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JOURNAL OF
THE TRANSACTIONS
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E. WALTER MAUNDER, F.R.A.S.

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1918.

598TH ORDINARY GENERAL MEETING,
HELD IN COMMITTEE ROOM B, CENTRAL BUILDINGS,
WESTMINSTER, ON MONDAY, MARCH 18TH, 1918,
AT 4.30 P.M.

DR. A. T. SCHOFIELD IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed.

The HON. SECRETARY announced the election of the Rev. Thomas Llewellyn Edwards as an Associate, and the deaths of Miss A. R. Habershon and Prof. S. E. O'Dell, Associates.

The CHAIRMAN called on Major W. McAdam Eccles to read his paper, entitled "Why we Die." The paper was illustrated by lantern slides.

WHY WE DIE. By Major W. McADAM ECCLES, M.S. (Lond.),
F.R.C.S.Eng., R.A.M.C., T.

DEATH has always been an enigma, a fascination or a horror. The war has forcibly brought the fact of death into many a household where its appearance was scarcely thought of four years ago, and the question why we die deserves investigation.

THE FACT OF DEATH.

Physical death was a fact long before man's transgression, and cannot in any way be connected therewith. Death of the living is a universal mundane law, and is of the highest utility. Dissolution of the animal body must not be conceived as other than a most beneficent occurrence. The human body dies in order that many another human body may live. Death is a necessary factor in the continuance of life. The sacrifice of life means the maintenance of life.

The circumstances which surround death both in the animal world and human environment may be distressing and in many instances tragic; nevertheless the beneficial purpose of the death still holds good.

The fact of death is often difficult to prove. An animal may consist of a single living cell, as an amoeba; or of a few hundred cells, as an hydra; or of many, many millions of cells, as a man.

When an animal possesses a large number of cells these become differentiated and grouped into tissues, such as skin or muscle, and these tissues are again co-ordinated to form organs, such as the heart.

The more highly developed the cell, the more delicate it is, and the more prone to dissolution it becomes.

All animal cells may roughly be said to require inorganic and organic matter for their existence and growth. The inorganic matters are represented by water, salts, and some elements including oxygen, nitrogen, carbon, phosphorus and sulphur. The organic matters chiefly consist of albumins, such as are found in vegetable and animal tissues, used as foods.

A portion of a highly organized animal body may be separated from the rest and its cells kept alive for some time. Such a circumstance may be indicated by the movements of the excised heart of a frog, by the reflex action of the foot of a frog scratching the irritated side of its body after the removal of its head and therefore brain, or the contraction of muscles in an amputated human limb.

The only reliable sign of death is decomposition, which is the process of the return of the once living and highly developed animal cell to its constituent elements. It will now be seen that death, and its natural consequence dissolution, is beneficial. Therefore death of human beings is necessary in order that others may live; for had no human being died since Adam and Eve appeared, the earth would have become so populated by reproduction that an absolute absence of food would have occurred and universal death would have resulted.

THE CAUSES OF DEATH.

Physical death may be brought about in one of three ways, viz. :—

1. Accident.
2. Simple wearing out.
3. Action of micro-organisms.

Not infrequently two of these may be combined.

DEATH BY ACCIDENT.

The term "accident" is here used in its widest sense. In many instances the circumstances which lead to a human being's death are called accidental when in reality they are due to gross

carelessness. An example is as follows :—A man passes through an open lift-well gate and falls to the bottom of the well, and is killed instantly. His death is said to be from an “accident.” It was, however, occasioned by culpable negligence. The lift-well gate should only be capable of being opened when the lift is level with the gate ; no one should have left the gate open, and the man who passed through the open gate should have looked where he was going.

Therefore, “accident” as a cause of death may be classified as :—

- (a) “An act of God.”
- (b) Unintentional accident.
- (c) Intentional accident.
- (d) Gross carelessness.

DEATH BY “ACT OF GOD.”

Death caused by a so-called “act of God” is said to occur in the circumstances when human lives are lost by a ship foundering in a terrific gale, or when a man is struck dead by lightning. Whether it is right thus to attribute death to the Almighty may be open to dispute, but it is a type of unforeseen death over which finite man has little if any control.

DEATH BY UNINTENTIONAL ACCIDENT.

A certain number of deaths occur in civilian life by unintentional accident, that is, occur purely accidentally. A good example of such a death is from drowning while bathing, cramp seizing the swimmer. But death thus occasioned must be looked upon as being uncommon. In war the number of deaths from this cause goes up by leaps and bounds. A man happens to be in a certain spot and a bullet strikes him dead by traversing his heart ; if he had happened to be ten yards away, he would still be alive. A body of men happen to be over a mine just at the time it is exploded, and half of them are killed, the other half escape. A torpedo strikes a ship ; those actually within the spot struck are killed, all the others on board are saved, and so on. Deaths from wounds may, of course, be dependent upon other causes than the actual missile, as will be discussed later.

DEATH FROM INTENTIONAL ACCIDENT.

This is only another name for suicide. A man deliberately ends his life by a revolver shot. His death is accidental though premeditated. He would not have died then were it not for

the bullet; he might not have died then had it not been that the bullet struck a vital organ. His death was accidental, but it was an intentional accident.

DEATH BY GROSS CARELESSNESS.

This is perhaps the commonest cause of death by "accident" in civilian life. It is the cause which so frequently leads to prosecution or litigation, as it is so often a crime, or an event presumably calling for compensation.

Quite recently damages were awarded to a widow on account of the death of her husband through an "accident" arising from and in the course of his work; but common sense would seem to show that this so-called accident was in reality gross carelessness, not only on the part of the deceased himself but of a second party. The man was a porter in a large warehouse. Another workman had left open the trap-door into a cellar; the deceased, although on several occasions warned not to do so, entered the floor in the dusk, and fell through the trap-door, with fatal consequences. If he had taken heed to his warnings, and his fellow-workman had not been careless about his duty of closing the trap-door, no "accident" would have occurred: thus his death cannot be put down to anything except gross carelessness. One of the most distressing types of this culpable negligence leading to so-called accident is the all-too-frequent instance of a small child burnt so severely as to die, the cause being that the child was left unattended in a room in which was an unprotected fire. Many other such fatal accidents might be instanced, but the above suffice to indicate the need there is for greater care in many departments of life. The "Safety First" campaign shows the necessity for the instruction of the public. Some of the "trite sayings" seen on the 'buses in London are so "topical" as to be remembered easily, and they are having a definite effect in minimising the number of accidents.

DEATH FROM SIMPLE WEARING OUT.

This is a rare cause of death. Probably in many cases the "wearing out" is actually produced by disease, frequently by the toxin formed by a bacterium, and only occasionally by such a process as occurs in a machine when due to friction. The human machine is a very intricate one, and parts of it are constantly at work; and it is marvellous that it lasts so long. Take the heart, for example. This beautiful pump works regularly and without

intermission; if it did not, the whole machine would come to a standstill.

The heart "beats" normally 72 times in each minute, a little more often than once a second. An easy calculation proves that it beats 4320 times an hour, 103,680 times a day, and no less than 37,843,200 times a year! Yet it will go on working for 70 years without wearing out! Of course the heart is a living structure, and unlike an inorganic machine, such as an engine, it is being constantly invigorated by nourishment, which is very different from the extraneous oil lubricating a machine. But the heart, just like an engine, will not stand being tampered with. If grit be allowed to find its way into the delicate parts of an engine, irretrievable damage may ensue. Just so if a poison is continually reaching the heart by the blood its muscle will "wear out." One very common poison to act in this way is alcohol. Taken by the mouth, absorbed into the circulation from the stomach, carried by the veins to the heart, it permeates the delicate muscular fibres, and causes them to "wear out," and to cease working sooner than they otherwise would.

DEATH BY THE ACTION OF MICRO-ORGANISMS.

Another law of Nature is that a dead body shall be resolved into its constituent elements. Such a dissolution is brought about by the action of parasites. From this separation of highly complex animal matter into the elemental material of which it is formed, the growth of other living beings is permitted; and thus again the law of dissolution, like the law of death, is a most beneficent one.

Bacteria.

But there are parasites which actually bring about death before their colleagues can occasion dissolution. These parasites are in the main microscopic living creatures, some of them so minute as to require some of the highest powers of the modern microscope to detect them. The varieties of these organisms are many. Some of them are quite harmless to the human body, while others if they get a foothold will kill in a few days or even a few hours. Many of the pathogenic organisms belong to the vegetable kingdom: are plants, in fact, of the type of fungi, and are termed bacteria. They are three readily differentiated forms:—

1. The coccus. 2. The bacillus. 3. The spirillum. The *coccus* is a minute spheroidal bacterium. It multiplies extra-

ordinarily rapidly by mere division. There are two chief cocci which are pathogenic in man :—

- (a) The taphylococcus, so called because when these cocci divide, the colony formed holds together like a bunch of grapes.
- (b) The streptococcus, so called because when these cocci divide, the colony formed holds together like a string.

The *bacillus* is a minute rod-shaped bacterium. It multiplies either by fission, or by spores. There are many varieties of bacilli which are pathogenic in man, for example :—

- (a) The tubercle bacillus, producing numerous lesions, including phthisis.
- (b) The enteric bacillus, producing enteric or typhoid fever.
- (c) The tetanus bacillus, producing tetanus or “lock-jaw.”

The *spirillum* is really a curved bacillus, and is but rarely pathogenic in man.

All types of bacteria tend to kill their host by the production of toxins. These are specific poisons produced by the bacteria during their life and reproduction in the living tissues. These toxins are either intracellular, remaining closely associated with the bacterium and acting locally, as is the case with the tubercle bacillus, or extracellular, passing into the blood or lymph stream, and acting distantly from the bacterium as is the case with the tetanus bacillus.

There are two ways in which the human tissues are able in many cases to withstand the onslaught of bacteria.

The tissues, especially the white cells of the blood, actually kill the bacteria ; it is, in fact, a pitched battle between cell and parasite. Or there is produced in the blood an anti-toxin which neutralises the toxin, just as in chemistry an alkali neutralises an acid. An antitoxin can be artificially prepared outside the body ; and on being injected it often serves its purpose, and renders the toxin harmless.

THE WAR AGAINST BACTERIA.

It is wonderful, seeing the multitude of bacteria that surround the human being, that the tissues are able to withstand them. It is only when the phagocytes—the special white cells of the blood—are fit, and therefore able to do their duty efficiently, that the blood is able to overcome the bacterial invasion. Any condition which makes these cells feeble, is a menace to the human

organism. One of the most interesting poisons which makes the action of the phagocytes inefficient is alcohol, and what appears to be a very small amount (0·1 per cent.) of this drug actually in the circulation is sufficient. In a recent official pronouncement* the following occurs :—“ The relation of alcohol to infective disease is of a somewhat similar kind : the chronic poisoning, by devitalising the tissues, lowers the defences of the body against microbial invasion : consequently, specific germs, such as those which cause pneumonia and tuberculosis, as well as the ordinary microbes of septic inflammation and blood-poisoning, find a suitable soil. A slight general depressing influence—a chill or a local injury—which would have no harmful effect upon a healthy individual, even if the micro-organisms were present, because the vital reaction of the living tissue would prevent a general infection, may be most dangerous to a chronic alcoholic. It has also been suggested that resistance to infective disease may be prejudicially affected by alcohol when taken in even moderate and occasional doses ; but the experimental researches by which it has been sought to establish this view have not given any clear results. On the other hand, there is no evidence for the popular belief which attributes to such doses of alcohol a protective value in cases of exposure to infection.”

IMMUNITY.

There is another extraordinarily interesting question in relation to the action of organisms in producing disease, and possibly fatal disease in the human being—the question of immunity. It is well known that certain animals are immune against the effects of certain pathogenic micro-organisms, while others are not ; that is, an organism which would cause no ill-effects when introduced into the circulation of a horse would kill a man. Immunity is a subject about which little is really known, but the fact that the human being can be rendered immune against pathogenic micro-organisms is one of intense practical importance. Here are some statistics which put this matter very forcibly, especially as they bear upon the present war. In the Napoleonic Wars, just one hundred years ago, the percentage of deaths from disease—mostly preventable disease—was 97, and from death on the battle-field 3. In the South African War there was an average

* *Alcohol : Its Action on the Human Organism.* London : H.M. Stationery Office, 1918.

strength of 265,000 men in the British Force. There were 22,450 deaths from disease, of which typhoid fever caused 7991, or more than one-third. Only 8590 were killed by the enemy, so that more than two and a half times as many men died of disease than were killed by missiles.

In the present War, in France, the incidence of disease has been extraordinarily low, and that of typhoid fever almost negligible. This remarkable absence of typhoid among the troops on the Western Front, that is, in France, where typhoid is by no means infrequent in the civil population, is almost entirely due to protective vaccination.

Among the Expeditionary Force in France and Belgium about 98 per cent. have been protected by anti-typhoid vaccination. Up to October 25th, 1917, the annual typhoid admission-ratio per 1000 has been nineteen times greater among the non-protected than the protected. Among the non-protected, it has been 9.4 per 1000, while among the protected only 0.5 per 1000. The death-ratio is 84 times greater. Among the non-protected, it has been 1.69 per 1000, while among the protected only 0.2 per 1000. Such figures are illuminating, and bear out fully the fact that specific vaccination is not only the most powerful prophylactic measure against the incidence of typhoid fever, but the most potent preventive of death therefrom.

A similar condition obtains, and has been in force for many a year now, in the ordinary vaccination against small-pox. There are other reasons, such as improved sanitary measures, better housing, and greater care in preventing contact with infected persons; but giving all these their due weight, no unbiased observer can ignore the tremendous influence of vaccination in both lessening the incidence of the disease and fatal results therefrom.

WOUND INFECTION.

While the soldier has been so wonderfully protected against enteric fever, he has been exposed, particularly in France, to infection of his wounds by the numerous bacteria which exist in the highly manured and cultivated soil in which the trenches have been dug. Imagination does not need to be great to understand how, when a missile strikes a soldier, it will carry in with it "dirt" from the air, ground, clothing, and skin, so that bacteria—part of this "dirt"—are introduced into the man's living tissues. The bullet may strike a vital part, and the combatant is killed at once; this is death by accident. The shrapnel may

lodge in the muscles of the thigh, and the pathogenic organisms introduced induce septicæmia—blood-poisoning—and death results. This is the death by the action of micro-organisms, or perhaps, strictly speaking, it is a death by both accident and the action of micro-organisms.

An attempt is made by the man immediately after he is hit to prevent infection by applying a spirit solution of iodine to the area of the wound, and covering the aperture with an antiseptic dressing. Every soldier carries this antiseptic and this field dressing. Unfortunately only a comparatively small proportion of cases are either sterile from the first, or are rendered so by the first-aid application. At the casualty clearing station, behind the regimental aid post, many wounds are excised, and in this way the actual infected tissue is removed.

There are three chief types of organisms which infect wounds and lead to fatal issues. They are: streptococci, the bacillus producing "gas gangrene," and the bacillus of tetanus.

(a) *Streptococcus*, or the coccus which forms chains when it multiplies, is very virulent. Introduced into the tissues, these cocci multiply very rapidly, and pass into the circulation. They are capable of producing very potent toxins, so that the delicate muscular tissue of the heart, and the sensitive nervous tissue of the nerve centres, are quickly poisoned; and ceasing to work, death ensues.

There is always a high temperature, and a quick pulse, with increasing exhaustion. Once these minute vegetable parasites get a hold it is very difficult indeed to cope with them.

(b) *Bacillus aerogenes capsulatus*, or the bacillus which is the chief agent in the production of "gas gangrene," is also very virulent. Unlike the streptococcus, this bacillus grows and multiplies best in the absence of oxygen, and therefore of air. Hence its rapid and fatal activity when pent up in the tissues. Within a few hours gangrene has occurred and the patient is so poisoned as to become moribund. Fortunately easier and more thorough treatment in the way of wound-cleansing has led to a great diminution of gas gangrene.

(c) *Bacillus tetani*, often called the "drum stick" bacillus, is the cause of tetanus, or lock-jaw. It is an interesting point that it is found chiefly in garden mould, especially when this has been richly manured, and in road sweepings. Hence the great liability for wounds received by men in trenches to become infected. The clothing of the soldier very commonly holds these

bacilli ; he is struck by a piece of shrapnel, this and some clothing enter his tissues, and the wound is infected. In the early days of the War, tetanus was all too frequent and deaths therefrom numerous.

Now the disease is comparatively rare, and this although the men are fighting under the same conditions of trench warfare as they were in France and Flanders in 1915. What has caused this great diminution of incidence of, and therefore mortality from, tetanus ? It is undoubtedly the fact that every wounded man now receives a protective injection of antitetanus serum, and most a second dose about seven days later. As a result of these, the bacilli fail to multiply, and no lock-jaw occurs. Anyone who has seen the spasms of tetanus, and the terrible death which closes the scene, will be ready to bless the marvellous effects of these prophylactic doses of serum.

CONCLUSION.

Enough has been said to show that the intricate machine—the human body—withstands a great deal which should cause its activity to cease. Its powers of resistance, its capabilities for recovery, and its response to external help, all tend to prolong its life. But a sudden, unforeseen catastrophe may overtake it, and its vital parts are affected, and it stops its functions and disintegrates—it has died by accident. Three-score years and ten go by, and gradually there seems to be a failure in the perfect movement, and in the nice co-ordination of parts, and the functions slow down until they stop : the body has worn out, death has occurred from old-age, from wearing out. These two causes of dissolution, however, only account for a small proportion of deaths. It is to the action of parasites, vegetable or animal, that the bodily economy has so often to surrender.

The fight may be short and sharp, and the defeat rapid ; or the struggle may be prolonged and suffering great ; but the same beneficent law holds sway, and the being dies and his tissues resolve into their elements, and another rises in his place.

“ Except a corn of wheat fall into the ground and die, it abideth alone : but if it die, it bringeth forth much fruit.”
“ O death, where is thy sting ? O grave, where is thy victory ? ”

DISCUSSION.

The CHAIRMAN: Major Eccles has raised in the title of his Paper a most important question—a question which he certainly has not answered. This is no reflection upon the lecturer, who well knows that the ultimate “*why*” of anything can never be answered scientifically; and the question “Why we die?” has never been answered outside the Bible. I have a standard work on “Death,” by Carrington, of nearly 600 pages, in which it is shown that the author asked the question “Why we die?” of every scientist he could refer to, from St. Petersburg to New York, and was himself surprised at the entire lack of all knowledge on the subject. The only suggestion he got was that perhaps we die from *habit*!

The problem, of course, is that in man, growth, when the anabolic exceeds the katabolic, has a fixed period, say, of twenty-five years. For, say, forty years, apart from accident or disease, there succeeds a spell of adjustment between katabolism and anabolism—decay and repair; but after that, for some unknown reason, decay gradually exceeds repair and brings death. No scientific reason is known for this.

I speak here only of natural death. Major Eccles has shown that the vast majority of deaths are not natural, but due to accident or disease; but in England one in nine, and in Ireland one in eleven, still die of old age, which he calls “wearing out”—for which process the lecturer has given no reason. To me it always seems that at birth each individual receives a varying amount of life-force, according to his heredity, and like a clock is constructed to last a certain time and no longer. An eight-day clock will live eight days if no one stops the pendulum, and a man will live out his days if no accident or disease cuts them short.

This unaccountable mystery, death, seems to prevail everywhere over life, although indeed an interesting question has been raised as to fishes. In them growth has no term, and inasmuch as the more vital cartilage never hardens into the more mineral tooth, it is stated that no death from old age has yet been recorded; in other words, there seems a possibility that natural death is unknown amongst them.

The fact, however, remains that outside Scripture, to the question

“Why we die?” there is no answer. I find that the first object of this Society is “To investigate in a reverent spirit, important questions of Philosophy and Science, especially those bearing upon Holy Scripture;” and I suggest that no more suitable philosophical and physiological question could be raised than “Why we die?”—and that the final reply, “Because of sin,” is the only one as yet given—a reply that is at any rate sufficient for all believers.

In conclusion, the CHAIRMAN moved a cordial vote of thanks to the lecturer; and this having been duly seconded, was carried with acclamation.

MR. J. O. CORRIE, B.A., F.R.A.S., parried the thrust which the thought of the overcrowding of the earth with deathless human beings might make on the credibility of the Bible. He quoted Luke xxiv, 39 (R.V.); Acts i, 9; 1 Cor. xv, 44, 51, 59; 1 Thess. iv, 17; Gen. v, 24; and Heb. xi, 5, as bearing upon a life free from material limitations, and proceeded: It is a modern scientific speculative possibility (if I understand it correctly) that matter, as we know it, is a ponderous condition only, of that which could exist as an interaction of electricity and ether. To quote Mr. Balfour’s phrase in his presidential address to the British Association, “Matter is thus not merely explained; it is explained away.” This view admits of the supposition that, if humanity had had neither fall nor death, men’s bodies, etherealized after the will of God had been done through them upon earth, might have passed through space to other planets, revolving round other suns. And no limit can be assigned, either to space, or to its contents. We know that, for Christ’s true disciples, there are reserved “many mansions,” or abiding places (John xiv, 2).

Modern physical science, then, seems to interpose no bar to the thought of the “change” of the natural body into that which St. Paul calls “a spiritual body,” which has no need to occupy space upon earth. Such, on the other hand, may, rather, be regarded as potential in humanity. But even elementary mathematics gives us evidence of the existence of what, for distinction from the *real*, we call the “imaginary” or the “impossible.” The symbol $\sqrt{-1}$ denotes something which, first operating upon unity, and then upon the result of that operation, produces -1 ; just as unity taken three times, and the result three times, produces nine. But $\sqrt{-1}$

cannot exist in the known universe. Yet, by its means, we obtain expressions from which sines and cosines are calculated with any required degree of accuracy. And these, when tabulated, enable us to measure distances, whether accessible or not, even those of the heavenly bodies ; also to sail the oceans, to use big guns, etc.

The science of Mathematics, which has so humble a mundane origin in common facts of number and space, enforces our recognition of the existence of transcendental entities, mysteriously connected with common fact. This may ease the thought of a spiritual body, which St. Paul says that "there is." And it helps the mind to encounter the tremendous cogency of the evidence of the facts of experience.

Mr. M. L. ROUSE, B.A., B.L. : Does not the lecturer's theory that men would have died physically (although not spiritually), even if Adam had not sinned, conflict with the statement of Holy Scripture in Romans v, 13, 14 : "Until the law sin was in the world : but sin is not imputed when there is no law. Nevertheless death reigned from Adam until Moses, even over them that had not sinned after the likeness of Adam's transgression." Surely a distinction is drawn there between the punishment of a person's actual sins and his physical death, and this death is said to have befallen everyone as a result of Adam's transgression (including even infants who have never actually sinned).

In answer to the contention that physical death was needful in order to prevent the overpeopling of the Earth, a previous speaker has suggested what was already in my mind, that the Creator could easily from time to time have transferred portions of the vast human family to other worlds. Mr. Maunder did, indeed, on a former occasion prove that Mars and all the outer planets of our Solar System are unfit for human habitation, and gave us some reason to think that the inner ones were unfit also. But it is safe to assume that the hundreds of millions of suns which we call stars have planets revolving around them, and that very many of these are suited to be our dwelling place, and perhaps are only waiting to receive believers after resurrection. Yet the Earth might never have become too full of people up to the present time ; since it is quite certain that if our huge tropical forests were thinned, our deserts irrigated with artesian wells, and the soil deeply dug and well manured,

it could support many thousand times as many people as it does now.

Even in England now where the soil is turned to account, wheat by more intensive tillage yields 27 bushels to the acre against 16 in North America. But it was found by Lawes and Gilbert that whereas land which had remained without manure for 20 years had a residual fertility of 13 bushels to the acre, land that received an ordinary dressing of manure yielded 30 bushels to the acre; and if the additional production be availed of to feed more cattle, it is manifest that, with the application of the resulting manure, an increase of five or ten bushels will be obtained at the end of the next four years' rotation of crops, and at the end of the second rotation another such increase at compound interest, and so on until 55 or 60 bushels of corn is reached. But the soil if further enriched would be too rank, you will say. Not if, instead of stirring it to a depth of five or even seven inches, you stir it to one, two, and even three feet as has been done. It was my privilege—in his very old age—to visit Sir Arthur Cotton, the first great English irrigator, who had made the region round the lower Godavery river support ten times the population that it had supported before; and upon retiring to Dorking he had the soil of his little estate analysed and valued, and it was found to be worth 15 per cent. less than the average for the district; yet when I visited him, it had for upwards of twenty years yielded enormous crops, the success being due to no special manuring but entirely to deep digging, his practice being to dig down three feet and then turn the two upper spits (or foot depths) completely over, and the lowest over upon itself. At my first visit, in early spring, Sir Arthur drove his stick straight down into the bare soil until it was buried to the crook; at my second visit, in summer, I counted the stalks of two or three plants of wheat, and upon each there were upwards of 100, while in a tiny barn stacked with other huge plants I counted upon one 104 ears, while in each ear there were at least 40 grains, as I proved. This would make one grain to be the parent in one generation of 4160 grains. But it must be borne in mind that Sir Arthur's practice was to sow the grains in clumps at even distances apart, three grains going to every clump, and later to remove the two weaker plants, leaving the choicest one, which makes the multiplication $1386\frac{2}{3}$; and further,

the beds were protected from the birds by a high network, which through keeping off many breeding butterflies, moths and beetles, may have halved the tribute usually paid to insects. Without this protection, according to farming traditions, he would have lost $\frac{2}{3}$, or one-half more, or his total produce would have been 694 grains from a single one. On the other hand, if he had systematically used manure, he would have multiplied this at least four times over, and thus have obtained a 2776 fold return for his sowing.

Mr. SIDNEY COLLETT: If I understand the Scriptures aright, the connection between sin and death, as cause and effect, is one of the great fundamental doctrines of the Word of God, *e.g.*, "The wages of sin is death" (Rom. vi, 23); "Sin, when it is finished, bringeth forth death" (James i, 15); "As by one man sin entered into the world, and *death by sin*" (Rom. v, 12). Surely there can be no mistaking such passages as these, whether we have in mind physical or spiritual death. Indeed, the Bible seems to teach most clearly that had there been no sin, there would have been no death.

The lecturer has really dealt with the *immediate* causes of death, and has ignored altogether what is far more important, *viz.*, the original cause. What would be thought of a man who attributed the motion of a train of railway carriages solely to the link that connected it with the engine, claiming that it had nothing whatever to do with the complex machinery of the engine, the power of the steam, the fire that generated the steam, or the intelligent mind of the engine driver, whose hand controlled its entire movements? Dr. Eccles tells us that the causes of death are three, *viz.*, accidents, wearing out, and deadly parasites. He also speaks of war, carelessness, and suicide. But, I ask, would any of these things ever have been possible, *but for sin*? Surely they are the very products of sin!

Mr. W. HOSTE, B.A.: Is physical death in man the result of his transgression? If so, in what sense? Spiritually, Adam died the day he sinned: he was then and there separated from God. Physically he survived for some nine hundred years. It is noteworthy that to ensure his physical death, in addition to the spiritual, God took an additional precaution. He hedged him off from the tree of life, by driving him out of the garden: "Now lest he put forth his hand, and take *also* of the tree of life (that *also* forbids

confusion between the tree of life and the tree of the knowledge of good and evil) and live for ever," etc. (Gen. iii, 22). What, then, was this "life for ever" ? not a renewal of spiritual life, for the leaves of a tree could not atone for transgression, but a continued physical existence in a condition of sin. May not the fruit of that tree have contained the elements, in the form of some essential tonic, necessary to the preservation of man's physical being in ideal health ? in other words, to hold the perfect balance between waste and renewal of tissue, the katabolism and anabolism of which our Chairman spoke. (See Rev. xxii, 2.) Spiritual and physical death in man, then, are both the results of sin, but while the former is the direct result, the latter is the indirect.

LECTURER'S REPLY.

In the course of his reply to the remarks made upon his Paper, Major ECCLES said he thought no one's faith in God and the Bible could be stronger than his ; and yet he held, on grounds that satisfied his own judgment, that man's transgression had nothing to do with physical death. Many questions had been raised with which it was not possible to deal in a brief statement. When, however, we consider the problem of food, as Mr. Rouse had done, we must remember that food comes from matter that was once living and had died.

The meeting adjourned at 6.10 p.m.