

EDITORIAL

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Mathematics and the Medical Profession

In times past it was most important to be literate for this was the measure which determined levels of education in most fields of human endeavour. In the modern world it has become equally important to be numerate. Numeracy may require definition, viz. the ability to understand and converse in terms of scientific principles, methods and the ever-multiplying jargon of modern technology. Mathematics always has been and always will be the most powerful tool and medium of expression of the numerate sciences. Therefore it staggers one that medical men by and large are quite content to amble along on the basis of what often tends towards pseudoscientific jargon without a clear concept of the basic principles which govern the applied science, which modern medicine is, and with complete neglect of mathematics.

Historically the development of mathematics in both its pure and applied forms has been related to concepts and fields of science which could be reduced to relatively simple abstract terms. This resulted in its application being confined to those problems that could be formulated in terms of simple deterministic mathematical models. The mathematics of the ancients through Euclid and up to and beyond Newton was basically of such simple form and although analytically developed to great complexity, had limited range and could deal only with simple systems. Physical reality which largely consists of highly complex probabilistic systems which interact dynamically, cannot readily be reduced to simple mathematical analogues. Fortunately this reality does crystallize into simple systems at specific levels of physical scale. This phenomenon has made possible the formulation of

many very simple scientific laws. Newtonian physics, including engineering, has made great advances with the aid of such simplified procedures because many problems can be isolated, simplified or idealized so as to be manageable in these terms. However, we know that these laws are merely approximations based on probabilities and are reliable only within specific bounds. There remain vast fields of human activity and interest which are not amenable to such procedures. Where such mathematical analogues have been produced to sober aspects of complex systems, these models usually suffer from oversimplifications, making extrapolations unreliable and consequently severely restricting the usefulness of the procedures. Many problems remain intractable because of the limitations of classical mathematics even with the aid of powerful experimental techniques that have been developed to overcome these shortcomings.

The development of the so-called numerical methods coupled with electronic digital computers has changed the picture completely in a matter of a few decades. Procedures are now available for the solution of highly complex problems and the method as such is no longer the limiting factor, but rather the computer capacity. Computer technology is making such rapid strides that new fields of development are opening, the horizons of which are not even visible!

The medical profession is concerned with the human body which cannot be classified other than as a very complex probabilistic system. For this reason mathematical analysis suitable for simple systems has in the past played an insignificant role in medical science and knowledge has largely been

gained by empirical phenomenological methods. The usefulness and power of the latter procedures are not disputed. The time has, however, arrived for the medical profession to take stock and to think and plan ahead. The medical specialists of the future will require a sound training in mathematics not unlike that of engineers if they are to cope with the analysis of the complex probabilistic models which must ultimately be the only way to place medical science on a more acceptable basis.

The science of cybernetics as developed by Norbert Wiener et al.¹ has given some indication of the capability of these tools. In this methodology lies the future key to development in a wide range of human activities. A clear understanding of the principles underlying this new science is extremely difficult if not impossible without a basic knowledge of the related mathematical theories. It may be necessary to develop a specialized brand of medi-

cal mathematics. New breeds of specialists will no doubt emerge from this, but the GP and the majority of other specialists will require at least a reading knowledge of these developments, even if only to know what they do not know.

Professions that do not attend to their numerate ability are going to stagnate in the world of the future. Engineers, by the development of systems engineering, made ventures such as the Apollo moon missions feasible in spite of predictions by certain learned gentlemen who were reasoning along the lines of orthodox probability theory that it was utterly impossible.

These developments present a challenge to the medical profession to take a major step forward which may be no less significant than that of progress in the past from witchdoctor and superstition to modern medicine.

1. Wiener, N. (1948): *Cybernetics*. New York: John Wiley & Sons.

My Baba en Ek

Die jong moeder met haar eerste baba kan nou die bloedjie in Afrikaans versorg. Vir die eerste keer is die boekie **You and your Baby** wat deur die Mediese Vereniging van Suid-Afrika in samewerking met die Britse Mediese Vereniging uitgegee word, volledig in Afrikaans beskikbaar. In die toekoms sal hierdie publikasie gereeld in sowel Engels as Afrikaans uitgegee word en daar word beoog om dit ook op 'n later datum in een of meer Bantoele beskikbaar te stel.

Geneeshere wat bykomstige eksemplare van die boekie wil hê, word genooi om aan die **Tydskrif** te skryf. Ook lede van die publiek is welkom om

eksemplare aan te vra. Die boekie word kosteloos verskaf.

Ons poog gedurig om die inhoud van hierdie voorligtingspublikasie so volledig en prakties aanwendbaar as moontlik te hou en ons wil graag ons lesers nooi om wenke aan ons te stuur as daar leemtes is wat aangevul moet word. In dié verband sal dit goed wees as veral huisartse die boekie met hul pasiënte bespreek ten einde menings in te win oor die bruikbaarheid van die inligting. 'n Dokter wat aan ons skryf met 'n wenk loop natuurlik gevaar dat hy gevra gaan word om die voorgestelde artikel te skryf, maar dit is 'n kans wat mens maar moet vat.