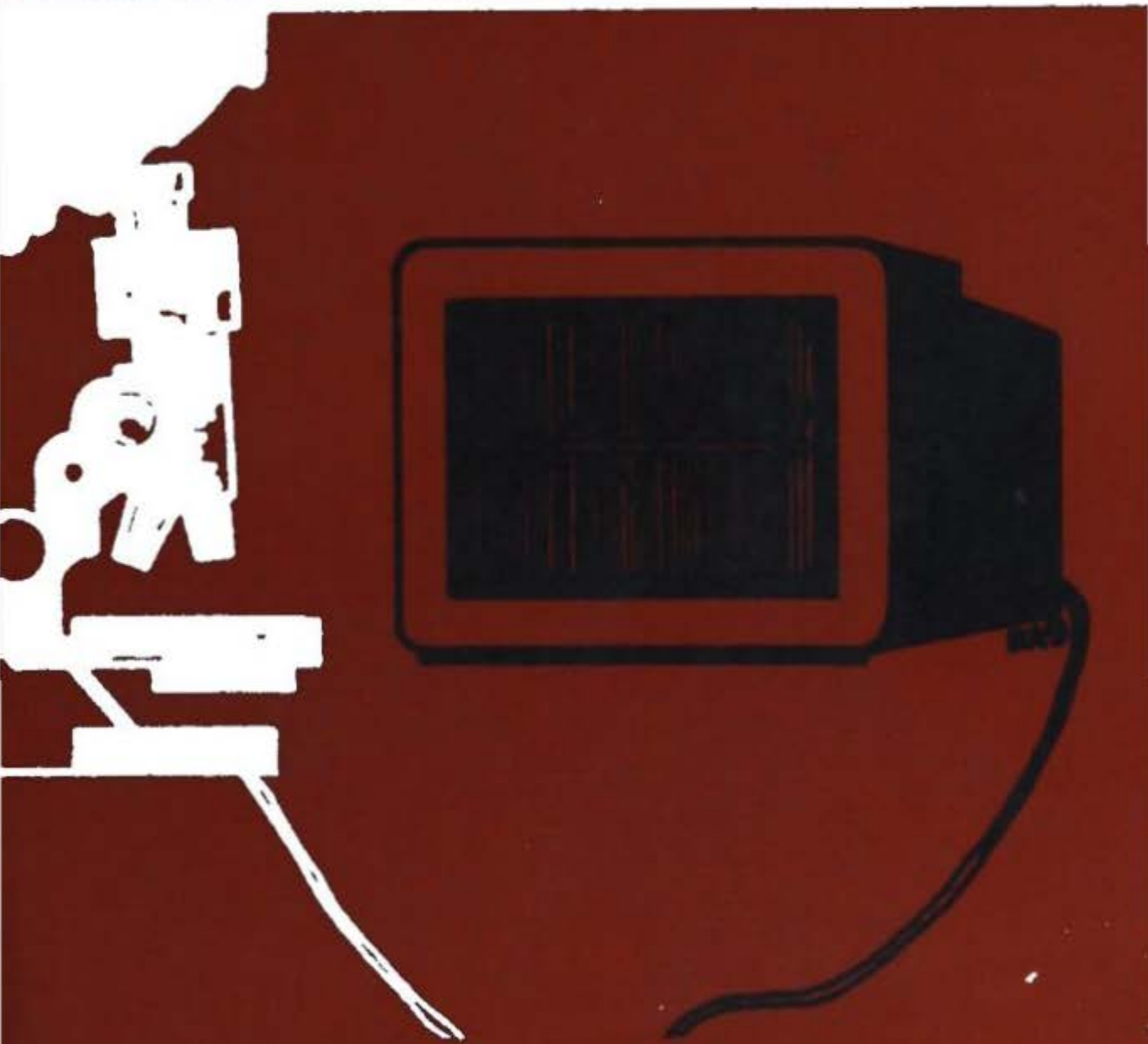
MAN , MICROBES, MACHINES AND MEDICINE



S.K. OWUSU

MAN, MICROBES, MACHINES AND MEDICINE

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The Ultimate Partnership

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An Inaugural Lecture delivered at the University of Ghana on 12th March, 1992

GHANA UNIVERSITIES PRESS
ACCRA
1996

Published for the
UNIVERSITY OF GHANA
by
Ghana Universities Press
P. O. Box 4219
Accra

ISBN: 9964–3–0209–6

PRODUCED IN GHANA
Typeset by Ghana Universities Press, Accra
Printed by School of Communication Studies Press, Legon

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INTRODUCTION

That which is born must die. That is a natural law. In the interval between life and death, man is in constant struggle with nature to prolong this inevitable end for as long as possible. The end may come sooner through accidents made possible by man's own ingenuity such as the invention of the car, the train and the aircraft or through natural disasters like floods, drought, famine, hurricanes and earthquakes but by far the greatest threats to his survival are the minute creatures that have taken to parasitic mode of living – the micro-organisms of disease or microbes for short.

Primitive people believe their lives are ruled by both benevolent and hostile spirits and it is natural, therefore, that they should attribute illnesses to possession of the afflicted person by an unfriendly spirit. This demonic theory of illness was popular in Palestine during Christ's lifetime. It is interesting to note in this connection that the authors of the Gospels make a distinction between the illnesses due to possession and those resulting from other causes. They describe Christ as making use of exorcism only in cases of epilepsy and madness and as treating leprosy, fever, palsy, and an issue of blood by other means such as by prayer, reassurance of the forgiveness of sins, and the laying on of hands. But a blind man's sight was restored by Jesus spitting on the ground, making mud with saliva and daubing the mud on the blind man's eyes and telling him to go and wash them in the Pool Siloam.

In the earlier part of the Greak Age the explanation of illness changed, but it was still regarded as being due to supernatural causes. It was punishment meted out by the gods to men who had grown too arrogant, and it was not until the coming of Hippocrates in the Golden Age of Greece that the medical profession realized the absurdity of this view and learnt to look upon illness as natural phenomena to be

observed and studied.

After Hippocrates came Aristotle, not a medical man himself but a scientist who happened to be keenly interested in the subject of physiology. Aristotle accepted the view that has previously been propounded by the Hippocratic School of Medicine that the body was compounded of four humours – blood, phlegm, yellow bile and black bile – and that in health these humours maintained a balance which became disturbed in illness. This idea became so entrenched in medical thinking and teaching that for many centuries it blocked all progress. When we pause to review the various theories of illness put forward at different times in history, we find that they are reflections of the philosophy and science prevalent at the time. Because the materialistic- and determinstic-minded scientists of the last Century interpreted everything in terms of mechanism, it was natural that contemporary medical men should follow their lead and should look upon the sick man as a broken machine. They said that something had gone wrong with his interior mechanism, so that many wheels of his being no longer moved together harmoniously, and as the new science of Pathology advanced, a more exact account of the nature of the mechnical breakdown was offered. The broken machinery of disease was half truth because man is a mysterious complex of mind, body and spirit none of which can be disturbed without the rest of him being disordered. The concept therefore gave rise to a legion of errors. Today the causation of disease is viewed from a wide angle lens that encompasses microbes, mechanical failure of organs, genetics, disturbance of the mind and spirit and even attack on the body by itself.

MAN AND MICROBES

The micro-organisms or microbes responsible for disease are a part of that great single whole on this earth known as organic

life and in order to be able to understand disease better, it is necessary first to be aware of some of the laws pertaining to that great whole. The first of the fundamental laws regulating existence is that life must live on life, eat life, and in turn be eaten by life. Thus, we all live by 'robbery'. In life, we harbour within us a number of bacteria which make use of the indigestible residues in our food as it passes along the lower bowel. So many different varieties of bacteria lodge within this part of our anatomy that it has become a kind of battleground for them but their conflicts do us no harm. But we know from experience that all bacteria are not well disposed towards us. As there are robbers and racketeers in this outer world of ours as well as good honest traders, so also are there within us marauding as well as benevolent bacteria in constant struggle for survival. Epidemics are incidents in the great struggle for survival between man and the world of microbes. An epidemic represents a shifting of the balance between the two great components of organic life in favour of the microbes, a movement that will, in all probability, be quickly readjusted a few months or in rare cases, years later. For man the great influenza epidemic of 1917, which caused more casualties than all the previous fighting, was a disaster of the first magnitude, but for the virus influenza, it was a signal triumph. Then slowly humanity managed to increase its resistance to the virus and the balance between the two warring ingredients of the one great life was restored. Humanity has continued and will continue to improve its defence against infective illness in the future, but it is unlikely that it will ever free itself entirely from the onslaught of pathogenic organisms. The tubercle bacillus still causes great mortality and morbidity; anthrax kills both cattle and man. Poliomyelitis virus still cripples many children in the developing world and *E. coli* is a major source of infections such as cystitis and occasionally septicaemia or blood poisoning. But these microbes do not have it all their way. The body can defend itself against attack by these hostile

organisms and in most cases it wins; because even though these disease-bearing germs are ubiquitous, only a few people succumb to them.

The body defends itself by means of the immune system. This consists of white corpuscles which though much less than the red corpuscles (about 1 white to 500 red) in diseases of inflammatory nature, that is, in diseases produced by microbial invasion of the body, the number of these leucocytes or white blood cells rises in the blood significantly. There are four different types of white blood corpuscles and each type plays a different role in the repelling of the microbial invasion – one type (neutrophils) engulfs and destroys bacteria and viruses; another fixes the poison produced by the enemy and thus renders them harmless. Other defensive mechanisms include the complement system which is a group of at least twenty proteins that can stick to the invader setting off a chain reaction that eventually kills it. Macrophages migrate through the body, engulf microbes as well as cellular debris and signal other cells in the immune system to join in the fight by displaying specific markers from the invader on its surface. These markers are called antigens which signal, in turn, T cells to grow and divide into Helper T cells, Killer T cells and Suppressor T cells. The Helper T cells in turn stimulate the macrophages, release a variety of substances (Interleukins) that stimulate the Killer T cells to recognize and destroy viruses and bacteria by firing lethal proteins that punch holes in their membranes and cause them to rupture and die. The Suppressor T cells send out chemical signals that slow or stop the immune reaction after the invader had been destroyed. They may also prevent the body from attacking itself. Helper T cells also stimulate B cells to mature into plasma cells which produce antibodies which attack specific antigens. These antibodies and memory cells originating from B cells together with the neutrophils then become the first line of defence for repeat invaders.

I have gone into much detail not as it were, to teach you

immunology but to show you the complex way by which the body defends itself. If the AIDS Virus i.e. the HIV Virus can overcome this complexity to cause an epidemic, then it appears to have emerged not to correct imbalance in population growth as epidemics in the past tended to do, but indeed to wipe out populations altogether. This has indeed happened in some parts of East Africa already. But the ingenuity of man has not been paralyzed by this apparently overwhelming tragedy. In the past, the body's defences have been increased by innoculating it with cultures of reduced virulence – in other words, by means of vaccination and that is why the race for an HIV vaccine is still on.

It will be realized, therefore, that a person can be protected against a disease in two different ways, which we can call the active and the passive methods. The active method of conferring immunity is to inoculate the person with increasing doses either of a toxin or of a micro-organism, and thus stimulate the formation of protective substances or antibodies in his own blood. The passive method is to make an animal such as a horse perform this protective work and to borrow from it the immunized serum produced and to use this to protect someone else. Vaccination against typhoid fever is an example of the first or active method of conferring immunity, and the use of anti-diptheric serum to protect a child against diptheria an example of the second or passive method of protection. The use of vaccination against the smallpox virus has wiped the disease from the face of the earth – the first complete conquest of a disease-carrying micro-organism by man.

No spectacular success was achieved in the early decades against two of man's most dangerous enemies, the Streptococcus and Staphylococcus, the two organisms that are usually responsible for acute inflammation such as pneumonia, boils and blood poisoning. When success did eventually crown man's efforts to obtain protection from these powerful and ubiquitous foes, it came from quite a different

direction from that of immunization, namely, from the use of specific or synthesized drugs prepared in chemical laboratories. However, the microbes also decided to put up a fight. They developed mechanisms to defeat man's efforts and became resistant to these drugs. Sometimes it seems that these microbes will eventually win the battle but so far man has kept one step ahead and the battle continues.

MAN, MACHINES AND MEDICINE

Man has always felt inferior to the bigger animals with respect to their strength but, by means of his superior intelligence, has gained mastery over them. He has then used them to supplement or greatly enhance his limited physical strength to enable him to survive and be master of all creation. But the animals, like himself, also have limitations and, therefore, man has sought even bigger help from machines in all spheres of his activity including farming, travelling and the curing of the numerous diseases that afflict him.

The first machine to be invented for use in clinical medicine was the Stethoscope by Laenec. Today it has become the symbol of medicine and many patients do not feel they have received proper attention from a doctor unless it has been used on them during consultation. But let us hear what Forbes who translated Laenec's work on the Stethoscope from French to English in 1823 said:

> I have no doubt whatever from my own experience of its value, that it will be acknowledged to be one of the greatest discoveries in medicine by all those who are of a temper, and in circumstances that will enable them to give it a fair trial. That it will ever come into general use, notwithstanding its value, I am extremely doubtful because its beneficial application requires much time and gives a good deal of trouble both to the patient and the practitioner, and because its whole hue and character is foreign,

> and opposed to all our habits and associations. It must be confessed that there is something even ludicrous in the picture of a grave physician formally listening through a long tube applied to the patient's thorax, as if the disease within were a living being that could communicate its condition to the sense without. Besides, there is in this method a sort of bold claim and pretension to certainty and precision of diagnosis, which cannot at first sight, but be somewhat startling to a mind deeply versed in the knowledge and uncertainties to which the English Physician is accustomed. On all these counts and others that might be mentioned, I conclude that the new method will only in a few cases be speedily adopted.

This long sermon was about the Stethoscope, a simple instrument indeed. Our medical forefathers will turn green if they see the highly-complicated machines and computers being used to assist diagnosis of diseases today. Today doctors are using more and more sophisticated machines to increase precision in diagnosis and for treatment.

Imaging which may be defined as the process of obtaining and interpreting pictures of patients' internal anatomy has today become a complex process. From the plain X-ray films, through the use of water-soluble contrast media – the renal and biliary systems and barium preparations in the alimentary tract of yesteryears to the more complex techniques of angiography (including arteriography, venography and lymphography) and of interventional radiography. Other methods are now available, notably Computerized Tomography, Nuclear Medicine, Ultrasonography and Nuclear Magnetic Resonance (NMR).

How do the different techniques work? A radiograph is essentially a transmission image; the X-ray beam passes through the patient and is variably attenuated by different tissues normal or abnormal and produces on the film a differential attenuation pattern. It is a two-dimensional representation of a three dimensional object, as if flattened. It must be analyzed in layers.

Computerized Tomography (CT), formerly called

Computerized Axial Tomography (CAT), is also a transmission process. X-ray beams at right angles to the long axis of the patient impinge on detectors at varying angles through a selected site. Data input to a computer allows an attenuation value to be assigned to each small part of 'pixel' of the slice and stored in memory. When the scan is complete the computer builds up and displays a composite image, usually shown in shades of grey, or a transverse section through a part of the body.

Nuclear Medicine produces an emission image. A radio pharmaceutical injected intravenously or taken by mouth will be taken up by or pass through the chosen organ or system for which it has a specific affinity. The radioisotope within the compound emits gamma radiation and the gamma camera, usually linked to a computer acting as a data processor, acquires an image of this emission from one aspect, a planar view. By rotating the gamma camera head round the patient, an image of a slice can be reconstructed by the computer. Functions such as uptake, output, blood flow, and transit time can also be studied; the image is only one facet of the data. There is a gamma camera at the Korle-Bu Teaching Hospital.

Ultrasound does not involve radiation. Pulses of high frequency are emitted from a transducer held against the patient's skin with gel coupling. Electronic analysis of the return echoes allows an echopattern image of a slice of the patient to be built up in almost any direction. Sound of frequencies (3.5 up to 10mhz) is not conducted by gas or bone, so access is barred by lungs and gut; the pelvis is approached through a full bladder. I am glad to say that this imaging machine is also available at the Korle-Bu Teaching Hospital.

Nuclear Magnetic Resonance (NMR) uses the fact that some atoms, notably hydrogen, behave as small magnets so that in a strong magnetic field their axes of spin, normally arranged randomly, become aligned in the direction of the

field. By disturbing this with another field at right angles applied at the appropriate frequency, energy changes on realignment that depend on the physio-chemical state can be detected. From the time parameters determined for each small volume or 'Voxel', the computer constructs an image of a slice in any direction, commonly transversely or longitudinally. If you do not understand it, do not worry because frankly I am just as puzzled about how it works as you are! Of course, this is not yet available at Korle-Bu.

All these new diagnostic tools have changed the face of medical practice. The traditional concept of going to see the doctor at the hospital, being examined and then prescribed a bottle of medicine or tablets to take home has changed. Today, any patient who goes to the hospital is likely to be asked to do laboratory tests which are now handled largely by machines after preparation of the blood by laboratory technicians or technologists. The patient may be referred to the X-ray Department where plain X-rays are taken by radiographers or X-ray technicians and interpreted by radiologists. Most special procedures are undertaken by or supervized by radiologists with stepwise interpretation as they proceed. Cardiovascular radiology may be undertaken by cardiologists, and procedures requiring fluoroscopic control done by other clinicians such as endoscopic retrograde cholangiopancreatography, colonoscopy and chemical sympathectomy. The patient may meet a physicist or a radiopharmacist at the Nuclear Medicine Department for his tests there but the final interpretation of the tests lies with the medical profession. Machines have forced doctors and non-doctors to work together as a team for better results. Hence, for example, nuclear magnetic resonance is mostly in the hands of radiologists (who are doctors) guided by physicists and the functional and metabolic aspects interpreted by physician specialists.

In neurology and neurosurgery (especially head injury), Computerized Tomography has now replaced most other

techniques. Nuclear Magnetic Resonance is even better. The skull X-ray is still of value and Digital Substraction Angiography permits non-invasive angiography. Radioisotope studies remain useful for screening cerebrovascular problems. Chest Medicine still lives by the chest X-ray assisted by Computerized Tomography (CT) for mediastinal and pleural problems, percutaneous lung biopsy and the radioisotopic ventilation – perfusion scan are available for suspected thromboembolic disease. Nuclear Cardiology now competes with coronary angiography in selecting patients for consideration of coronary bypass grafting although the latter is still necessary before the definitive procedure. The thyroid gland is now best imaged by using both a radioisotope scan and an ultrasound scan, preferably on the same day. The diagnosis of upper abdominal problems has been made much easier by ultrasound though it is unwise not to take plain X-rays as well. The management of renal disease has changed radically. The high dose of intravenous urograffin to look for obstruction in renal failure has been replaced by ultrasound. Renovascular hypertension, best identified by renography and arteriography followed by ballon angioplasty, is the simplest treatment for renal artery stenosis. Ultrasound in bladder outlet obstruction can distinguish benign from malignant prostatic disease and screen for renal obstruction. Bladder papilomata can also be shown. In the gut, endoscopy has to a considerable extent replaced the barium meal, less so the swallow but the barium enema, nearly always double-contrast, is still necessary for the colon. Radioisotope bone scans have supplanted skeletal X-ray surveys in search for bone metastases and so the list goes on and on.

Machines have changed the practice of medicine but at a price; for example the cost of one Computerized Tomography Scanner is £½ million. Nuclear Magnetic Resonance equipment costs £1 million. One thing on which doctors agree is that changes in medical practice cost money. Better is certainly more expensive. It was lack of resources on offer

that caused Gladstone, a British Prime Minister, to say of doctors that there is no great profession that has so little to say to the public purse, and Sir Humphrey Davy Rolleston, physician to King George V, to say, "Medicine is a noble profession but a damn bad business." I am sure many ministers and secretaries of Finance have re-echoed these words from generation to generation as they struggle to balance the budgets of their countries and find the Health Ministry taking more and more out of the economy without apparently brining in any visible returns. But is this true? There is an Arab proverb which says, "Health is a crown visible only to the sick". We can say the provision of good health to the people is a drain on the economy only when we are healthy. When we are sick, we want the best diagnostic tools and drugs to make us better and the same people who criticize Ministries of Health for being a drain on the economy have no compunction flying overseas to seek the best medical treatment available when they are ill. Whether Ghana can afford these expensive machines is a political decision which should be taken on the basis of national priorities but one thing I know is that a sick person is incapable of performing his best in any situation. From the resume I have given you with respect to the usefulness of these new medical equipment, I have no doubt that they will revolutionize the practice of medicine in any country with the money and manpower to utilize them in the delivery of health care to her people.

MAN AND MEDICINE

Everybody is interested in doctoring, and the layman can often be watched rushing in where Presidents of Colleges of Physicians and Surgeons would fear to tread. I myself have been diagnosed and treatment prescribed for me by well-meaning relatives and friends as well as my own patients without a history from me or examination, whenever they

hear that I am ill. The amateur doctor possesses an infallible cure for illnesses which the medical profession confesses it is unable to treat such as the common cold. Every layman has been, by instinct, a physician ever since the dawn of human history, and Herodotus informs us that the Babylonians were so interested in disease and their treatment that they laid out their sick in the streets of Babylon in order that passers-by might be able to indulge their medical hobby. Babylon was a paradise for the amateur doctor, a paradise he has probably lost for good, for not only was his hobby encouraged in ancient Babylon, but even made obligatory. Such privileges are never likely to be accorded him again and even in the later eras of Babylonian history amateur doctors were in the process of disappearing, the professional physician having managed by that time to gain a footing. Later he established himself still more firmly, and a great number of different varieties of physicians and specialists appeared.

The first occasion on which the word 'doctor' seems to have been used in its modern sense – that is to say, to denote a man holding a special qualification for the treatment of illness – was in the year 1221, the year in which King Roger II of Sicily decreed that no one should be allowed to practise medicine until he has been examined and approved of by the medical professors of Salerno. At that time, Salerno was by far the most progressive of all universities in Europe, and this special law on the subject of the practice of medicine was drawn up by King Roger II in order to protect his Sicilian subjects from the malpractices of incompetent physicians. Henceforth, the following preliminary requirements were demanded of all candidates for a licence to practise medicine: that they should have gained the ripe age of twenty-one, that they should have studied logic for at least three years. The medical course that had to be taken after these conditions had been satisfied, lasted five years, and even then the candidate had not finished his training but had to serve another year's apprenticeship to an experienced physician.

Then, having completed his long training and passed all his examinations, he took an oath to uphold the honour of his Alma Mater (the Medical School of Salerno), to attend the poor free of charge, to refrain from administering noxious drugs or keeping an Apothecary's shop (a pharmacy) and to avoid teaching that which was false. The newly-fledged Salernitan doctor was finally presented with a ring, a laurel wreath, a book, and a 'Kiss of Peace', and was allowed to call himself Magister or Doctor.

But Salerno was very far ahead of any other European university as regards medical education and it was a long time before similar qualifications were demanded elsewhere of those practising medicine. It was not until 1511 that an Act was passed in Britain demanding some medical test of all who proclaimed themselves to be doctors. That this 1511 Licensing Act was badly required by that time is obvious from the legal preamble to it:

> For as much as the science and cunning of Physick and Surgery is daily, within this realm, exercised by a great multitude of ignorant persons, of whom the greater part have no manner of insight in the same, nor any other kind of learning: that common artificers as Smiths, Weavers, and Women boldly and accustomably, have taken upon them great cures and things of great difficulty in which they partly use sorcery and witchcraft, partly apply such medicine unto the disease as to be noxious and nothing meet, therefore to the high displeasure of God, great infamy to the Faculty, and the grevious hurt and damage, and destruction of many of the King's liege people, etc. etc.

So runs the introduction to the Act of 1511. Seven years later after this Licensing Act had been passed, the College of Physicians of London was founded and given both authority and power to suppress quacks and medical imposters. A licensing authority of this kind was highly necessary.

Yet, intelligent people, among them Bernard Shaw, have protested against what they regarded as being the jealousy

and exclusiveness of the medical profession on the grounds that doctors refuse to have anything to do with unorthodox and unlicensed methods of healing. It cannot be emphasized too strongly that the law requiring a proper training of those practising medicine was not passed in the interest of doctors but of the public, a fact that is too often forgotten. Today, many well-meaning people in Ghana and indeed the rest of Africa are urging the medical profession to incorporate traditional medicine into their practice. Coming from a long line of traditional healers myself, I have confidence in some of the traditional practices but until traditional healers and herbalists set up an Institution or Authority which will prescribe the method and period of training and examination whether written or oral, of all those who aspire to join them as well as to disclose to all such practioners the ingredients of their concotions and decoctions so that others may use them as well and probably improve upon them to heal the sick, the medical profession cannot wholly accept them into their midst. In the meantime, an over-credulous public must be protected from quackery whether well-meaning or frankly piratical in nature. That very acute observer, Francis Bacon, long ago wrote: "We see the weakness and credulity of men is such as they will often prefer a mountebank (a charlatan) or a witch to a learned Physician". This observation is as true of the layman of today as it was true of Bacon's contemporaries and partiality for quacks and charlatans and witches is particularly prevalent among intellectuals. What is attractive about charlatans, quacks, witches and spiritualists is that they dangle before our eyes cures which are far less tiresome than those prescribed by ordinary doctors and all of us want to get well quickly and on our own terms rather than those of the doctors. We are quite willing to swallow a magical potion in order to recover but are not prepared to submit to the inconvenience of going into a hospital for an operation, for carrying out tedious tests, or for the carrying out of difficult forms of treatment. The quack and the unorthodox prac-

titioners have methods of circumventing these incoveniences, and that is what is so attractive about them.

Today the medical student still has to go through a stringent training for five or more years to qualify as a doctor, and then spend another year or in some cases two years as a houseman or intern before being given a licence to practise. He will have to undergo another two or more years of training under supervision before he can set up a practice on his own. No wonder Ogden Nash says, "When Physicians stop to consider themselves, they get so excited and tinglish because every physician knows that to be a Physician is to belong to the most exclusive club there is".

If the doctor wishes to become say a specialist physician, then he will have to undergo three or more years of further training in order to obtain the Membership or Fellowship of the Colleges of Physicians (MRCP) Certificate having been assessed by the best brains there are in medicine in the United Kingdom, America, Canada, Australia or West Africa. Dr. Donald Hunter claimed in 1953 that the examination for the membership of the Royal Colleges of Physicians in Britain is "an examination currency which has never been debased". I am sure that this applies to the examinations of the other Royal Colleges such as Surgery, Obstetrics and Gynaecology, Psychiatry, Pathology and Community Medicine. And yet there is no profession which the public regards with so much ambivalence as Medicine. Listen to Voltaire: "Men who are occupied in the restoration of health to other men . . . are above all the great of the earth. They even partake of divinity since to preserve and renew is almost as noble as to create." Obviously, a doctor had just cured him or his loved one of a very serious illness. Voltaire also wrote that "doctors are men who prescribe medicine of which they know little to human beings to which they know nothing". Perhaps this time the medicine did not work!

The doctor's great ally without whose aid none of his treatment would be of any avail, is the patient's body. For

the body, charity begins and ends at home and it struggles for its own survival not only with great determination but with astonishing cleverness. 'Who hath put wisdom in the inward parts?' asks the author of the Book of Job, and this is a question that every thoughtful doctor must often have pondered over, for few things are more absorbingly interesting to watch than the manner in which the body repairs its injuries and overcomes its ills. The skill with which it does these is the outcome of millions of years of experience and inherited memory; for from the day on which life made its appearance in some backwater of this planet, it has been forced to grapple with immense difficulties. Brought up in this hard school, it has acquired tenacity and dexterity in defending itself against the assaults of its many enemies.

Where it is not for the body's will to live and for the great cunning it has accumulated in its struggle to overcome adversity, the doctor would be but a poor figure of fun. He would stand there at his patient's bedside, unable to do anything except to look on. And on many occasions this is all that the doctor really does in actual practice. He stands near his patient, holding a watching brief for him, making sure that nothing is done to hamper the recuperative activities of his body. Not that help of this passive kind should ever be belittled for many a sick man has been killed by the efforts of his friends and physicians to save him. Hippocrates was so keenly alive to this danger that he put foremost the golden rule, that if a physician was unable to help his patient, he must at any rate make sure that he did nothing to harm him. In making this the first rule of medical practice, Hippocrates acted with his usual wisdom, for to remain passive in a crisis is often more difficult than to be active, and many a physician has been goaded into giving mischievous treatment when all that was really required of him was that he should do nothing. Yes, the body's clamour for survival will ever make sure that microbes, the doctor's knowledge, and machines are put in their proper place.

THE QUESTION OF MEDICAL FEES

The difference between the charlatan and the honest physician is that the quack works entirely for personal gain, whereas the reputable physician puts first the welfare of his patient. Now this does not imply that the doctor is so idealistic in his attitude to his profession that he is indifferent to financial profit although the ultra-delicate manner in which some patients often handle the awkward matter of the doctor's fee suggests that this is a popular belief. Now it is generally recognized that the labourer is worthy of his hire, and the fact that the labourer happens to be a doctor marketing his professional skill for a living should make no difference to this. Patients should be able to pay their doctors, and doctors should be able to receive their fees without any shame or embarrassment on either side.

There are some patients who complain that some private practitioners (Doctors) charge too much for their services. Well, Henry Acland, a physician in Oxford, was called in by a county practitioner to see a patient of his. As Doctor Acland left, he was told, "When we send for a Physician from Oxford we expect the prescription to come to at least a guinea; this comes to eighteen pence". He was not called there again. So you see the dilemma of the doctor with respect to his charges. Of course, it is possible for a patient to explain to a doctor without feeling awkward that as he or she is not well off and is unable to pay for expensive investigations at a private laboratory or for a costly stay in a private clinic, anything of this nature that is required will have to be done at a government hospital. If it is difficult for him to pay the doctor's usual consultation fees, he should say so quite frankly, for unlike the laws of the Medes and Persians, medical charges are always subject to revision. Should the doctor be unwilling to undertake the case at a reduced rate himself, he can generally suggest the name of another colleague to whom the patient can entrust himself with complete confidence.

EDUCATION

Medicine is not only for the treatment of sick people. Every doctor is essentially a teacher as well – educating his patients about the correct way of living, and prevention of disease, teaching medical students, nurses and paramedical staff as well as educating the public. He must constantly upgrade his knowledge by regular study. In other words, a doctor does not stop learning until he dies or, put in another way, when a doctor stops learning, he dies. This prompted Mainonides, a twelveth century Physician to pray thus "Grant me strength, time and opportunity always to correct what knowledge I have acquired, and always to extend its domain. For knowledge is immense and the spirit of man can extend infinitely to enrich itself daily with new requirements. Today he can discover his errors of yesterday and tommorow he may obtain a new light on what he thinks himself sure of today".

In the course of his practice, the doctor also learns a lot from his patients. He learns not to be shocked by man's incredible foolishness such as continuing to smoke fifty cigarettes or more per day in spite of the indisputable consequences to his health. He also sometimes learns about the amazing ease by which some of his patients have amassed wealth. In time he learns to view life with a great sense of proportion. Nothing shocks him. Nothing amazes him realizing that in the long run every man will pay the penalty for his own actions.

RESEARCH

The doctor is also an innovator as well as a researcher. It is this innovation and research which has sometimes been misinterpreted by patients as experimentation on them. It has bred such a great deal of suspicion that when hospitals began to be established they were not greeted with universal

approval. A Doctor Champney in 1797 reported that people thought that the hospitals were founded for the benefit of doctors rather than to cure and when the Royal Cornwall Infirmary at Truro was opened in 1775, a newspaper commented ". . . the new Hospitals are schools of Medicine and Surgery where practitioners make experiments on the poor to improve themselves in the art of healing the rich". These views have been echoed in Modern Sociological Studies, claiming that their importance (research) lay in the stimulation of a consumer market for professional medical attention. Without research we would still be using leaches for the treatment of hypertension and hot irons for pain as is still practised in some Middle Eastern countries. The aim of medical research is human welfare. It was through research that vaccines were produced to prevent some of the diseases which have been and still are the scourages of mankind. It was through research that remedies were found for the cure of syphilis, plague, amoebic dysentery, sleeping sickness, malaria and pneumonia in close partnership with doctors, chemists and scientists.

It was through research that Mr. Opare Mante and I were able to characterize the Glucose-6-Phosphate Dehydrogenase Enzyme in Ghana. Now about twenty per cent of Ghanaians lack this enzyme in their red blood corpuscles. Such cells are destroyed when people with the deficiency take certain drugs. However, it had been reported in medical books that the type of deficiency found among Africans was mild as compared with the type found in people in the Mediterranean countries so that even if one continued to take the drug causing the destruction of the red blood corpuscles the destruction (haemolysis) would sooner or later cease because as the old red corpuscles were destroyed, the new ones which replace them contain enough enzymes to prevent their destruction by the drug. Our researches showed that while this is largely true, five per cent of Ghanaians do not have enzymes at all in the old as well as the new red blood corpuscles so that if the drug which is destroying the

the red blood corpuscles is not stopped immediately all the cells would be destroyed causing death. God knows how many patients have died because of this wrong teaching in the past. Besides, we found that the so-called Mediterranean type of Glocose-6-Phosphate Dehydrogenase Deficiency (G6PD) also exists in this country.

Through observation which is a most important part of clinical research and the minimum laboratory investigations available, I was able to report to the medical world in 1972 for the first time that the new wonder drug, Co-trimoxazole or Septrin which had just been introduced for the treatment of bacterial diseases including Typhoid Fever could cause severe destruction of red blood corpuscles in patients with G-6-PD deficiency. Through research, I was able to report that acute jaundice is not always due to Viral Hepatitis in Ghana but could also be due to pneumonia in G-6-PD deficient patients. My colleagues and I were able to report the high frequency of Typhoid Fever in patients with the deficiency. We were also able to report that the combination of G-6-PD deficiency, urinary tract infection and anaemia, could precipitate an acute kidney failure which is reversible and does not require that a small piece of the patient's kidney be taken for microscopic examination (biopsy) in order to make a diagnosis or the patient to be put on the artificial kidney machine with all its implications, for recovery. Finally, through my research on the enzyme deficiency, I was able to come to the conclusion that while the absence of the enzyme is deleterious to the health of the male, females with the deficiency are protected against diseases like malaria and the deficiency evolved in all probability as a protection for the female against malaria which was and still is, a great killer, to prevent the extinction of the human race in the malarious regions of the World.

The lay public have always imagined that clinical research is conducted by doctors on their patients only. This is not true for in order to prove that a hormone from the

base of the brain – the Hypothalamus, which had then been synthesized could be effective when given through the nose every thirty minutes, my colleagues and I at the Queen Elizabeth Hospital, Birmingham, England, had to submit to putting cannulas into our veins for sampling of blood every half-hour and the hormones instilled into out nostrils at half-hourly intervals. The result was positive and following on this experiment which was published, the hormone, Luteinising Hormone Releasing Hormone (LHRH) has been incorporated into a nasal spray which can be administered intranasally by women who are unable to bear children because of the absence of this hormone in their body.

Not all researches are as dramatic as those I have described. My researches in diabetes have largely been based on clinical observation, analysis of documented data, and comparing with other published work. For example, Dodu in 1969 found a greater incidence of diabetes among female than male patients attending the Diabetic Clinic at Korle-Bu. In 1971, I found a preponderance of females over males in the ration of 2:1 but in 1976 the ratio was found to be 1:1 in the same Clinic. What was the reason? Perhaps the males were catching up with the females with respect to obesity which is the commonest cause of adult-type diabetes, the female diabetic patients were dying faster than the males, the females had stopped attending the Clinic because of economic hardship which had forced them to become the breadwinners of the family and therefore had no time to come to the Clinic or more men had been convinced of the value of attending the Korle-Bu Hospital for treatment because they could see the improvement in health of the female diabetic patients. How can such questions be answered except by further research?

For years, it was taught that African Diabetics did not develop eye complications of the disease to which their European counterparts were prone. This teaching was based on the work of Osuntokun in Nigeria. The effect of this is

that no African country made provision for the treatment of early retinal damage (retinopathy) in diabetes which could ultimately lead to blindness. Diabetes is the commonest cause of blindness in Europe and America. In a study by Dr. Bentsi-Enchill, the Ophthalmologist, and I, fourteen per cent of diabetic patients attending the Diabetic Clinic at Korle-Bu were found to have background retinopathy and potentially in danger of becoming blind. The explanation for Osuntokun's observation is that he was dealing with a diabetic population which had not had the disease for a long time. They had not had enough time to develop the complication. Previously, it can safely be assumed that diabetic patients died soon after the development of the disease because of lack of medical attention. As a result of our work there is now no longer an excuse for the continued absence of Argon and Xenon Laser equipment in the teaching hospitals of African countries for the treatment of background retinopathy in diabetics particularly as the machine is not too expensive and diabetes is on the increase in all African countries. I think I have said enough to highlight the importance of research in medicine in order to improve our health and therefore our economic attainments so as to achieve the ultimate happiness which we all strive for.

MAN, MICROBES, MACHINES AND MEDICINE

I have already depicted the struggle between man and microbes, each trying to gain the upper hand for survival. Today such confrontation is being replaced by co-operation. Such co-operation already exists between man and *E. coli*, the organism which frequently causes urinary tract infection such as cystitis which makes us urinate with pain, diarrhoea in infants and occasionally death by blood poisoning. I can hear the sceptics saying: What *E. coli* an ally? It's a lie! But it is true. Today by means of Recombinant DNA Technology,

E. coli is producing abundant supply of human insulin for the treatment of diabetes thus dispelling the fear that we once held that one day there may not be enough pigs to produce insulin for the treatment of diabetes, a disease which is increasing all over the world with the rise in the standard of living; for I do not think the world will ever run short of *E. coli* germs. By means of Recombinant DNA Technology, *E. coli* is producing in abundance, human growth hormone for the treatment of children whose heights are grossly below normal because of lack of growth hormone from the pituitary gland. Yes, the Lord has made everything for His purpose even the wicked for the day of Calamity (Proverbs 16:4). Newer antibiotics are being obtained from microbes, and Interferon for the treatment of multiple sclerosis, labial and genital herpes, has been obtained from viruses, a group of micro-organisms one of which causes Acquired Immune Deficiency Syndrome (AIDS). And so nature shows man where and how he can intervene and defend himself with precision drugs that will selectively and safely correct what went wrong.

To those iatrophobians – people who dislike doctors whose prayer is the replacement of doctors by machines, their prayers may soon be answered by the introduction of machines which can diagnose diseases and issue a prescription for treatment. So it may be possible in the not too distant future to walk into a booth, insert a few coins, press a button, wait for questions or indeed answer the questions by speaking to the machine directly followed by the scanning of the body organs by laser beams, and then end with a prescription from the machine to be taken to another machine which will dispense the drugs. But let such hopes be tempered by the knowledge that machines break down and need frequent maintenance to be able to function properly. Electricity which provides energy for these machines fails, and a wrong button may be pressed or indeed the button may be stuck. Besides, a machine is unable to give that simple which reassures

the anxious patient that all is well. A doctor can! It was Lord Horder who before the introduction of endoscopy – machines for looking into the inside of the alimentary tract for the diagnosis of such diseases as peptic ulcer, cancer of the stomach or large bowel-said "When the machine becomes greater than the Doctor, the Patient perishes". Perhaps we should take note of that.

Are doctors then to fight the introduction of new equipment and machines that will take over most of the work being done by them or help in the improvement of diagnosis such as the Nuclear Magnetic Resonance Machine, or the cyclotron for the treatment of cancers or the lithotripter for the crushing of kidney stones without operation? My answer is definitely NO! And are we to continue to pursue microbes with all the forces at our command and not to rest until we have conquered them? I think we should look at them in a new light; in the light of the great benefit we are beginning to derive from them and replace competition with co-operation where possible.

I submit, indeed I deposit that not only should man, microbes, machines and medicine be encouraged to co-exist for the benefit of mankind they should all co-habitate in convivial symbiosis.

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