm? While lack of acceptance in a formal sense may be extensive, many working within fields of medicine acknowledge and accommodate to these factors. It is common for physicians to appreciate how psychosocial events in the life of a person can precipitate or worsen a health condition. Many physicians appreciate the frequency with which signs of ill health do not fit established patterns of illness as defined in the ICD, and they shift to patterns of care adapted to the needs of the particular patients with whom they are dealing. Family physicians, in particular, face this challenge as they are often confronted with the need to discern the underlying nature of disease and its possible causation as a step toward offering care or referring to a specialist.

An interesting test site for these questions can be found in the field of community health in a developing country setting, where the focus is on population-based health care. In that setting, we are very much aware of how various factors impinge on health.
The context is very complex—a contaminated environment and inadequate housing are constant threats to health; poverty and lack of education are further risk factors for ill health and mortality; anxiety and depression are frequent afflictions; violence in the community and the household are stark dangers, and stress has a constant presence. Within this complexity, trying to separate traditional biomedical forms of causation from psycho, social and cultural factors becomes exceedingly difficult. Indeed, it is likely that here we are seeing dynamics where various forms of disease causation are overlapping, cyclical and reinforcing—far from the linear, monocausal biomedical model in which a system total might simply be the sum of its parts.

A further issue closely related to the role of the physician in a changing paradigm is that in the population-based poverty setting described above it is abundantly clear that the relationships and dynamics of interaction are so complex that there must be a close and trusting partnership involving physician (and other health workers) and community so as to share insights into causative factors and support systems that might ameliorate the problems. In this instance, the physician can be the focal point for sensitive and thoughtful analysis. She (or he) will have firm understanding of threats to health based on the traditional biomedical model, and will also (hopefully) be fully aware of the variety of factors that might, on the one hand, worsen those factors, and, on the other, act independently or interactively with them. Goals of research and medical education will be to continually broaden and deepen her capacities for dealing with these complexities.

What will be the content of the changed paradigm?

It is one thing to challenge the status quo of the biomedical paradigm. It is quite another to define the content of the changed paradigm. Actually, it seems most unlikely that there will be a radical change. Acceptance of the need for change will come slowly, reluctantly, and the change will be at the margins. All the more reason for building the science base for the emerging paradigm.

The point is made in the paper and in referenced papers that the object is not to demean biomedical science, but rather to build on its strengths, broaden the boundaries of what is considered to be scientific, and to emphasize the steps required to build and strengthen the revised paradigm. As stated in The Task of Medicine: “It might be useful to consider the paradigm of medicine to be in a never-finished state, in need of continued revision, and forever holding new promise for improving health and for enhancing physician effectiveness.” Certainly, this is the time to encourage broader definitions of the research agenda and to systematically address the place of biobehavioural aspects of health and disease.

The work of Thomas Kuhn, and his writing of The Structure of Scientific Revolution (1962) is worthy of mention. When he spoke of changing paradigms of science, he observed that such changes usually come when a body of accumulated evidence no longer fits the prevailing theory and a new theory must be developed. An important further observation was that it is a community of scientists who discern the lack of validity of a given theory, and it is also they who will judge the validity of the changed theory. A key question, here, is: in this instance, who will be the community of scientists who make those judgements? Thus, it is fundamentally important that a community of scientists respected for their research strengths in fields related to behavioural science becomes a voice in support of this paradigm change.

Whence with medical education?

The paper makes the point that, it will focus on the WHAT of medical education, and not on the HOW. Once progress is made, however, and there is reasonable likelihood
that there will be movement of the medical paradigm beyond the traditional biomedical
mode, then the HOW of medical education must be addressed.

Given the likelihood of patterns of change that are gradual and at the margin, then
medical education will have the opportunity to formulate appropriate and effective means
of educational methods that will fit the challenge of the new paradigm.

While the care of individual patients by concerned physicians will be a crucial
issue, it will be fully as important to include the care of families and communities in
population-based settings, where the full range of psychological, social, cultural and
system factors are at work.

Then, with this shift in content and orientation of medicine and medical education,
the possibility of a meaningful social contract between medicine and society that
embraces these new dimensions becomes increasingly viable.

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