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Introduction to the First Day: Emerging Concepts

Background

The symposium on 'The discipline of Medicine' follows from a widely spread feeling of uneasiness, both of the public and the profession, with many aspects of the present state of medicine. The word discipline in the title is used in the sense of a field of knowledge and skills applying common basic concepts, in this case the concepts of disease. Thus the wide field of medicine may be divided in two parts: a *theory* of medicine (which develops concepts) and the *practice* of medicine, the latter concerned with prevention of disease and the cure and care of people with illness.

During the past fifty years the cluster of knowledge and skills related to illness (theory) and the medical care (practice of medicine) went through a true metamorphosis, as the result of new knowledge, drugs, medical technology and increase of wealth. Medicine has a large interface with society. In many industrial countries medical care has reached the status of being a social right. Serious repercussions at the level of society, as to cost and solidarity, and fundamental ethical problems have now arisen, also for the individual.

These general trends are the results of the efforts by a large number of scientists of different disciplines, such as physics, biochemistry, biology and mathematics etcetera, collaborating and/or interacting with doctors. *The medical discipline acquires knowledge with a purpose:* to use it for prevention, cure and care. The doctors had to integrate the new advances to make them suitable for application in patient care.

Many new specialties emerged, with their own journals. This stimulated further fragmentation of medical knowledge and narrowing of views about the state of illness in patients. Many new acquisitions were successful, but a number were ultimately disappointing because of simplified mechanistic thinking with a deterministic overtone.

The section of Medicine of the Royal Netherlands Academy of Arts and Sciences (KNAW) shares the expressed concerns. It therefore wants to promote discussions on this subject, with the aim to broaden prevailing thoughts and to develop concepts for integration of medical sciences which may reduce fragmentation and promote more satisfactory decision making. It was decided to initiate the discussions on fundamental aspects of the present concept of disease, its manifestations and underlying mechanisms, otherwise said: to reflect on the *disease model*, presently in use, and which elicits diagnosis and treatment, and research activities.

On disease models and the 'scientific method'

Since human beings have consciousness at their disposal and are able to reflect, disease models must always have existed. In this context it is amazing to find that the theory and practice of Greek medicine were able to withstand time for 2000 years, up till the eighteenth-century despite of the fact that all reality was missing. The concept of disease was that disequilibrium of four humors of the body in quantity and in action, caused disease. The practice of medicine had to aim at support of the natural forces for restoring the equilibrium and so the health. The Hippocratic physician – writes the medical historian Ackerknecht – was primarily not interested in diagnosis, but in prognosis and treatment. He was concerned with the body as a whole rather than with the lesion parts (Ackerknecht, 1982).

'*The dominant model of disease today is biomedical*, with molecular biology its basic scientific discipline. It assures disease to be fully accounted by deviations from the norm of measurable biological (somatic) variables,' (G.L. Engel 1977). Observation, experimentation, logical reasoning on basis of cause and effect, unidirectional and therefore mechanistic and deterministic have to identify the cause of disease. This analytical approach means the application of 'the' scientific method, so successful since the eighteenth century in the physical sciences. Its use needs complex questions to be broken down and studied in parts, and the results re-integrated to achieve a conclusion. The Dutch physician Boerhaave generally receives the credit for starting and pushing this new eighteenth century approach also for medicine with his famous book: 'Institutiones Medicine' (Leiden 1708), translated in many languages (figure 1).

For medicine this frame of thought turned out to be successful in the nineteenth century with the study of microbial disease and nutritional problems, both being mainly induced by the environment. The human organism as whole (like a black box) was used as parameter for the presence or absence of the disease (the 'effect'). The harvest was the identification of 'causes', and consequently the doubling of life expectancy at birth over the period 1850-1950 with measures of prevention. In spite of the success, already around 1900 investigators realized that matters were not so simple as the study design suggested. Most diseases do not have a single cause, but are multifactorially determined!

In our century, with the rise of the life sciences and many new analytical techniques, living organisms as objects were studied in detail in health and

A

METHOD

OF

Studying PHYSICK.

CONTAINING

What a Phyſician ought to know in Relation to the Nature of Bodies, the Laws of Motion; *Staticks*, *Hydroſtaticks*, *Hydraulicks*, and the Proprieties of Fluids: *Chymiſtry*, *Pharmacy* and *Botany*: *Oſteology*, *Myology*, *Splanchnology*, *Angiology* and *Diſſection*: The Theory and Practice of Phyſick: *Phyſiology*, *Pathology*, *Surgery*, *Diet*, &c. And the whole *Praxis Medica Interna*; with the Names and Characters of the moſt excellent Authors on all theſe ſeveral Subjects in every Age: *Syſtematicks*, *Obſervators*, *Operators*, &c. their beſt Editions, and the Method of reading them.

Written in *LATIN*

By the Learned HERMANN BOERHAAVE,

Now Profeſſor of Phyſick in the Univerſity of *LEYDEN*.

Tranſlated into Engliſh *by Mr.* SAMBER.

Medicum creavit Altiſſimus. Altiſſimus creavit de Terra Medicinam. Eccleſ. cap. 38.

LONDON:

Printed by *H. P.* for C. RIVINGTON at the *Bible* and *Crown* in St. *Paul's Church-yard*; B. CREAKE at the *Bible* and *Ink-Bottle* in *Jermyn-ſtreet* againſt St. *James's* Church; And J. SACKFIELD in *Lincoln's-Inn-Square*. MDCCXIX.

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Figure 1: the frontispiece of Boerhaave's book in the English translation by Mr. Samber in 1719.

disease with intensified effort of a tenfold increased number of investigators. The production of data and mechanisms on what happens in the body was immense, mostly obtained by the methodology of the classic scientific method. An important finding was the concept of the dynamic state of body constituents!

Reintegration of many isolated data to a (sub)system serving functions was however very difficult, and bridging these to illness even more. Theoretical support came from computer scientists who drew attention to the fact that the available data originated from different levels of organization in the body and therefore were of a different kind and reliability. It needed *vertical* thinking! (Blois, 1988).

In one sector it was in a number of cases easier to gain insight in altered mechanisms through disease, that is in the field of *clinical genetics*. The cause of the disease was known for many of the monogenetic forms of disease and did not therefore have to be searched. The result in general is that the biochemical and molecular biological studies are able to provide means for unequivocal diagnosis and classification. This cannot be said for many other diseases where abnormal values or mechanisms are identified as diagnostic clues instead of causes. It leads to *uncertainty* of different degree for diagnosis, prognosis and choice of intervention. The failure to achieve a *certain* diagnosis may be related as well to the methodological approach of unicausality, as to the incompleteness of knowledge about functioning of the living human body. Physicians are in a different position than engineers; when these have to repair a machine, a detailed *blueprint* is available, while the physician works with a constructed *model*, which is upgraded regularly. This model is furthermore constructed on much information originating from reductionistic studies.

There are also two major criticisms against the above sketched biomedical model and the analytical approach. First, that the remarkable quality of living organisms to be able to adapt to changes inside and outside the body is not explicitly taken into account. And secondly, that the property of human beings of consciousness and reflection provides psychological and social inputs proven to be of functional significance for the organism. The arguments therefore go strongly in favour for extension of the biomedical model into a bio-psycho-social model for studying illness and disease.

As to the analytical approach ('the scientific method') it should be remarked that since many years the suspicion in the philosophy of science exists that not in all fields of knowledge the analytical approach fits the problems to be studied. Sociologists have defended the position that social sciences have a different purpose or a different method from the natural sciences including biology.

Recently a study carried out at the University of Groningen concluded that the most important dividing line in science is that between biology and chemistry. Anne Ruth Mackor writes in a summary of the study: 'In fact, biology, psychology and the social sciences have a common characteristic, which distinguishes them from physics and chemistry. This is related to the manner in which the sciences classify the objects of their research. Whereas physics and chemistry classify their objects in terms of their dispositions (for example, glass is fragile) and/or in terms of their physicochemical microstructure (water is H_2O), biology, psychology and the social sciences classify the objects they study (organs, behaviour) in terms of their function. This function in turn is determined by the reproductive history of the objects in question. This difference in classification has far-reaching consequences, in particular for the nature and role of laws and explanations in these sciences. At the same time, however, the study shows that the differences do not stand in the way of cooperation with physics and biochemistry. The study therefore claims to give a justification within the philosophy of science for cooperation between physics, biology, psychology and the social sciences.'

Many biologists, psychologists and also many physicians therefore prefer to develop a picture of what happens inside the living body through reasoning from *the whole of the organism* down to lower levels of organization (eventually atoms), instead of the other way around and trying to integrate facts obtained with the analytical method. They strongly underline the significance of this view for the unique human individual whose behaviour is also developed and determined (through consciousness and reflection) by interacting with the environment, other people and culture (Brody, 1973).

The psychologist W.B. Cannon developed in his book 'The wisdom of the body' a rational construct of a living (higher) organism as being a set of *integrated* subsystems (such as circulation, digestion, respiration etcetera) which are *interconnected* (Cannon, 1932). The entire system strives for *equilibrium*. Illness was conceived as a state of disequilibrium. (The term 'system' is used for a group of related element organized with a purpose (Harper etc., 1988)). Introducing equilibrium as aim for the organism, restores the old Greek concept for illness. Recently the approach of the organism as a set of subsystems which, as a whole, strives for equilibrium has been philosophically extended by Foss. He also developed tentative schemes for new disease models (Foss, 1988).

Systems thinking as a conceptual method developed already in the end of the nineteenth century, but went through fast development in the second half of the twentieth century, with the start of cybernetics, and also through application of information theory, and new developments in thermodynamics. The approach to living organisms, described as *open* systems because of their interaction with the environment through a flow of matter and energy in and out the system, was better founded and given form.

Brody developed a view of man postulating a hierarchy of levels of organization (figure 2). If these are considered the horizontal component of the hierarchy, the flow of information with feedback loops may be con-

Systems Hierarchy (Levels of Organization)

Biosphere

Society-Nation

Culture-Subculture

Community

Family

Two-person

Person
(experience and behaviour)

Nervous System

Organs/Organ Systems

Tissues

Cells

Organelles

Molecules

Atoms

Subatomic Particles

Figure 2. After Brody, with slight alterations.

ceived the vertical component. Each level of the hierarchy has its own environment internally, while at the level of the satisfactorily functioning person the environment is outside the system.

I have sketched in a few words a rough outline how systems thinking in an abstract construct views the way humans achieve to function in their environment. To quote Brody: 'The hierarchy of natural systems labelled "Man" has a number of requirements for its proper functioning. Each if its components systems on each hierarchical level must be intact and functioning. ...It seems reasonable to identify the disruption of hierarchical structure that results from (such) a perturbation with the concept of disease ... The nature of the hierarchical structure dictates that in time the perturbation will result in some disruption on nearly all levels.' (Brody, 1973)

Hopefully this model of disease conceived as a disruption of the dynamic equilibrium in a hierarchy of levels of integration, will be scrutinized at this symposium for possible advantages over the 'analytical model.' Does it redress the problems caused by fragmentation? Will it provide new hypotheses for solving medical problems? Is it 'either or', or will they be used in combination?

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