PHILOSOPHY IN A PETRI DISH*

DAVID ORDMAN

Does it seem strange to consider philosophical questions in a journal born in the laboratory? It may be that the mere dry bones of laboratory work are—mere dry bones; but no laboratory activity has any meaning unless thought enters to impart that spark which is life. In the world of bacteriology what do we cultivate on a Petri dish? If bacteria only—then the true laboratory

* Reprinted from Newsletter of the SAIMR, April 1961, vol. 8, No. 1. Published by the South African Institute for Medical Research, Johannesburg.

function is dimmed. If you cultivate philosophy on a Petri dish you surely see more than the colonies; a living growth of positive thought reveals itself to stimulate and refresh. For after all, are not bacteria living things—and of a social kind! Who has heard of a single lonely germ appearing on the plate!

And so it is not only with the Petri dish, but with that vast interesting phenomenon we call the laboratory. Indeed, is not the whole of life a laboratory where consciously or unconsciously we become entangled in nature's experiments? Does not contact with other human beings or situations constitute a series of actions and reactions? Can we be confident in advance of responses or emotions which a particular set of circumstances will invoke in us?

Laboratory life is a life of adventure—explorations, huntings, discoveries, excitements. You trap bacteria, harmful and otherwise, on an agar plate. Your trapping may not be successful, so you set a new trap—a medium of a different kind. You cannot work with tools and apparatus blindly. It may be subconsciously, but you are constantly thinking not only of a particular germ or chemical or tissue or force, but also of the relation of these to yourself and to your fellowman. Is it enough to say that there is albumin in the urine, or do you wish to know why the albumin is there and how it got there? When the report of 'albumin present' is issued, the task is not completed—it is only just beginning, not for you perhaps, but, at least, for a fellow human being.

There is a certain fascination in the medical laboratory: the fascination of another world, the microcosm of living bacteria—their unimaginable numbers and their unbelievable powers. To turn the objective onto a field is to enter a wonderland that Alice did not dream of. It is easy to become blasé, to take these worlds in our stride, but in so acting we lose that child-like freshness of outlook that keeps man young. Parasites are a nuisance to you when they make you ill—but you are a nuisance to parasites when you die; your death imperils their existence. It is give and take in the world of nature and, looked at objectively, is it not a little difficult to determine the relative importance of the *Bacillus coli* and you!

It is a privilege to take part in laboratory life. It is more than a job; it is a relaxation from the artificialities of an outer world. It brings you into contact with nature, it provides you with the opportunities of delving into her secrets. The outlook is limitless—the horizon is never-ending. Soul-hunger can be satisfied at the laboratory bench; for in the search for truth you find beauty, and truth and beauty are happiness. You manipulate worlds with a platinum loop; you control the destinies of animals in your biological experiments; you are the wielder of an immense power, and, are you worthy of it? You help in the advancement of knowledge and play your part in the interrelationship of the creature and its host. You collect the facts for speculation, you assist in the solution of the problems—philosophical and material—of the welfare of mankind.

The Patient First!

In the drama of human health the principal actor is our fellowman—the patient. As the efforts of the doctor are directed to the well-being of his patient, so, too, from the laboratory point of view, the patient comes first. As the doctor must needs give of his best to the patient, so the laboratory worker is solemnly bound to give of his best. In a medical laboratory, however routine the work may appear to be, each specimen represents an individual human being with hopes and fears and pains and passions like yourself. Specimens are sometimes received in the laboratory, taken from the patient, which are obviously unsatisfactory in type or variety or manner of collection—unsatisfactory, that is to say, in providing the best for the patient. Is it our business to carry on and get the job done, or is it wiser to direct attention to what we as laboratory people consider deficiencies. Is there not sometimes a mental struggle suspecting a possible resentment at our interference! Experience, however, reveals that the physician is almost invariably appreciative of advice from the laboratory, for laboratory services are specialized services, and the medical practitioner is seldom also a laboratory specialist. In any event, with the laboratory slogan of 'the patient first', the signpost to where duty lies is not far to seek.

Is the Laboratory a Machine?

The danger of the laboratory becoming an automatic, fact-finding mechanism is always present. But you may say, as we pay the barber for a shave, the tailor for a suit, so the patient pays the laboratory for the result of an investigation, and that is all there is to it. In a sense that is true, but the laboratory worker is in the peculiar position of noting, not only the results of an investigation for one doctor, but also of thousands of investigations for hundreds of doctors. In other words, you score over the individual physician in that you have bulk of material to deal with and so are in a position to compare and contrast. There is always the possibility of finding a better or more economical way of arriving at the same result or indeed at a more accurate or more worth-while result. Has any laboratory process reached perfection, no matter how simple the procedure?

In one sense though, a medical laboratory is indeed a machine in which we, as individuals, are the cogs. And the cogs must fit and integrate harmoniously, for the machine will not function if a cog breaks down. If one department fails in some particular respect, Mr. Jones will not be properly treated for a bacillary infection of the bowel or Miss Smith for a blood condition. There are no water-tight compartments in the medical laboratory, and cooperation and collaboration are of necessity the watchword. The doctor is interested in the final picture presented by the various laboratory reports he receives, and probably does not appreciate the preliminary basic work and experience that have gone to make a laboratory diagnosis a matter of a few hours or even a few minutes. But this basic work, this fundamental background, is not made of loose rubble, but of rock cemented together by departmental cooperation and held in place by intelligence. Co-operation and collaboration result in a far greater thing than the mere issue of a report; there is the meeting of minds, the exchange of experiences and the healthy friction that emerges therefrom. Friction of this kind is a good thing—it lets truth appear. No one has the monopoly of the right point of view; indeed, who is to judge what the right point of view really is! But the more comprehensive the outlook, the more receptivity there is of the other man's viewpoint, the greater the possibility of attaining that completeness which approaches truth.

Accuracy

Even if the chemical laboratory is rapidly approaching it, the biological laboratory has not yet reached the factory stage where results are obtained by machine. Whether a thousand tests have to be done or one test, some person has to do them and interpret the findings. You cannot yet pass a series of tubes of blood or pieces of tissue through an apparatus which will automatically record the more subtle biological findings or pathological conditions. It is vital in bulk work to avoid blunting accuracy. The results of multiple tests must equal in accuracy that of a single well-conducted test. But bulk work introduces monotony and fatigue, so precautions are necessary to counter these bugbears. Accuracy dare not suffer on any consideration; if it does the whole function of the laboratory is lost. The factors tending to reduction of accuracy in laboratory work must at all costs be rigorously searched for and eliminated.

Teamwork and the Individual

What is the importance of teamwork in laboratory life? In some organizations and in the conduct of certain experiments, a set of specialists is put on to an investigation so that a particular subject is investigated fully from all angles. There is little doubt that, by this method of the properly coordinated expenditure of energy and labour, a maximum of results is derived with greatest human economy. It is anything but certain, however, that this is the method that will produce great thinking—great in the sense of brilliant or epoch-making, a 'break-through' of current conventional concepts. A committee can certainly decide upon a procedure, formulate its findings and evolve a mode of action. But can you conceive of the combined brains of persons sitting in solemn conclave giving birth to a profound idea! Can a committee write a poem, compose a sonata, or paint a picture? After all, the great ideas in the history of mankind were born in the minds of individual men and not as a result of teamwork. Consider Moses, Jesus, Mohammed, Newton, Darwin, Pasteur, Einstein and others who have, as it were, lifted mankind from one developmental plane to a higher level, not by a gradual evolutionary process, but in a jump. It is indeed given to few of us to provide a new and vivid slant to the outlook of the human mind or to flash a new vision before mankind. But many of us have the privilege, in a smaller way, in more humble circumstances and

to a relatively small community or even to one other individual, of giving a new point of view, of formulating an idea, of crystallizing and giving substance to vague conjectures. The artist in his painting teaches us to see things we have perhaps not noticed before; he directs our eyes upon an aspect of life and matter previously overlooked.

How Sacred is Authority?

A 'point of view' is not an ephemeral matter, but the resultant of the conflicting material and spiritual forces of a lifetime. A point of view is based on training and experience, and the complex, multiple influences that mould man to what he is. It is obvious, therefore, that an honest point of view deeply held is a precious thing, a treasured possession, and must contribute to the progress of the society in which we live. We are in peril when our point of view wavers—not when it wavers in the presence of convincing and reasoned demonstration, but when it is weakly aborted in the presence of an authority. So many permit their point of view to emerge as a still-birth or a weakling because an authority has held otherwise. In this sense authority and the all too often cramping influence of tradition act as brakes on progress, and scorch with their baleful gleams the tender shoots of thought and action in that great mass of population, half contemptuously referred to as the 'average man'. The average man is a myth; there are no average men. Each man is an individual—an entity in whom life's forces flow. A million machine-made harps struck in the same way by the same force will produce an identical note. There are no identical notes in that fluid, plastic, mobile collection of ever-changing personalities we call man. But the herd is there all the same—that mass of human beings, struggling, eating, loving, living, blown about in particular directions by the wind of authority, by the forces of convention, by the pressure of tradition. He is a strong man who fights these forces and preserves his individuality. But it is these strong men who are the doers, the creators, the salt of the earth! They are the worth-while. They are the instigators of progress. They constitute the axis on which the world revolves. It is unjust to personality to permit oneself to be swamped by the heavy-handed dictum of authority. Let your point of view prevail until it is untenable. No man should be so enmeshed in the coils of the complex of inferiority that he does not raise his voice because it is written otherwise in a book, or said otherwise now or in the past by another person looked upon as an authority. Why, the literature of science is littered with the discarded theories of authority! In physics, most strikingly, concepts of matter change and change again and have not yet reached finality. Medical books are monuments to the outworn thoughts of tradition. Laboratory people, no less than others, should not allow themselves to be dragged along at the wheels of the chariot of authority, but should leap into the driving seat and think for themselves!

This surely does not mean ignoring or overlooking the work of others, but it does mean positively and critically and even sceptically evaluating the productions of contemporary and past authorities—and building on them if found good. In research work it can be a matter of opinion whether it is wise first to soak oneself in the findings of other people on the same line of investigation and to commence from there. Some consider it better to approach a problem with a fresh eye and an unbiased outlook, and to settle down to read the work already done on the same subject only after a thorough consideration of the whole matter from one's own view-point. There is a danger, however, in over-reading, for it tends to throw the mind into a groove and dim the vision.

This desire not to accept authority at its face value is a good thing for another reason. It promotes experimental work in repetition of that of others and, in stimulating the critical faculties, helps to elaborate the truth. To confirm a finding is a satisfaction, to differ from it a stimulus, but to go in pursuit, to determine the 'how' and establish the 'why' of these differences brings a joy to the heart of the experimenter. It is in divergent results that clues lie—clues perhaps to problems even greater than the ones under investigation. And, more especially in the laboratory, it is tragic to permit the unusual to be neglected. For the unusual finding may be that by-path waiting to be explored. It is only too common for the unusual to be explained away vaguely as an error in technique, perhaps, or even worse, shrugged off with a deprecatory gesture at one's fallibility. That inferiority complex rears its sombre head again and should be ruthlessly fought.

Experimentation and the Statistician

It is interesting to consider the methods of experimentation in the medical laboratory world. The 'bulk' method involves large numbers of trials, and it is tempting to conclude that the finding is the correct one if it is supported by the comforting phrase 'statistically significant'. It is perhaps subtler to design an experiment which shall be crucial. Thus, a thousand guinea-pigs may be sacrificed to determine the prophylactic or therapeutic value of a substance, but a crucial test or a series of such tests may be arranged to give the required information with far less animals. And yet biological work in the laboratory entails a profound appreciation of the fact that animals, unlike chemicals, have their individual idiosyncracies, and that conclusions from inadequate numbers of tests are apt to mislead. The transfer of results of animal experiments to human application may be fraught with danger. And, turning the situation around, it is sometimes only too difficult to find a suitable animal in which the human disease will be represented more or less in the human way, if at all!

There is a humbling and salutary lesson for the laboratory worker to be found in the trenchant criticisms of the statistician. It is desperately easy to slide smugly down the path of data-accumulation and result-finding, either in diagnosis, prophylaxis, or treatment, but the correct evaluation of the findings demands a respect bordering on reverence. And to those without the mathematical flair, let your conclusions be guarded until the statistician has stopped frowning. They say that anything may be proved by statistics, but it is more true and less flippant to assert that too many things can be demonstrated without statistical control.

Beware of Finding what you Seek!

When the mind is ardently focussed on an objective, cool judgment comes tardily and enthusiasm may bring into existence that which does not exist. Have you searched intensely for virus bodies and found them with a whoop of joy to be quenched by the chilling glances of a colleague, not so interested, who sees just debris? Have you inoculated white mice with material from 'pink disease' and found pink feet in these animals, only to discover when your excitement has waned that the feet of white mice are pink anyhow? How easy it is to be swayed by your desire, how difficult to preserve a judicial calm undismayed by a fruitless quest. But negative results are as valuable as positive results—they smooth the way for the searchers that follow. They are a contribution to knowledge, and he is wise who records them with honesty and objectivity. You may find what you look for, so beware! Curb your thrill with a sigh, and look again!

Depression in the Petri Dish

But there is another humbling thought in the bacteriological laboratory in particular, and that is: when you have planted your specimen on the standard media recommended for that purpose, what assurance have you really that the organisms found are genuinely all that are present in the specimen or causally associated with the morbid condition under investigation? Think of the many germs that grow differently on different media and that grow on some and not on others. Think of the influence on germ growth of variations of pH value. Consider the influence on germ cultivation of a carbon-dioxide atmosphere, of a moist atmosphere, or of no atmosphere at all. How little is known of the germs that might be revealed by anaerobic cultivation of specimens, and of the significance of organisms that do come up in these circumstances. What is the real truth about the bacterial flora in secretions and excretions in different pathological conditions? How often have you searched for a possible virus infection in specimens sent to you? You report with confidence that the *Staphylococcus aureus* is present in a sample of pus. It no doubt is so, but surely the report should read:

> 'The *Staphylococcus aureus* was recovered from this specimen on agar medium of a particular concentration, made with a particular brand of peptone and a certain pH value, after growing for a period of 24 hours in an incubator designed to keep the temperature constant at 37°C. We do not know what organisms would appear if we grew the specimen in semi-solid medium or *in vacuo* or in carbon dioxide or in the yolk sac of an egg or in the peritoneal fluid of a guinea-pig, the brain of a mouse or the muscle of a fish, or under anaerobic conditions or in a medium which we do not yet know, but which we may find out one day to be most suitable

for the growth of an organism which may be in the specimen, but which we have not recovered because we do not know quite how to look for it.'

Of course this is exaggeration, but the trend of thought will be obvious. And yet there is so much exaggeration! The physician is as ignorant, or else he would chuckle and say: 'your fantastic report is right; a vaccine was duly prepared from the *Staphylococcus aureus* on the basis of your report and the patient still enjoys the company of his boils'.

We are proud of our laboratory and realize what a clever handmaiden to medicine it is, and yet how crude our knowledge still is with regard to bacterial physiology and the interrelationship of parasite and host. It is sometimes depressing to philosophize over the Petri dish and wonder: are they all there or have some important elements escaped our vigilance because our handling is so relatively primitive? What do we see with our high power lenses? Already a start has been made, but we are still at the beginning of seeing the internal structure of bacteria. Perhaps we shall laugh one day at the crudities of our present microscopic examinations. In the associated science of immunology we are only now at the threshold of the knowledge of immunizing processes and the chemistry involved. Does it not seem crude to inject the bacterial bodies in vaccine form instead of the refined essential chemical products extracted from these bodies? Does it sound so advanced to you to inoculate a child therapeutically with the blood serum of an immunized horse, rather than with essential clearly-defined specific chemicals constituting the antibodies!

Hope in the Petri Dish

It is fascinating to be in a laboratory if only to see in it a mirror reflecting the general trends and tendencies in modern medicine. A new fashion in diagnosis or treatment and lo! the laboratory is flooded with specimens for specialized study. The sea of medicine billows and swells with new currents in medical thought—drugs, endocrines, vitamins, and each at its crest carries with it, in the breasts of the lay and medical public, the hopes for a disease panacea at long last. But the wave crashes and a new wave comes and the sea remains sea and the navigators thereon remain—doctors. The song of the antibodies echoes around the world. Infectious diseases are being beaten, nutritional diseases are nearly conquered. Assuredly with further developments bacterial and parasitic monsters of disease will find their fate, and metabolic diseases will slink out, vanquished. It is a grand thought, but perhaps it is a little difficult to visualize the Utopia of 'No complaints'. Is it possibly a little depressing to wonder if the goal of human happiness will be attained when mankind may idle with impunity and overindulge without retribution. Will there be drugs to stimulate the production of self-control, vitamins to tone the system against selfishness, and hormones to regulate the flow of the milk of human kindness!

But in the great laboratory of human life all is possible, and the experimenters in health and happiness must always come back to work and philosophize over the Petri dish of mankind.