Scriptura 61 (1997), pp. 179-192

TRANSFORMING MEDICINE'S CLINICAL METHOD: A CRITICAL ASSESSMENT OF THE INFLUENCE OF THE NATURAL SCIENCE WORLD-VIEW ON MEDICINE

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Abstract

Since the beginning of the nineteenth century western medicine has identified itself with the natural sciences and therefore with the world-view of the natural sciences. This 'natural science turn' led to great technical insight into and control of body processes, technical advances in diagnosis and management of diseases. However, it has also fundamentally influenced the understanding of the basic concepts of medicine such as patient, disease and therapy and in this manner has had a decisive influence on the nature of clinical practice and medical research. It has in particular failed to give the clinician the tools to understand the meaning of the illness for the patient and the role that these subjective meanings plays in diagnosis, therapy and healing. In spite of the technical advances made possible by the biomedical model, this loss of consciousness is a great limiting factor of the model. The regaining of consciousness (and with it the importance of the social sciences) is a central requirement for a transformed clinical method. In this paper the structure of the natural science world-view is outlined and its influence on medicine analysed. The theoretical requirements which are necessary before a transformed clinical method will be accepted by the profession for medical practice and research are defined as a new model of the nature of science and a new understanding of the structure of reality which can recognise consciousness as real. In the final section an attempt is made to redefine science in a manner that recognises the human and social sciences not only as 'real science' but as essential to medical education, medical research and clinical medicine.

1. Introduction: how medicine became a natural science

Since the middle of this century, when penicillin was discovered by Fleming, medicine has undoubtedly headed the natural sciences hitparade with dramatic advances in the understanding of disease processes, diagnostic technologies and therapeutic breakthroughs. But the fundamental shift in thinking - call it a paradigm change if you will - that made all this possible, actually took place at the beginning of the nineteenth century, soon after the French Revolution. French physicians (amongst others Laennec who introduced the stethoscope into clinical practice) introduced a simple change in clinical practice. They examined patients in the wards, and then, if they died, attended post mortems in order to correlate clinical findings with the pathology found in organs.

From this practice the whole complex nosology (classification of diseases) of twentieth-century medicine was developed, and on this pathology-based nomenclature and

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classification, all other diagnostic and therapeutic developments depended. Apart from advances in therapy, most of the conceptual and technological advances of twentieth-century medicine are the more sophisticated ways of examining patients and of defining tissue pathology and pathophysiology, modern technologies enabling clinicians to image tissue changes and pathologists to obtain tissue samples without having to wait for the post mortem room. Twentieth-century medicine could, from a history-of-ideas point of view, be described as a series of footnotes to the change in conceptual framework brought about by Laennec and his colleagues.

In the eighteenth century, apart from possibly feeling the forehead for signs of fever, examining the pulse and noting the facial expressions and state of the tongue, doctors did not examine patients, they only talked to them. This is understandable, because for them disease was not located in an organ of the body (even though they had very good anatomical knowledge), but was due to an imbalance of the humours in the blood. There was no sense in examining the body, since an assessment of the balance of the humours depended on the report by the patient of her/his experience of the illness. Doctors recognised essentially only one pathology (imbalance of humours) with many manifestations but individual to each patient. Treatment for these conditions was either purging, emetics or blood letting (Dixon 1996). One advantage of the humoural theory was that it recognised psychological aspects of disease as part of the clinical picture and responsibility of the doctor as the humours were also responsible for psychological states of mind. At one time in England there was an attempt at a botany-like classification of disease. Sydenham (who first described gout) tried a classification based on the natural history of diseases, but these had no prognostic or therapeutic usefulness (McWhinney 1986).

Everything changed when clinical pictures began to be correlated with actual pathology in an organ. Diseases were now located not in an imbalance of humours, but in observable (even quantifiable) pathological processes in an organ or organ system. This opened the way for more accurate descriptions and classification of organ pathology. Searching for causal factors and correlating clinical findings at the bedside with the organ pathology, improved the clinical diagnoses. It also paved the way for specific therapeutic measures and for checking the effectiveness of medication.

Disease came to be understood as something physically wrong in an organ, and the only task of the clinician was to identify the organ pathology underlying the clinical presentation. In his *Traité de l'auscultation médiate* (1819) Laennec provided masterly descriptions of pulmonary TB (of which he himself probably died in 1826), bronchiectasis, pneumothorax, cancer of the lung, empyema and pneumonia.

According to McWhinney (1986) this change to clinical examination with the purpose of diagnosing organ pathology, was not a development or new discovery within medicine. It was a fundamental change in attitude towards the patient and the human body, a change in attitude that made a new way of practising and thinking about medicine possible, and opened the way for medical science to develop.

Foucault (1975) points out that this change in medical thinking depended on a number of changes in French society of the time, such as the reorganisation of medical schools and hospitals during the French Revolution and new societal power relationships in terms of help-seeking and available knowledge. However, there is another story that needs to be understood in order to grasp this fundamental shift in medical thinking and practice, the story of the development of the natural sciences. Laennec was 18 years old when Lavoissier (who was the first to demonstrate the role of oxygen in combustion and thus refuted the phlogiston theory) was executed by the revolutionaries. And there had been nearly a

hundred years of development of Newtonian science and the Newtonian world-view to which French scientists had made a major contribution.

I believe that the new clinical method (correlating clinical picture with underlying organ pathology) which established modern medicine was motivated by a desire to emulate the methodology of the physical sciences which had by then proven its efficacy, or, to put it more definitively, medicine identified itself as a natural science (Foss and Rothenberg 1988). Examining the patient and then following up in the post mortem room was an application of the empirical experimental method to disease. But of course, with this identification of itself as a natural science, medicine also took over the whole world-view of Newtonian science. It is this world-view that I now wish to analyse, but before doing so I have to show that science functions on the basis of a world-view.

2. Does science have a world-view?

The term world-view is usually associated with cultural analyses. Every known human society is thought to rest on some set of largely tacit, basic assumptions about who we are, what kind of universe we live in, and what is ultimately important to us. These assumptions underlie the institutions and mores, patterns of thought, and systems of value that characterise the society. These assumptions are accepted as given, as obviously true and are throughout most of the history of an individual and the society, never questioned (Harman 1988). The term *scientific world-view* could therefore refer to the world-view of a society which has incorporated the findings and world-view of the science of its time into its structure so that these become part of the cultural set of tacit assumptions about society itself and the world.

However, since Thomas Kuhn (1970) introduced the term 'paradigm' into our understanding of what science is, one could argue that science itself functions on the basis of a set of largely tacit assumptions regarding the nature of reality (ontology) and how this reality can be known (epistemology). This set of assumptions can therefore be called *the world-view of science*. The world-view is not part of science, but makes science possible. It consists of certain assumptions regarding the nature of the world (called ontological assumptions) and assumptions regarding the methods that will enable us to know the world (called methodological or epistemological assumptions).

The world-view and the body of scientific knowledge stand in a dialectical relationship to one another in that the world-view makes science possible, but the findings of science influence the world-view. On the whole, the world-view shapes how science, the scientists and thus the culture(s) influenced by that science, will see the world. It is only when very creative and imaginative scientists find anomalies that do not fit the world-view, that a conceptual crisis develops and the world-view becomes consciously formulated, questioned, and sometimes reformulated.

The methodological and ontological assumptions of a discipline tend to become a world-view of science in another sense when they are generalised as the fundamental characteristic of the nature of science as such and of the nature of the world as such. This happened to the science that developed from the work of Descartes and Newton, the science that Lavoissier practised and that Laennec and his colleagues adopted as they commuted between ward and post mortem room. The paradigm that Descartes proposed and Newton applied in his physics was increasingly generalised as the requirement for science as such, as the only way to generate valid scientific knowledge, and eventually came to be considered as the defining characteristic of human rationality. This was consciously and aggressively done by the positivist school in the philosophy of science, but it represents the world-view of the

majority of practising natural scientists (Van Niekerk 1992) and, I believe, of medical scientists and medical practitioners.

During the second half of the twentieth century the tendency to generalise from one science or set of sciences, has been fundamentally questioned, and a much more nuanced, open and pluralistic understanding of science has replaced the natural scientific totalitarianism of before. At the same time a much more complex view of reality has been emerging, a complexity which must be kept in mind in our efforts to understand the world and our scientific methodology. However, this pluralistic view of science has had little influence on medicine as yet.

I now wish to analyse the effects of the natural science world-view on the clinical practice and the science of medicine.

3. How medicine lost consciousness: the world-view of science and the clinical method

Searle (1995) has given the following summary of the ontology (view of reality) of modern science. It is assumed, he says, that:

> We live in a world made up entirely of physical particles in fields of force. Some of these are organised into systems. Some of these systems are living systems and some of these living systems have evolved consciousness.

In the same vein Popper claims that, being a modern man, he shares 'with old fashioned materialists the view that ... solid material bodies are the paradigms of reality' (quoted by Griffin 1988). Because reality is equated with basic material building blocks, the consciousness that is recognised as having evolved, is considered to be an epiphenomenon of material processes (neurological activity). In other words, consciousness does not have a reality of its own, but is dependent on material processes and can be completely understood, so it is claimed, in terms of those processes. Because he takes the phenomenon of consciousness seriously, Popper is forced (with the neuro-physiologist Eccles) to opt for a dualistic understanding (they call it interactionism) of the relationship between consciousness and brain (Popper and Eccles 1983).

But if reality only consists of material building blocks interacting according to timeless laws, it also has implications for the methodology that will be found to be scientifically acceptable, for the types of phenomena that will be scientifically investigated and for the types of explanation and understandings that will be found to be scientifically acceptable by the scientific community. It is understandable that the metaphor for describing the world that became dominant in science was that of the world as a physical machine or mechanism. Because of the fixed interactions of the elements of a machine, the view of these interactions was a deterministic one, and the task of the scientist was to find the deterministic laws defining those interactions.

The first characteristic of the world-view of science is therefore a mechanistic and deterministic materialism. When this world view is translated into medicine, the patient is conceptualised (and treated) as a biological machine which, according to Descartes, will continue to function normally even if there is no mind in it at all. Disease is understood as a purely physical phenomenon (a malfunction of the biological machine) requiring physical interventions. The task of the clinician is purely that of correlating the clinical findings with a nosology (classification) of physical diseases, or, as McWhinney (1986) put it, to diagnose a disease rather than to understand a patient. The conscious worlds of the patient and the doctor and their interaction in the doctor-patient relationship will become irrelevant.

The research tradition based on this world-view will seek to understand the patient in health and disease in mechanistic and deterministic biological terms while ignoring consciousness as a causal factor in both.

The methodological correlate of this mechanistic and deterministic materialist ontology is the assumption that what is scientifically real (i e a necessary quality of scientific knowledge) is what is physically measurable. The assumption that all real knowledge is based on direct or instrument mediated observation of what is physically measurable, is called empiricism.

A second methodological correlate is reductionism, that is, the assumption that scientific explanation can only be found in the reducing of phenomena to more elemental events, such as explaining the temperature of a gas in terms of the motion of its molecules or human behaviour in terms of stimulus and response. A phenomenon is understood by analysing it into its parts and then elucidating their interaction. A whole is the sum of its parts.

Because the conscious worlds of the patient and the doctor and their interaction in the clinical situation is not physically measurable, it was ignored in medicine. Medical research and clinical practice concentrated on quantitatively defining the normal and the biological deviations from the norm which were called diseases. The reductionistic assumption found expression in the progression from explaining disease in terms of organ pathology, to explanations in terms of cellular pathology by Virchow at the end of the nineteenth century (with the triumph of his cellular model of life and disease over vitalism), and now to chemical and molecular pathology. At the end of the twentieth century a disease is considered to be completely scientifically understood only when its molecular basis has been defined. The whole thrust of medical research and medical technological development is determined by these methodological directives of the world-view of the natural sciences.

But it also determines the interaction between the doctor and the patient. The doctor's agenda is to diagnose the physical disease causing the patient's symptoms. The doctor is therefore not interested in the patient's needs, fears and expectations(Levenstein et al 1986) (i e in the patient's agenda) but wishes through directed questioning to draw the patient into the doctor's reductionistic, mechanistic and materialistic medical agenda (even if he/she is not a materialist in ordinary life!) in order to make a diagnosis and prescribe treatment. The natural science paradigm therefore dictates the structure of the interaction between the doctor and the patient.

Another aspect of natural science methodology of importance for medicine is the belief in the objectivity of scientific knowledge and the scientific method. By the objectivity of scientific knowledge scientists expressed their belief that through the scientific method it was possible to know the world as it is in itself (Van Niekerk 1992). It was thus knowledge which is free from all personal bias and commitments of the knower (the scientist) whether these be theological or ideological, and free of all personal feelings, expectations, fears et cetera. Scientific method gives direct access to reality in the form of knowledge which is impersonal, generally valid, a-cultural, value-free, universal and timeless (Foss and Rothenberg 1988).

The effect that this framework of assumptions has on the clinical method is obvious: the subjective world of the patient, the doctor and their interaction must be methodologically excluded. Not only are the values of the patient and the doctor methodologically irrelevant, but the uniqueness of *this* patient, in *this* situation, interacting with *this* doctor must be subsumed under general categories which are a-cultural, impersonal, universal and timeless. Just as a physics laboratory in Tokyo and London function in exactly the same manner, so

the clinical interaction in Burkino Fasa and New York must take place in exactly the same manner. The truth of the clinical situation must always be impersonal and generally valid.

The scientific method proceeds according to a strict sequence of experimentation, inductive logic, verification (or, according to Popper, falsification) and theory formation. This model holds a tremendous fascination for clinicians who consider the clinical method itself to be an expression of the scientific method. Harvey and others (1984) express this conviction in the following words:

> The analytic process by which clinical information leads to the diagnosis is closely akin to the scientific method - the process whereby experimentation leads to the discovery of new knowledge. (E)xperimental observations yield data. By analysing and extracting meaning from these data, an hypothesis is formulated that will explain the observed facts ... The scientist then designs a further experiment that will test (support or refute) the current hypothesis. The scientist may also have formulated alternative hypotheses and will design an experiment to distinguish between them.

They then go on to construct a model of the clinical situation which is analogous to this process.

To summarise - the world-view of the natural sciences as it developed from the time of Newton to the beginning of the twentieth century consists of a set of well integrated ontological and methodological assumptions. The ontological concepts are materialism, mechanism and determinism. The methodological concepts are: empiricism, objectivity, the use of inductive logic in the process of theory formation, quantifiability and verification or falsification of the theories thus formed.

The influence this had on the definitive concepts of clinical medicine can be summarised as follows:

3.1 The patient

The patient is understood as being essentially a biological mechanism (machine) which, in the words of Descartes, is 'so built up and composed of nerves, muscles, veins, blood and skin, (that) though there were no mind in it at all, it would not cease to have the same functions' (quoted by Foss and Rothenberg 1988). This is today still the basic model of the human being underlying the teaching of both the basic sciences and the clinical sciences as taught at medical schools in the western world.

Descartes' dualism sanctioned the idea of the body as a machine that can be analysed independently of the mind and of the social and cultural context of the person. This means that the diagnostic process abstracts the patient from his or her concrete existence and assumes that the patient, conceptualised purely as a biological organism, can be diagnosed in a context-free environment. Cartesian dualism was later reduced to a monistic materialism in which the body became primary and psychological functions became secondary epiphenomena of bodily processes. The psychological and social dimensions of human existence became irrelevant to the science and practice of medicine.

3.2 Disease and disease causation

In biomedicine disease is conceptualised as something physically wrong in an organ or organs which can be described as a deviation from the norm of measurable biological parameters (functional or structural). Disease is thus a material entity and can be completely described in physicalist language. Similarly the causes of disease are physical factors: the presence of too much or too little of a critical substance or the presence of an intrinsically

harmful agent. Disease is caused by a linear chain of physical causal events so that essentially there is one cause for a disease.

Since disease is biology gone awry, and since the biological organism can best be understood by an understanding of its constituent parts and their physical interactions, there is no need to delve further than the physical mechanisms of disease. In this manner the ultimate level of explanation of disease becomes the level of molecular biology. To the extent that disease is strictly interpreted in physical terms, both research energies and research funding will be focused strictly in this direction.

3.3 Therapy

Against this background it is clear that therapy will also be conceptualised in purely physical terms as physical intervention (chemical, electrical or surgical) that will compensate for the surplus or deficiency of the critical substance or will neutralise the pathogenic agent.

A last concept to understand the positivistic world-view with which medicine identified itself, is that of the unity of science (Van Niekerk 1992). According to this concept, there is only one model of scientific activity and that is the natural science model. This concept has tremendous controlling power within the scientific community. To be accused of being unscientific in the above sense is the most damning accusation that can be levelled at any scientist. It brands him or her as a heretic as fatally as in the case of the theological heretics of the middle ages.

Against this background it is clear why medical education, research and clinical practice could not see the importance of the social and human sciences for theory and practice, and why any attempt to transform the so-called scientific clinical method will have to take cognisance of the powerful controlling concept of the unity of science.

According to McWhinney (1986) an analysis of the medical curriculum indicates that '... medical knowledge is defined as that which is verifiable empirically by the scientific method. In this medicine has embraced positivism'. Not only did the identification of itself as a natural science affect the medical practice and medical research, but it also fundamentally affected medical education. The world-view as sketched formed the background for the development of medical education curricula in Europe, but also for the educational reforms brought about by Flexner in medical education in the USA in 1910. In spite of rhetoric to the contrary, medical education became natural-science based, with no place for the social sciences in the curriculum or in the thinking of clinicians and researchers (Kriel & Friedman 1990).

In the embrace of positivism, medicine gained power over the objective world of anatomical pathology. However, in the world so understood there is no scientific role for the characteristic contents of the human consciousness, or of the sciences that deal with that content. (I consider social relations and culture to be formative and constitutive of human consciousness.) The real object of clinical care and of scientific study became the nonconscious, broken down biological mechanism.

4. The limitations of the classical clinical method

Much has already been said about the clinical method that was born from the embracing of positivism. It has proved to be tremendously powerful in understanding and controlling certain aspects of biological function and malfunction. McWhinney (1986) identifies two major strengths of the traditional, positivist

based clinical method. First it tells the clinicians precisely what they have to do to get the required results: 'Take the patient's history and conduct the examination in the prescribed way, and you will either arrive at the pathological diagnosis or be able to exclude organic disease.' The 'prescribed way' focuses on objectively verifiable complaints, physical signs and abnormalities found on special investigations (blood tests, biopsies, imaging techniques such as X-rays, CAT scans etc). The second strength is that it provides precise criteria for validation. The pathologist tells the clinicians whether they are right or wrong.

McWhinney (1986) then lists four major limitations:

- First, the method is strictly objective. In the whole process the subjective world of the patient, the doctor and their interaction is meticulously excluded. The aim of the process is to diagnose disease, not to understand the patient and his/her experience of the illness. The patient's agenda is overwhelmed by the doctor's objectively orientated agenda. In spite of the advantages of this method, patients claim that they feel dehumanised in the clinical process, whether it takes place in a hospital setting or in the consulting rooms of the profession. The scientific strength of the method becomes, in the eyes of the patient, it's Achilles heel.
- Second, the method concentrates on the technical aspects of care. This has led to the tremendous escalation of the cost of health care (Dixon 1996). Quality of care is assessed in terms of the technology thrown at the clinical problem, but the patient experiences a decline in the quality of care.
- From what was said above the method cannot deal at all with the problems of meaning experienced by patients - or with that of the doctor. Illness represents a crisis in the self-understanding of every patient. This is an inherent part of the meaning of the illness. Illness happens to the whole person, and healing consists in a restoration of wholeness. Suffering can be endured if it can be understood. But this whole dimension of being human is excluded in principle from the clinical method.
- Finally, the objectivism and technological bias of the traditional clinical method lead to a poor doctor-patient relationship. This has been shown to be related to patient dissatisfaction with modern scientific medicine, with the move towards alternative medicine and with the increase in litigation of medical professionals by patients. It has also clearly been shown that a good doctor-patient relationship leads to improved diagnosis and response to therapy, which cannot be explained on purely mechanistic terms. Here is an anomaly (the placebo phenomenon is another) which signals the end of a paradigm!

5. Regaining consciousness for the clinical method

In the discipline of Family Medicine a strong attempt is being made to formulate a transformed clinical method, which radically transforms the biomedical method and is not simply an add-on to it. It is generally referred to as 'the patient-centred method' (see e g Levenstein et al 1986; Henbest and Fehrsen 1992; Fehrsen and Henbest 1993). The main thrusts of this clinical method can be summarised as follows: it is based on dialogue and empathic listening; it aims at understanding each patient in his/her uniqueness; it attempts to understand illness at many levels; it requires thinking in terms of causal webs and it requires a transformed physician (McWhinney 1986).

McWhinney believes that in order to transform medicine's clinical method, it must be recognised that the scientific method is only one of several routes to knowledge. Although I

support this statement completely, the problem is what to call these alternative routes to knowledge. He refers to the three routes to wisdom recognised by the 'the perennial philosophy' namely the sensory, the mental and the transcendental, but such concepts will not cut ice in the hard world of the clinical sciences. Because of the tremendous emotional commitment to scientific medicine, any attempt to include anything that is not considered scientific by the profession is bound to fail. In attempting to transform the clinical method, the tremendous controlling power of the concept of the unity of science must be kept in mind.

My suggestion is therefore that it is necessary to demonstrate convincingly that the term *science* cannot in any scientific manner be limited to the specific methodology of the natural sciences. It must be a view of science that creates a legitimate space for the social and human sciences as scientific (without sacrificing them to the natural science version of empiricism), which then opens the door for their methodologies (and principles of verification) to become a legitimate and necessary part of the armamentarium of scientific medicine. For the transformation of the clinical method, medicine therefore requires a new understanding of science or, as McWhinney (1986) put it more broadly, a new epistemology. (For attempts to do this see Engel 1989; Schwartz and Wiggin 1989; Foss and Rothenberg 1988.)

Unfortunately the work of Thomas Kuhn does not give us a sufficiently different understanding of science. According to his model of science, the human sciences are still in what he calls 'a preparadigmatic phase of development'. Chalmers' version of critical realism does not help either (Chalmers 1982). But if we develop a model that takes seriously the essential dialectical relationship between method and research domain this might be achieved. The method is determined by the presumed structure of the research domain or, to put it more technically: ontology determines epistemology and vice versa.

The emerging systems' view of reality is that of a hierarchy of levels of complexity and meaning (physical, biological, personal, social etc), each operating in terms of appropriate meanings and laws with interconnecting laws of action between adjacent levels in the form of bottom-up and top-down causation, but in which higher levels cannot be reduced to the meanings and laws of lower levels (see Capra 1982; Ellis 1993; Peacocke 1993).

This means that research domains may differ from one another in principle and therefore require essentially different methods to access the truth of the domains. There is thus not only one scientific method. A method is scientific if it is relevant to the structure of its research domain and therefore generates valid knowledge. The human person requires different method(s) of knowing than the physical world.

But a transformed view of methodology is not enough. Because of the intimate link between method (epistemology) and research domain (ontology), for a transformed clinical method to be acceptable within medicine, a new way of understanding reality and a new model of reality are fundamental requirements. McWhinney signals this when he argues that the linear (mechanistic and deterministic) understanding of causality (the metaphor of the chain of causality) must be replaced with the metaphor of a causal web or network. However, in an incisive article Krieger (1994) has argued convincingly that replacing the metaphor of a linear chain of causality with the metaphor of a web of causality (multiple causation) does not help us to overcome the limitations of biomedicine. We require, I believe, an understanding of reality (an ontology) that is capable of including the so-called subjective world of consciousness as real (not as an epiphenomenon of matter), or as Perry put it, it must be able to include consciousness as a causal reality (Harman 1988).

There is experimental evidence of this in clinical research and in the field of psychoneuroimmunology. But the problem is that these findings are formulated against the conceptual backdrop of the classical mechanistic materialist ontology which sanctions an objectivistic and reductionistic consciousness-free clinical method. We therefore need a new ontology.

I believe that such an ontology is emerging from the late twentieth-century sciences, from certain interpretations of quantum physics, chaos theory and a radical form of systems theory (organicism) (see Griffin 1988). We are on the way to a paradigm revolution in the ontology of science which will enable a new understanding of life (a new biology) and a new understanding of conscious life which will not negate what can be said from a materialist viewpoint, but will transcend the limitations of that point of view.

By consciousness I do not refer only to individual consciousness, but to consciousness as a psycho-social phenomenon. The point I am trying to make is that medicine will not take consciousness (including the social relations implied in human consciousness) seriously until we can offer a theory of consciousness that recognises it as ontologically real without taking recourse in dualism. By consciousness I am also referring to both animal and human consciousness. Although human consciousness has a distinctive feature in that it includes self-consciousness (meta-consciousness), it is, from an evolutionary point of view, linked to animal consciousness. Without (animal) consciousness there can be no (human) self-consciousness. As a subset of the required ontology we therefore require a new philosophical anthropology or theory of the human person. (I call it a philosophical anthropology to differentiate it from cultural or physical anthropology.)

I therefore propose that in order to overcome the limitations of the traditional clinical method and to develop a transformed clinical method which will not simply be an add-on to biomedicine but will transform biomedicine, we need to overcome

- the epistemological reductionism with a new understanding of science and the scientific method which will enable us to incorporate the methods of the human and social sciences as a legitimate part of scientific medicine necessarily and directly applicable in the clinical consultation;
- the mechanistic materialistic ontology with a new metaphor of reality which will enable us to overcome the reductionistic, mechanistic materialist understanding (and elimination) of consciousness and will enable us to formulate
- an understanding of consciousness which recognises it not only as real, but as a causal reality. We have to regain an ancient understanding of the body as a conscious body and of consciousness as embodied consciousness, that is, of the unity of the person.

In the final section I wish to present a simple but hopefully persuasive argument (even if only for medics!) which attempts to develop a framework within which science can be understood to include the many and diverse methodologies of the human and social sciences - not only as legitimately 'scientific', but also as necessary for clinical medicine.

6. What is science?

Most discussions about 'science', even very heated ones, rarely define exactly what is meant by the word. The meaning is simply assumed. Usually the assumed meaning equates *science* with *the natural sciences* which is unhelpful because it assumes that we know what the natural sciences are, that we know why they are called *science* in the first place. It is also plainly wrong because there is by now a long tradition of the social and human sciences

which claim to be scientific as much as the natural sciences, but in a different way. And this makes a lot of sense, because the objects of their scientific curiosity (their research domain) differs quite markedly from that of the natural sciences and so will require other methods to access the truth of their specific domain.

In this very simple statement that the social and human sciences claim to be *science but in a different way*, there lies a lot of information about science. It implies e g that science involves research domains which may differ in principle from one another and which therefore require different methods by which they must be understood and explained. This argument could of course be launched from other more 'scientific' or more 'philosophical' starting points. Taking seriously the claim by our social science colleagues that they practice *real science* is, I believe, a straightforward manner of entering the debate even if it consists of opposing one dogmatic claim (only the natural science method is science) to another (science must be understood in such a manner as to recognise the scientific validity of the social and human sciences).

This should not be strange to the natural scientist, because, although most of the natural sciences (except mathematics which is a science of logic rather than one of physics) use more or less the same conceptual framework to understand and guide what they are doing, the methods may differ quite markedly. So, for example, the appropriate methods for the study of tectonic plate movement is quite different from that of the ultra structure of atoms which in turn is quite different from that of galaxies, not to talk of the communication of bees. The important point is that science is linked to method which is linked to the structure or the nature of the research domain. Extreme sociobiologists claim that all of social reality is simply the expression of DNA codes. This is a form of biological reductionistic materialism which depends on denying the causal reality of consciousness. They would therefore deny that in sociology we are dealing with a research domain which is different in principle from that of biology and that it requires a different methodology. This argument cannot be settled on a methodological level - it requires an ontological debate which is beyond the scope of the present approach.

The meaning of the term *science*, is intimately linked with *method* and the method that is involved here, is the rules for gathering information and rules for classifying and interpreting information and for validating evidence. The rules between research domains will differ, but science is in the methodological business. Even in relation to the same research domain, the methods may differ depending on the objectives of the researcher. Research domains are rich in content, and the method which is relevant for one type of information and researcher interest may not be suitable for another type of information or research objective. Some methods are simply more suitable for meeting some objectives and totally unsuitable for meeting others, even within the same research domain.

But gaining information is not yet understanding or explanation. Information has to be interpreted, must be moulded into hypotheses, models and theories. Scientific understanding and explanation will differ - depending on the research domain and the methodology and objectives of the scientist - but it is usually expressed in the form of hypotheses, models and theories. In some cases these may be heavily dependent on mathematics, while in others it may be expressed in narrative form. Both are science. The scientist therefore reworks the information of the research domain gathered by the method and presents it in the form of concepts, hypotheses, models, theories or narratives. Each of these steps is done in terms of criteria considered to be valid by a community of researchers. Science is a specific hermeneutical method of reading the text of the aspect of reality investigated by the researcher. Galileo drew the analogy between reading written texts and science as a reading

of nature as a text. He recognised only one language in terms of which scientific reading can take place, namely mathematics.

When we believe that our understanding or explanation of something (regardless of what that something is) is in some manner correct (regardless of our criteria for correctness, or how we decide on those criteria), that it gives us valid insight into and understanding or explanations of an aspect(s) of the domain, then we say that that understanding or explanation is true. So science is in the truth business.

Truth is clearly not the sole prerogative of science. Poetry and other forms of literature as well as the dramatic and fine arts are all in the truth business. If we did not recognise something of our subjective or objective reality in their artistic creations, we would not find any connection with the artifacts produced. However, the truth of the artist is not paradigm-mediated, domain-related and method-dependent in the same manner as that of the scientist. Truth is also used in an ethical sense within societal relations to indicate a manner of behaving and living within the societal context. So society too is in the truth business.

But for science truth is linked to method, and truth (like method and like science) is multifaceted. The truth of science of literature is quite different from the truth of the science of human society (sociology), or the truth of the science of history - which is again quite different to the truth of sciences of human structure (anatomy) and human function (physiology), although they all have something to do with humans as a research domain. And the truth of science of literature will show more links with the science of society than with the science of human structure, just as the science of galaxies shows more links with the sciences of matter (physics and chemistry) than with anatomy.

Therefore we must neither equate science with the natural sciences, nor must we equate the method and the truth of one group of sciences, or even of one science, with *the* scientific method. Science represents a wonderful kaleidoscope of methods and truths and of insights into, explanations and understandings of this wonderful thing we call reality, and which we have the privilege of inhabiting and trying to understand.

Science is a methodical way of investigating a research domain. But therefore the method - which in turn must in some meaningful way be related to the nature of the domain - cannot be part of science. And of course the nature of the research domain and thus the adequacy of the method we intend using, cannot be known before we start understanding it. So science of necessity operates with certain assumptions regarding the reality under investigation and the methodology appropriate to that reality. Science always starts with some form of pre-understanding. The work of the scientist is necessarily embedded in a tradition of understanding.

The scientist is therefore also creative, like the creative artist. Van Niekerk (1992) refers to scientific models as *creations of the human imagination* (my translation). But where the creative artist creates a new reality (which can then be studied scientifically) the scientist's creativeness is always in relation to, and therefore bounded by, an already existing reality, and within the context of a method accepted by the scientific community. But it is nevertheless an act of creative imagination. Einstein's contribution to science involved creative imagination regarding the nature of physical reality quite on a par with that of Beethoven or Van Gogh. And his postulates regarding reality opened up new vistas for the development of new methods, just as great artists open new possibilities of artistic expression and thus new possibilities of experiencing and seeing ourselves and the world. It makes methodological sense to talk about beauty in science as much as in art (see Barrett 1995).

Just as creative artists may create art forms that do not continue to inspire artists and art lovers and thus to establish a sustainable tradition, so too, because we are dealing with imaginative assumptions regarding ontology and methodology, science may go along a route which eventually peters out. This is what Kuhn refers to as paradigm crisis and Lakatos (1978) calls a degenerating research tradition.

No science gives direct access to reality. Scientific knowledge is always paradigm-mediated, or tradition-mediated. It is never absolute, always perspectival, always *en route*. The biological epistemologists argue that the human brain has evolved, like all other brains in other species, for biological reasons (e g for survival reasons). Just as a frog knows reality within the limitations of its central nervous system and constructs its reality in terms of its nervous system, so too do we have a perspective on reality within the limits set by our nervous system (Riedl 1981). We construct reality in terms of the possibilities given by our biology. The fact that we have meta-conscious abilities and language does not mean that we can construct an absolute understanding of reality as it is in itself. All scientific understanding and explanation is a specifically human understanding. This means, I believe, that the structure of human consciousness is both the origin and the ultimate limitation of science. But it is also the unifying factor in all understanding.

Science is a paradigm-mediated understanding of a research domain by a scientific community expressed as a symbolic knowledge system in terms of concepts, hypotheses, metaphors, models, theories and narratives, and validated in terms of the methodological framework accepted by the community of scientists. The natural sciences do not have the prerogative to prescribe the nature of scientific method or scientific knowledge.

When the French physicians started to examine patients and correlate their findings with post mortem examinations, they identified themselves (and medicine) with the natural science of their day. They therefore took over the methodological and ontological assumptions of the natural sciences. The concept of a social science did not exist - thinking about social phenomena was still part of philosophy. One could therefore say that medicine took over the natural science paradigm, or research tradition or - because a paradigm functions much like a world-view, that medicine took over the natural scientific world-view.

However, while there have been dramatic advances in the understanding and management of disease at the biological level, so too have there been equally dramatic advances in our understanding of the nature of the sciences and in the understanding of the human person in society by the social and human sciences. These insights have to be incorporated into medical education, medical research and especially clinical practice - if medicine wishes to retain the trust of its patients and the right to continue calling itself 'scientific medicine'.

BIBLIOGRAPHY

Barrett, P 1995. Beauty in physics and theology, in Du Toit CW *Nature, God and humanity*. Pretoria: Research Institute for Theology and Religion, Unisa.

Capra, F 1982. *The turning point: Science, society and the rising culture*. London: Fontana.

Chalmers, AF 1982. *What is this thing called science?* Milton Keynes Open University Press.

Dixon, AS 1996. *Is 20th century medicine a prisoner of 17th century science.* Sun Yat-Sen Chair in General Practice Inaugural Lecture, University of Hong Kong, Hong Kong.

Ellis, GFR 1993. *Before the beginning: Cosmology explained.* New York: Bioyars Bowerdean.

Engel, GL 1988. How much longer must medicine's science be bound by a seventeenth century world view? in White, KL (ed), *The task of medicine: Dialogue at Wickenburg*, 113-136. Menlo Park: Henry J Kaiser Family Foundation.

Fehrsen, GS & Henbest RJ 1993. In search of excellence. Expanding the patient-centred clinical method: A three-stage assessment. *Family Practice* 10(1), 49-54.

Foss, L & Rothenberg, K 1988. *Medicine's second revolution: From biomedicine to infomedicine.* Boston: New Science Library.

Foucault, M 1975. *The birth of the clinic: An archeology of medical perception.* New York: Vantage.

Griffin, DR 1988. *The reenchantment of science: Postmodern proposals.* New York: State University of New York Press.

Harman, WW 1988. The postmodern heresy: Consciousness as causal, in Griffin RD, *The reenchantment of science: Postmodern proposals.* New York: State University of New York Press.

Harvey, A M et al 1984. *The principles and practice of medicine.* 21st edition. Norwalk: Appleton-Century-Crofts.

Henbest, RJ & Fehrsen, GS 1992. Patient-centredness: Is it applicable outside the West? Its measurement and effect on outcomes. *Family Practice* 9(3), 311-317.

Krieger, N 1994. Epidemiology and the web of causation: Has anyone seen the spider? *Social Science and Medicine* 39(7), 887-903.

Kriel, JR & Friedman, M 1990. Curricular inertia: A model to explain the failure of curricular reform in medical education. *South African Journal of Higher Education* 4:2.

Kuhn, TS 1970. *The structure of scientific revolutions.* Chicago: University of Chicago Press.

Lakatos, I 1978. *The methodology of scientific research programmes.* Cambridge: Cambridge University Press.

Levenstein, JH et al 1986. The patient-centred clinical method. 1. A model for the doctor-patient interaction in family medicine. *Family Practice* 3, 24-30.

McWhinney, AR 1986. Are we on the brink of a major transformation of clinical method? *Canadian Medical Association Journal* 135, 873-878.

Peacocke, AR 1993. *Theology for a scientific age: Being and becoming - natural, divine and human.* Minneapolis: Fortress.

Popper, K & Eccles, J 1983. *The self and its brain: An argument for interactionism.* London: Routledge & Kegan Paul.

Riedl, R 1981. *Biology of knowledge: The evolutionary basis of reason.* New York: Wiley.

Schwartz, MA & Wiggins, O 1988. Scientific and humanistic medicine: A theory of clinical methods, in White, KL (ed) *The task of medicine: Dialogue at Wickenburg* 137-171. Menlo Park: Henry J Kaiser Family Foundation.

Searle, JR 1995. *The construction of social reality.* London: Allan Lane/Penguin.

Van Niekerk, A 1992. *Rasionaliteit en relatiwisme: Op soek na 'n rasionaliteitsmodel vir die menswetenskappe.* Pretoria: Human Sciences Research Council.