



SPECIAL SERIES

Medical Education, Research, and Scientific Thinking in the 21st Century (Part Three of Three)

HANNES G. PAULI, MD¹, KERR L. WHITE, MD²
& IAN R. McWHINNEY, MD³

¹*Retired Chairman and Professor of Internal Medicine, former Director of the Institute for Medical Education and Evaluation, University of Berne, Switzerland;* ²*Retired Deputy Director for Health Sciences, the Rockefeller Foundation, New York; founding Chairman and Professor of Health Care Organization, the Johns Hopkins University, Baltimore, MD and former Associate Professor of Internal Medicine, University of North Carolina, Chapel Hill, NC, USA; and* ³*Retired Chairman and Professor of Family Medicine Emeritus and Member, Centre for Studies in Family Medicine, University of Western Ontario, London, Ontario, Canada*

ABSTRACT Background: *During the 20th century medical education has been largely preoccupied with discussions of the venues and methods for teaching. Little attention has been paid to what should be learned about the scientific paradigm underlying research and practice. A 17th century model has gradually produced an increasingly narrow, monocausal, reductionistic view of health and disease. Much good has resulted, but this “belief system” fails to accommodate or explain the meaning and impact on patients’ health of diverse internal and external experiences and influences. During this period quantum mechanics and its ever-expanding capacity to accommodate new information and enhance understanding have superseded Newtonian physics in much scientific thinking.*

Methods: *A broad range of historical and contemporary scientific literature is examined in support of four central questions in this three-part series: (1) Are there reasons to examine these matters now? (2) How is medical scientific thinking influenced by the general reorientation of science during the 20th century? (3) Are there reasons now to examine the impact of these changes on medicine? (4) Will a change of paradigm affect medical practice, research, and education?*

Results: *The extraordinarily productive contemporary biomedical model should be*

Author for correspondence: Professor Hannes G. Pauli, MD, Oranienburgstr. 13, CH-3013 Berne, Switzerland. Tel/Fax: 0041 31 331 23 21. E-mail: hg.pauli@bluewin.ch

expanded beyond the physical and biological to incorporate meaningful information about how each patient's experiences impinge on health status.

Conclusions: *Family and other primary care physicians together with collaborators in the biological and behavioral sciences and other health professions should undertake rigorous research to establish the validity of the expanded paradigm espoused. Its impact on practice, research, education, and policies could be profound.*

In the first part of this series, we discussed the urgent need to examine medicine's underlying framework at this time. In the second, we addressed the growing awareness by many clinicians that contemporary Western medicine's conceptual framework seems unable to accommodate countless clinical observations and experiences. In this third part, we turn to our third and fourth questions.

Third Question: Are There Reasons within the Realm of Medicine and Health Care Now to Engage in a Discussion of Terms and Concepts?

The dominant paradigm's monocausal, linear, reductionistic model of disease, so successful in the past, is in ever-greater need of broadening. There is growing recognition of the importance for health of socially based life conditions. The scope of connection between the two reaches from wellness and survival under balanced social and ecological conditions on the one hand to organ system breakdown, degenerative, neurological, arteriosclerotic, and neoplastic chronic illnesses under conditions of mal- and overnutrition, alcoholism, AIDS, drug addiction, family violence, work stress, unemployment, poverty and environmental poisoning on the other. The traditional, conceptual separation of the mental from the physical domain has become increasingly anomalous.

Augmented by the alienating effects of technology, we seem to have produced a generation of detached health professionals (especially physicians) who cannot communicate effectively with patients. While improvements in communication skills and courses in cost-effectiveness at the individual and societal levels may be necessary for managing many of these problems, they are scarcely sufficient. The most appropriate intervention(s) may not be identified without exploring the meaning to the patient of an experience or event that precipitates, for example, the patient's joy, depression, anxiety, or terror which, in turn, affects his or her immune system and consequent vulnerability to a lurking microorganism. Neither the physician nor the patient is likely to understand the genesis of a problem or implement a strategy to resolve it or prevent a recurrence without mutual appreciation of the experience and its meaning.

A practical reason for such a discussion *now* is that *the International classification of diseases* (World Health Organization, 1992–1994), the oper-

ational definition of medicine's paradigm, has become a Procrustean bed. For decades we have known that about half of the problems patients bring to general and family physicians cannot be fitted into this rigid classification system (College of General Practitioners, 1963). The *International classification of injuries, disabilities, and handicaps (ICIDH)* (World Health Organization, 1980) provides some assistance in appropriately labeling many material, functional, and social manifestations of ill health, while the *International classification of primary care (ICPC)* has to some extent facilitated more accurate designation of the diverse problems, ill-defined conditions, complaints, questions, and symptoms initially presented by patients, especially to primary care and family physicians (Lamberts *et al.*, 1993). These two classifications also embrace labels for patients who have well-defined diseases, but whose needs are for rehabilitation or palliation, rather than efforts at cure. New movements and disciplines have emerged to help some of these groups: the hospice and palliative care movements, multidisciplinary pain clinics, rehabilitation programs and, of course, family medicine and geriatric medicine. The fact that they often involve other health professionals working as a team is significant, since disciplines such as nursing, physiotherapy, and speech or occupational therapy think naturally in terms of function rather than pathology.

Several recent developments may be viewed as symptoms of the crisis that confronts us:

- Every Western society now places the rapidly escalating costs of technological medicine at the forefront of its agenda (O'Brien, 1999). Physicians have seldom been trained to think in terms of cost–benefit or cost-effectiveness analyses at the individual or population levels. But governments are increasingly compelled to confront the issue when health care expenditures amount to more than 10% of their gross domestic product (GDP).
- At the same time, the public service function of governments in the domain of health is increasingly restricted by, or involved in, the emergence of a powerful “medical–industrial complex” which tends to override scientifically justified policies with a profit-seeking orientation (Bloom, 2000).
- Failures in physician–patient communication are an important factor in the increasingly high rates of malpractice litigation (Lown, 1996).
- The rapid emergence of “alternative” or “complementary” medicine expresses the growing dissatisfaction of patients with what in Western societies has become traditional medicine (Gordon, 1996).
- Especially since the introduction of psychoactive drugs and the rise of experimentally oriented neurosciences, many exponents of academic psychiatry increasingly consider their discipline to be a biological domain. Apart from the many fascinating discoveries made during this development, in many institutions psychiatry (or rather “biopsychiatry”) has joined somatic domains in their transition away from a systemic and interactive orientation (Ulrich, 1997).

- The emergence in the last two decades of a literature of illness narratives—often highly critical of medical care—is a reminder that illness is a human experience, not only an abstraction (Brody, 1982).
- 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 equity for all persons, not to mention the even more important gap between so-called developed and developing regions of the world (Beaglehole & Bonita, 1997).
- The growing unrest, even disillusionment, among doctors in Western industrialized countries attests to their discomfort with the manner in which medical care is organized, managed, and financed (Le Fanu, 1999).

Our answer to the third question, then, is that health professionals directly confront a growing body of data that no longer can be explained or dealt with by the traditional paradigm, and as a consequence there are increasingly serious “internal” reasons for a fundamental reexamination of that paradigm.

Fourth Question: Will a Change of Paradigm Affect Medical Practice, Education, and Research?

We now provide examples of pressing questions and unsolved problems for which studies need to be designed, instruments devised, data acquired, and usable information generated. Research bearing on these types of problems is a requirement for understanding the contemporary panorama of health and disease. Empirical research by family physicians and other generalists, largely in primary care ambulatory and home settings, is essential for analyzing the webs of causality that we argue are associated with the manifestations of health and disease (MacMahon & Pugh, 1970).

- If *Helicobacter pylori* is a necessary factor in causing peptic ulcer disease, why do so many “carriers” not develop the disease? If the somatic factor alone isn’t always sufficient, what are the predisposing and precipitating factors?
- What role in the course and severity of breast cancer do sociocultural attitudes towards breast disfigurement play (Edelstyn & McRae, 1975)?
- What influence does separation, whether from a family member, neighbor, or even a pet dog, have on the precipitation of cardiac failure (White *et al.*, 1958)?
- How frequently does a patient’s onset of tuberculosis reflect a life consisting of “two years of increasingly disturbing occurrences,” including such contemporary plagues as AIDS, substance abuse, and aboriginal poverty (Lerner, 1996)?
- What levels of mortality correlate with the existence or non-existence of supportive social nets in the patient’s immediate environment (Berkman & Syme, 1979)?

- How does the psychosocial situation at work relate to the occurrence of myocardial infarction (Marmot *et al.*, 1997; Siegrist *et al.*, 1997)?
- Is the *placebo effect* the expression of an illusion (an artifact as it is often called) or is it an expression of the natural history of the disease or regression to the mean (Ernst & Resch, 1995)?
- Does the “healing context” or the “healing relationship” correlate with somatic improvement on its own or by intensifying the effects of conventional (and “alternative”) therapeutic measures (Brody, 1982; Harrington, 1997; Schön-bächler, 1998; Spiro, 1998)?
- How do fears, threats, grief, and mourning affect morbidity and mortality in close relatives (Cannon, 1957; Kiecolt-Glaser & Glaser, 1995)?
- Is depression associated with some conditions, such as pneumonia, a precursor or sequela of the illness?
- Why do patients recover more rapidly in some hospitals than in others (Gillespie, 1991; Revans, 1996)?
- How can we obtain, by descriptive clinical research, a better understanding of illnesses that do not fit contemporary conventional disease categories?
- Is there a relationship between emotional and spiritual development and the progression of cancer or survival?
- Are there illnesses that correlate with the patient being “caught in a trap”?

Once the hegemony of the biomechanical model was established, the types of questions presented above seldom rose to the level of awareness in established research communities. For the most part these communities continue to ignore the intriguing published research that is available and for which the findings rarely have been replicated by other investigators, to say nothing of being incorporated in medical education and practice. Yet, such questions are critical for understanding today’s health and disease issues and the personnel, resources, and institutions required to respond appropriately. The methods for tackling them and the type of data generated in this kind of research reaches across the mind–body borderline and the physician–patient and patient–institution (or health care system) interfaces.

Among the problems limiting the development and widespread acceptance of a new scientific view is the lack of empirical research on their preventive and therapeutic implications. For example, there is strong evidence for the *placebo effect*, and strong support for its explanation, at least in part, as an effect of the physician–patient relationship, but we do not know how physicians can actively and consistently produce this effect. We know that elderly people’s self-assessments of their health is a stronger predictor of their survival over the ensuing seven years than the objective data from their medical records (Idler, 1992). But we do not know the basis of this assessment. Do they have an intuitive sense of their health status that is superior to the medical assessment? Or do their beliefs determine their survival? If the latter, will a change in those beliefs affect their survival and can physicians actively promote this change? We

know the immune system in animals can be conditioned to respond to an inert substance (Ader & Cohen, 1991). We know also that the immune system response in humans can be boosted by such practices as meditation, self-hypnosis, imaging, and biofeedback (Hall *et al.*, 1993; Hoffmeyer, 1997).

We need to understand the webs of causality or even causal mechanisms—the *salutology* or *nosology*—that explain their correlation with related information bearing on the maintenance of health or susceptibility to disease in today's societies. Of greater importance, the expanded knowledge derived from such research can have significant impacts on preventive strategies, to say nothing of the comfort of patients. It may be easier and far less costly, for example, to deal with separation anxiety, concerns about job mobility or control, and provision of support services than to hospitalize or investigate the “organic” aspects of diverse conditions associated with such experiences. Granted it will take more time on the part of the physician to listen and understand each patient's life situation and, most important of all, its meaning and impact on that person at that time.

The *problem of the observer*, that is, the reconsideration of the relation between subject and object, calls for a *fundamental revision of the relationships between physicians and their patients*. A thorough understanding of this phenomenon is essential to the conduct of any research focused on medical care *per se*, especially at the primary care level. This follows from the insight that “*objects*” are perceived by people in ways that reflect their subjective environment. Perceptions may differ considerably between an observing and an observed person. The relationship between the two individuals, therefore, cannot be linear and static, but must be circular and dynamic. Part of the “*environment*” of an individual (physician or patient) is his or her partner in the relationship. The goal should be the creation of a common reality between physician and patient (Uexküll & Wesiack, 1997; McWhinney, 1996). This interaction is to be considered as an act of purposeful, scientifically founded endeavor and not merely an expression of a humanistic attitude or an invocation of the so-called “be kind to patients” movement.

Traditional, biomechanically oriented physicians, of course, cannot be accused of being inhuman. Nevertheless, if the present analysis has merit, it follows that medical schools should convey to students and physicians at the conceptual level an integrated view of the idiosyncratic environment surrounding each living system—including each patient's. At the practical and interpersonal level the physician must be familiar with the well-tested skills of listening, observing, and eliciting information and controlling its reliability, validity, and quality. These are concrete parts of the medical task for all physicians and especially for researchers in family medicine and primary care. Important as they are, however, skills alone are not enough. The control exerted by the physician in the traditional biomechanical clinical relationship protected him or her from some very disturbing feelings. Sharing this control with the patient, renouncing power, and encouraging the expression of feelings removes this protective barrier. Much

greater understanding of interpersonal relationships and, above all, self-knowledge are required (Lipkin *et al.*, 1995).

These insights also have major implications for medical education. On the basis of a scientifically corroborated world-view, described in our response to the second question, we will need to restore the idea of medical education as a moral education. By this we mean attention to personal development of each student in the moral sense through the cultivation of true sentiments, of habits of reflection, of imagination, of curiosity, and of capacities for introspection. It will involve also the correction of false sentiments. This requires a different paradigm of knowledge. It is a paradigm that has virtually disappeared from medical education: the personal, particular, intuitive, affective understanding of experience. Such tacit knowledge can be introduced by a new integrated “basic science” and transmitted mainly by the informal curriculum, the environment of learning, the moral climate of the medical school, and the belief systems and actions of its teachers (McWhinney, 1978; Pauli, 1989). Nor do recent developments in the teaching of ethics fill the need for this kind of knowledge. Courses in bioethics usually deal with ethical issues on the level of discursive logic or even legal exposure. This enables students to see the issues as external to themselves and absolves them from the task of self-understanding.

Under these circumstances, at a more basic level, medical education, as an important fraction of the overall health care enterprise, delivered by state *and* privately supported institutions, systems, and professionals, has to be considered as a social good. Consequently, a medical school’s responsibility to the public assumes the form of an enduring social contract which extends beyond the autonomy of the medical establishment or, even more explicitly, of its academic components.

The need to consider an ecological context of health, including all facets of communication, is part of the more general requirement that phenomena be viewed as components of the systems into which they are integrated at a higher level of organization (von Bertalanffy, 1968). At a somatic level, it will be difficult to understand the immune system without a notion of the environmental (ecological) factors that determine its function. In the sociocultural domain future physicians must learn to care successfully for patients of a cultural background different from their own; for this they will require some familiarity with this culture (Fadiman, 1997).

An epidemiological view of medicine’s history should modify assessments of the impact of clinical interventions on the population’s health. For example, increases in life expectancy are often cited as the consequences of treating infectious diseases with antibiotics. Thomas McKeown’s (1913–1988) meticulous analysis of historical data showed that “medical” factors usually played a minor role in these developments. Throughout the 19th and 20th centuries, until recently, mortality due to tuberculosis in Western societies decreased steadily. The advent of specific antibiotics in the 1950s only minimally bent the downward trajectory of mortality. Factors such as improvements in nutrition, water

supplies, and sanitation appear to have played major roles. The resurgence of poverty, alienation, and inadequate nutrition may well be associated with the contemporary increase in tuberculosis (McKeown, 1976). These examples 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 frontline responsibility for their patients do not have that choice. It is this level of responsibility, represented by family and other primary care physicians, at which medical education should aim.

Susanne Langer (1895–1985) said (1979) that when the springs of philosophical thought of an age have run dry, leaving questions that are unanswerable in terms of its *Weltanschauung* (world-view), 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 of Genius" (Whitehead, 1861–1947) have served their term (Whitehead, 1926). "If we would have new knowledge we must get us 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." Symbolism is an important feature of biosemiotics as defined above. We now have in our hands the key to the seemingly insoluble problems of our time: the separation of subject and object, the split between head and heart, and between the physical and the spiritual—not only at the "belief" but also at the scientific level. (Barbour, 1990; Polkinghorne, 1998).

In many ways the healing of this split is also an objective of gender studies. Feminist critiques of an objectivistic male culture of science question its aims, its premises, and its methods (Meier-Seethaler, 1997). They are seen as expressions of an historical evolution that 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 gross imbalance of scientific culture.

Systemic views and concepts, crucial to medical practice, emerging from these developments, have major implications for the profession's *educational policy and development*. The predominant role that primary care should play in this future development should be obvious (Pauli, 1990). Clearly a new paradigm will also shape *medical research, especially research by family medicine and primary care investigators*. More generally, the currently small and future large number of primary care professionals involved in academic development need a boost of support in terms of resources and training opportunities. The nature of "academic excellence" needs to be reexamined. Today it is tightly connected with the "predominance of the part" (see further, below). Nobel laureates in medicine are almost exclusively molecular or genetic biologists. The status of "physicians" and other generalist health personnel will have to be reconsidered.

Highly specialized disciplinary research will continue to be needed, but should no longer be so preeminent. It will share resources with interdisciplinary research as, for example, in the new field of psychoneuroimmunology (Ader *et al.*, 1991). Above all, but perhaps least clearly evident, a new paradigm will shape *health policy, planning, and organization*, including the distribution of political and professional power at the family, community, regional, national, and international levels. Systemic and integrated thinking by those who make the basic decisions should help to diminish much of the inequity, inefficiency, ineffectiveness, and waste characteristic of today's Western health care systems. Within health care institutions, the nature of relations between physicians and other health personnel, managers, and economists will come under basic scrutiny (White, 1991). With a renewed interest in the production and maintenance of health, the focus of the medical profession's task will turn to what is called a *healthy person* in everyday language. A *person*, as contrasted with *patient*, the term so long favored in professional medical contexts, should balance the traditional asymmetry between her or him 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 a sense of coherence, possibly in spite of the presence of disease, impairment, pestilence, imprisonment, etc. (Antonovsky, 1987).

Finally, the vision of a true change of paradigm in medicine must also include the use of other 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 and biophysics. Characteristically, they are aimed at parts—organs, cells, molecules—and their mathematically describable functions—rather than at organisms, persons, or even individual–environment contexts. Following our analysis of medical paradigms we have to consider whether these "parts" are truly "*basic*." Clearly they are important; we need many of them when we practice medicine and their study has contributed enormously to medicine's capacity to help individuals and populations. Future clinicians, however, can hardly survive with an ever-increasing number of them. The "basics" have become unmanageable.

These "parts" have emerged during the evolution of the scientific subjects and related disciplines and specialties, rather than from their relevance for health and disease or of competence to practice medicine. One answer to the problem of the information overload generated by contemporary biomedical research is the increasingly sophisticated technology available for information retrieval and management, *when needed*. This should increase the appropriateness of the search for requisite knowledge generated by the "parts." The fruits of the *information age* provide another reason for abandoning an outdated encyclopedic model of medical education. The medical disciplines as they evolve and divide have become optional scientific *resources*. If they can no longer 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 *where*, *how*, and above all, at the *what* levels of medical education. Medical education, in turn, will influence science and research as well as the organization and provision of health care.

As one example consider a vision of a reformed medical curriculum. Why should students not be introduced to medicine at its truly basic level, envisaging a *somatopsychosociocultural* model, drawing on existing *systemic sciences* concerned with the interactions of individuals and their environment such as the neurosciences, immunology, epidemiology, psychology, and sociology? In such a model the former “*basic sciences*” in the context of contemporary problem-based learning would become *instrumental sciences*, systemic ones could then be considered as basic (Uexküll & Wesiack, 1997; Pauli & Schüffel, 1998).

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

Conclusion

Change in the medical paradigm on which the preceding questions and answers were centered is, in most areas of the world, a vision far from reality. Reforms along the lines we propose will inevitably generate problems of sociopolitical power. Again, take medical education as an example. The established power of the present curricular decision-makers, the highly specialized academic elite, would have to be superceded. The slowly developing cadre of conceptually competent *generalist practitioners* (i.e. family physicians, general internists, and general pediatricians) in cooperation with representatives of other major health professions such as public health and nursing would be “in charge.” Specialized disciplines would render their services where needed—a bottoms-up situation!

Primary care professionals in venues with the least entrenched academic hierarchies might well take the lead in such an overdue development. At the same time, however, there is an urgent need for top quality primary care research on important clinical problems that provides empirical support for the 21st century’s new medical paradigm. If done under the paradigm we have sketched in this series of articles it would reinforce accommodation to the many messages, meanings, and observations that seem so frequently ignored by the scientific world-view underlying contemporary Western medicine.

Of equal urgency is the requirement that politicians, policy-makers, and the public understand that the expenditure of more money, the development of ever more technology, the proliferation of diagnostic procedures, and the labeling of more individuals as “diseased” may not be helpful. This is especially true when directed, for example, toward “correcting” cholesterol levels, blood pressure, coronary artery blood flow, or detecting minuscule, asymptomatic prostate

cancers. Such manipulations do not necessarily produce healthier populations or happier individuals. It may be more important to understand the impact of life experiences on individuals and to learn more about their influence on the body's sensory apparatus and regulatory systems. In general, we need to know more about the consequences of life experiences for the maintenance of "health" and the genesis of "disease."

And what exactly is the physician's task? Is he or she to be a "fixer" of disordered bodies, a "healer" or, as someone put it, a "biospiritual guru"? These are value judgments that individual patients, physicians, managers, and society will make. What comes first, however, is reforming the *what* in medical education and reinforcing scientific research, largely at the primary care level, to better understand the life circumstances that are associated with health and its absence. It is certainly not more data we seek—better information would help, and certainly credible knowledge is a requisite—but above all we seek wisdom. We hope that our analysis stimulates others to consider the issues we raise.

Acknowledgements

An earlier version of these articles constituted, in part, a working paper of an international group, the Berne Group, which met in Berne, Switzerland, and a different version was published in the *Human Resources for Health Development Journal*. The current authors are responsible for this series of articles and are grateful for the many contributions by the other members of the Berne Group: the late Anton Antonovsky (Jerusalem, Israel), Alistair Cunningham (Toronto, Ontario), Laurence Foss (Palo Alto, CA), Thomas Inui, (Boston, MA), Werner Ringli (Bern, Switzerland), and Thure von Uexküll (Freiburg, Germany).

References

- ADER, R. & COHEN, K. (1991). The influence of conditioning on immune responses. In: R. ADER, D.C. FELTON & N. COHEN (Eds), *Psychoneuroimmunology*. San Diego & New York: Academic Press.
- ADER, R., FELTON, D.C. & COHEN, N. (Eds) (1991). *Psychoneuroimmunology*. San Diego & New York: Academic Press.
- ANTONOVSKY, A. (1987). *Unraveling the mystery of health. How people manage stress and stay well*. San Francisco: Jossey-Bass
- BARBOUR, I.G. (1990). *Religion in an age of science. The Gifford lectures*. New York: Harper & Row.
- BEAGLEHOLE, R. & BONITA, R. (1997). *Public health at the crossroads*. Cambridge: Cambridge University Press.
- BERKMAN, L.F. & SYME, S. (1979). Social networks, host resistance, and mortality: a

- nine-year follow-up study of Alameda county residents. *American Journal of Epidemiology*, *109*, 186–204.
- BERTALANFFY, L. VON (1968). *General systems theory: foundations, development, applications*. New York: Braziller.
- BLOOM, S. (2000). The Institutionalization of medical sociology in the U.S.: 1920–1980. In: BIRD C., CONRAD, P. & FREMONT, A. (Eds), *Handbook of medical sociology*, 5th edn. Englewood Cliffs, NJ: Prentice Hall, Inc.
- BRODY, H. (1982). *The healer's power*. New Haven & London: Yale University Press.
- CANNON, W.B. (1957). "Voodoo death". *Psychosomatic Medicine*, *19*, 182–190.
- COLLEGE OF GENERAL PRACTITIONERS: RECORDS AND STATISTICAL UNIT (1963). Disease labels. *Journal of the College of General Practitioners*, *6*, 197–219.
- EDELSTYN, G.A. & MCRAE, K.D. (1975). Breast cancer: mistaken concepts, therapeutic consequences, and future implications. *Journal of the Irish Medical Association*, *68*, 30–32.
- ERNST, E. & RESCH, K.L. (1995). Concept of true or perceived placebo effects. *British Medical Journal*, *311*, 551–553.
- FADIMAN, A. (1997). *The spirit catches you and you fall down: a Hmong child, her American doctors, and the collision of two cultures*. New York: Farrar, Straus & Giroux.
- GILLESPIE, R. (1991). *Manufacturing knowledge: a history of the Hawthorne experiments*. Cambridge & New York: Cambridge University Press.
- GORDON, J.S. (1996). *Manifesto for a new medicine*. Menlo Park, CA: Addison–Wesley.
- HALL, H., MINNES, L. & OLNES, K. (1993). The psychophysiology of voluntary immunomodulation. *International Journal of Neuroscience*, *69*, 1–34.
- HARRINGTON, A. (Ed.) (1997). *The placebo effect: an interdisciplinary exploration*. Cambridge, MA & London: Harvard University Press.
- HOFFMEYER, J. (1997). *Signs of meaning in the universe*. Bloomington, IN: Indiana University Press.
- IDLER, E.L. (1992). Self-assessed health and mortality: a review of studies. In: S. MAES, H. LEVENTHAL & M. JOHNSON (Eds), *International review of health psychology*. New York: Wiley.
- KIECOLT-GLASER, J.K. & GLASER, R. (1995). Psychoneuroimmunology and health consequences: data and shared mechanisms. *Psychosomatic Medicine*, *57*, 269–74.
- LAMBERTS, H., WOOD, M. & HOFMANS-OKKES, I. (1993). *The international classification of primary care in the European Community*. Oxford & New York: Oxford University Press.
- LANGER, S.K. (1979). *Philosophy in a new key*. Cambridge MA: Harvard University Press.
- LE FANU, J. (1999). *The rise and fall of modern medicine*. London: Little, Brown.
- LERNER, B.H. (1996). Can stress cause disease? Revisiting the tuberculosis research of Thomas Holmes (1949–1961). *Annals of Internal Medicine*, *124*, 673–680.
- LIPKIN, JR., M., PUTNAM, S.M. & LAZARE, A. (Eds) (1995). *The medical interview: clinical care, education, and research*. New York & Berlin: Springer-Verlag.
- LOWN, B. (1996). *The lost art of healing*. Boston: Houghton Mifflin.
- MACMAHON, B. & PUGH, T.F. (1970). *Epidemiology: principles and methods*. Boston: Little, Brown.
- MARMOT, M.G., BOSMA, H., HEMINGWAY, H., BRUNNER, E. & STANSFELD, S. (1997).

- Contribution of job control and other risk factors to social variations in coronary heart disease incidence. *Lancet*, 350, 235–239.
- MCKEOWN, T. (1976). *The role of medicine: dream, mirage, or nemesis*. London: Nuffield Provincial Hospitals Trust.
- MCWHINNEY, I.R. (1978). Family medicine as a science. *Journal of Family Practice*, 7, 53–58.
- MCWHINNEY, I.R. (1996). The importance of being different. *British Journal of General Practice*, 46, 433–436.
- MEIER-SEETHALER, C. (1997). *Gefühl und urteilskraft: Ein plädoyer für die emotionale vernunft*. München: Beck.
- O'BRIEN, U. (1999). *Bad medicine: how the American medical establishment is ruining our healthcare system*. Amherst, NY: Prometheus Books.
- PAULI, H.G. (1989). Models of medicine: from a biomechanical to a biopsychosocial view. In: W.R. SHEA & B. SITTER (Eds), *Scientists and their responsibility*. Canton, MA: Watson.
- PAULI, H.G. (1990). Institutionalizing primary health care at the level of undergraduate education: didactic and structural considerations. In: P. BERGENHOFF, D. LEHMAN, & P. NOVAK (Eds), *Primary health care: public involvement, family medicine, epidemiology, and health economics*. Heidelberg & New York: Springer-Verlag.
- PAULI, H.G. & SCHÜFFEL, W. (1998). Wandel des denkens in der medizin? Wandel der ärzlichen ausbildung? In: W. SCHÜFFEL, U. BRUCKS, R. JOHNNEN, V. KÖLINER, F. LAMPRECHT & U. SCHNYDER (Eds), *Handbuch der salutogenese: konzept und praxis*. Wiesbaden: Ullstein Medical.
- POLKINHORNE, J. (1998). *Belief in God in an age of science. The Terry lectures*. New Haven & London: Yale University Press.
- REVANS, R.W. (1996). The hospital as a human system. *Bulletin of the New York Academy of Medicine*, 73, 418–429.
- SCHÖNBÄCHLER, G. (1998). Placebo from a biosemiotic point of view. *Forschende Komplementärmedizin*, 5, 18–23.
- SIEGRIST, J., PETER, R., CREMER, P. & SEIDEL, D. (1997). Chronic work stress is associated with atherogenic lipids and elevated fibrinogen in middle-aged men. *Journal of Internal Medicine*, 242, 149–156.
- SOLCUM, S. (1975). Woman the gatherer: male bias in anthropology. In: R. RAYNA (Ed.), *Towards a sociology of women*. London & New York: Reiter.
- SPIRO, H.M. (1998). *The power of hope: a doctor's perspective*. New Haven & London: Yale University Press.
- UEXKÜLL, T. VON & WESIACK, W. (1997). Scientific theory: a bio-psycho-social model. In: T. VON UEXKÜLL *et al.* (Eds), *Psychosomatic medicine*. München, Wien & Baltimore: Urban & Schwarzenberg.
- ULRICH, G. (1997). *Biomedizin. Die folgenschweren wandlungen des biologiebegriffs*. Stuttgart & New York: Schattauer.
- WHITE, K.L. (1991). *Healing the schism: epidemiology, medicine, and the public's health*. New York & Heidelberg: Springer-Verlag.
- WHITE, K.L., MARTIN, D.A. & VERNON, C.R. (1958). Venous pressure, emotions, and congestive heart failure. *Journal of Chronic Diseases*, 10, 163–185.
- WHITEHEAD, A.N. (1926). *Science and the modern world*. Cambridge: Cambridge University Press.

WORLD HEALTH ORGANIZATION (1980). *International classification of impairments, disabilities, and handicaps: a manual of classification related to the consequence of disease*. Geneva: WHO.

WORLD HEATH ORGANIZATION (1992–1994). *International classification of diseases*. Geneva: WHO.