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OF THE
CANCER PROBLEM

BASED ON AN ENQUIRY INTO

The
Bio-chemical and Radio-active
Properties
OF
Living Matter.

AND

their chemical and physical relation to
The Cancer Inducing Agents.

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“ Man suspects a Cause for every Law and is disinclined to acknowledge the existence of a Law unless he can account for the Cause of it.”

Prof. L. Meyer.

“ The plans of the structure of nature are locked up in the Atoms themselves, they are full of wonder and mystery because from them alone and what they contain grows the infinite variety of the World.”

Sir W'm. Bragg.

“ Science is a System of Knowledge built up by the concentrated thought of generations of acute inquiries ”

Canon Streeker.

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“ A Man of Moderate Attainments may be serviceable to those that have Greater Degrees of Knowledge, for though they have the greater Capacity yet have they not Leisure nicely to Enquire into these matters.”

R. Nelson, 1703.

THE completion of this work was delayed owing to a serious riding accident to the Author, which ended fatally after nearly two years of acute suffering, in December, 1930.

The book was finished a few days before the end, but the final revision had not taken place, which will account for any errors or repetitions.

F. WOODROFFE-HICKS,

The Gateway,

Langport.

April 2nd, 1931.

A NEW LINE OF CANCER RESEARCH.

Introduction.

IN PRESENTING a line of Research differing essentially from any that has hitherto been put forward, the writer must inevitably incur the charge of presumption, but who will regard such a charge when not merely a nation, but civilization is faced with what has been termed the "*direst woe*."

Let it be said at the onset that the writer is not a Student of Medicine, but of Chemistry and Physics, one who has been engaged for the past seventeen years in an endeavour to pierce the mystery of the *Evolution of Matter* and of those phenomena which are involved in *Metabolic* change.

The Solution of the Cancer Problem here put forward is based not alone on biological and physiological facts, it has its foundation in irrefutable scientific data—in facts that are not the mere hypotheses of speculative minds—but Scientific truths built up by generations of scientific enquirers—and crowned by the Researches of the brilliant band whose discoveries will forever make this century glorious.

I refer to the epoch-making discovery of a "*New Property in Matter*," a discovery which has not as yet perhaps sufficiently penetrated beyond the confines of the laboratories, but the true objective of which lies beyond the laboratory, and which conveys, or so the writer believes, nothing more or less than the explanation of those mysterious phenomena which surround the processes of organic growth, phenomena which have hitherto been regarded as impenetrable secrets. The fact that Cancer research has up to the present time been unsuccessful in finding any clue to the origin of the disease or its treatment, forces us to the conclusion that the solution of the problem **does not lie in the local line of investigation hitherto adopted, but, rather in research into those Primary and Constitutional Causes, by which all living Matter is built up and energised.** *Constitutional Research* has been too long neglected and though some may think that the sciences of Chemistry and Physics are remote from the problem of cancer, investigation shows that these twin sciences afford the clue to the mystery of malignant growth. Cancer has proved hitherto an impenetrable secret, but with the great discovery of the *radio-active property of Matter* we are introduced

to a line of research which leads directly to a logical interpretation of the Problem of the Growth of Matter.

Can it be said that the epoch-making discovery of the vital property contained in the Atom itself has as yet influenced our idea of "*living substance?*"

Has it as yet found practical application in regard to the solution of problems affecting living bodies? For example such problems as abnormal growth—notably cancer?

Has the knowledge of a "*new property in Matter*" served to modify in any degree our conception of the value of the treatment of certain forms of disease by radio-active measures?

To these the answer appears to be in the negative.

The "*new property in Matter*" has not seemingly influenced our conception of the growth of the body, its substances or its functions.

This is the more surprising since the aim of all true science is unity and simplicity, the new discovery provides an explanation which embraces both these attributes.

Hitherto our conception of the body has lacked both unity and simplicity.

No basal principal has ever been advanced which offers a broad and rational basis for its manifold phenomena and indeed so little has any root principle determining *vitality* been established that some have argued that to believe electricity or *vitality* could play the part of "*efficient cause*" was absurd.

The new knowledge of an unexpected property in Matter obliges us seemingly to very carefully consider what we had thought the foundations of organic life.

A new and startling factor has entered our calculations and the mind of man which has so long craved "*an explanation of the Matter out of which the Universe is made*" (J. J. Thomson) has at last received an answer shattering in its profundity and blinding in its very simplicity.

The vastness of the Universe, its substances, activities and phenomena have been interpreted for us by the microscopic forces that dwell within the Atom.

The Atom has become the interpreter of the "*infinite variety of World,*" Matter and Energy are interpreted, the indissoluble link that unites them is at last made manifest.

Prout and Crookes speculated as to the possibility of "*primordial substance*" in place of a primordial substance we find a **primordial energy, by which not alone substances, but elements are transformed and translated.**

Hitherto we have possessed no clue to the secret processes that determine the vital phenomena of the body. Such problems as Living Matter, its Structure and distribution, Embryology, Morphology, Reproduction, Transformation, Heredity, Evolution and Animal Heat have been more or less factors connected by no Common Principle; the result of no known System or Basic Law.

These phenomena are, we now see, united in a Universal Principle, a principle which is in harmony with all we know of Natural Laws. The discovery of the radio-active property in matter remakes and remoulds all Scientific thought, **but it is in its more immediate**

relation to living organisms that we are called upon to recognise its Dynamic importance.

The discovery that is the lodestar of Science, is the starting point of a new and startling development in Biological and Physiological research for it is by the aid of the new knowledge that we find the key to the problem of many forms of acute disease, above all to the most dreaded and cruel of all scourges, the abnormal cellular activity that we call Cancer.

Too often long custom exercises a tyranny over the mind, forbidding the reception of a new idea. New Ideas of necessity appear revolutionary, but better that should incur reproach, than that which a modern writer has summed up as "*a condition of complacent ignorance.*"

It will be admitted that for over fifty years Research has centred on the *local* aspect of malignant growth, it has been concerned with an inexhaustible examination of the final stage of the disease, i.e., *excessive cellular proliferation.*

There appears little evidence of any attempt to solve the problem by the light of recent Science, indeed it is not too much to say, that so far as Cancer is concerned Science stands where it stood half a century ago. Is it not due to this fact that research has been barren of result and that in spite of monumental labours, devoted investigations and brilliant experiment, the origin, cause and treatment of cancer remains unknown.

Again and again brilliant discoveries have encouraged the belief that the origin and cure of Cancer had been discovered. Amongst the most important of these were those of Professor Virchow, who in 1848 startled the world by his researches into cellular pathology.

Yet great as were those researches it cannot be said that they advanced our knowledge of the origin, cause and treatment of Cancer, and indeed we sometimes ask ourselves, how far the knowledge of cancer has advanced since John Hunter at the close of the eighteenth century promoted "*A Society for the Investigation of Cancer.*"

The outstanding problems concerning cancer remain unanswered. The secrets of immunity, susceptibility and heredity remain unsolved. It is true a number of agents have been observed to be causal factors of cancer, yet their precise influence has not been determined and the very variety and contradictory nature of these agents has obscured the issue.

Experimental Research has conspicuously failed.

Statistics conclusively show a high cancer incidence and mortality in certain occupational groups, amongst which are conspicuous the metal and aniline industries, a high incidence is also noted amongst petroleum, tar, pitch, salt and soot workers. **The very diversity of these agents has proved one of the greatest stumbling blocks to determining the nature of the influence they exert on living Matter.** It has been thought that the very fact of their diversity rendered the value of their acceptance as cancer-inducing-factors problematical.

But it is here that Science steps in and provides an explanation, the discovery of a "*new Property in Matter*" proves that Agents seemingly diverse are in fact fundamentally and essentially united. These cancer-inducing Agents are one in the possession of a common principle—that of inducing Heat, and thus each of these Agents induces the same malignant influence on the blood.

In a recent address to Medical Students, the *Dean of the Oxford Medical Schools, urged on students the necessity of scientific study, for said he, "*it is on the scientific side of medical education that the greatest blot remains.*" That this criticism is not wholly undeserved, we cannot doubt when we realize the explanation science affords to otherwise inscrutable problems.

The fact that the Sciences of Chemistry and Physics have shown that a common root-factor unites all the cancer-inducing-agents provides us with one of the most valuable clues to the nature of cancer and its treatment. For we now perceive that those problems which have hitherto rendered the Solution of cancer so obscure, receive not only a new interpretation, but an interpretation that is at once both logical and connected.

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HEAT.

A close investigation of the chemical and physical effects of intensive heat on the processes of growth and the development of the body cells and tissues, reveals the fact that the constant association with elements which induce heat procures conditions which are utterly opposed to the maintenance of the normal balance of the chemical and physical operations which control organic growth. Heat induces abnormal conditions, and energy is procured of a nature inimical to normal growth. Cellular activity is accelerated and the balance of chemical exchange suffers accordingly.

The bombardment of cells and tissues whether healthy or unhealthy by powerful heat-inducing factors exceeding that to which the body is adapted, inevitably procures conditions which are chemically, physically and biologically destructive. The more deeply we examine into the nature and processes by which in living bodies normal healthy growth is attained, the more evident does it become that association with all elements productive of great heat are a menace. Thus we are led to enquire whether a Heat-inducing Element such as Radium, though affording a temporary alleviation, by burning away the obstructive growth, must not in the light of the new knowledge be regarded as a danger, since it serves to accelerate and increase the adverse chemical conditions which are the root cause of malignant growth. More particularly is the danger apparent when intensive heat is applied to those regions of the body, where the most profound and complex chemical processes take place.

In less than a quarter of a century research has transformed the whole world of Chemistry and Physics and it may constitute a matter of surprise to future generations that while the discovery of radium and X-ray have been widely applied to the treatment of disease, these great discoveries have hitherto wrought no fundamental change in the conception of the energies of the human body, its physical changes and functions. Neither have these great discoveries vitally accelerated research into those fundamental antecedent causes by which the body is built up.

* Dr. Ainley Walker.

The writer can only here attempt to briefly outline the causes, chemical and physical, which render the treatment of cancer by radium a matter for profound disquietude, more particularly when the growth occurs in the regions where complex changes are continuously in progress.

A survey of the more important investigations in regard to Cancer Research as recorded in the Press and Medical Journals during recent years reveals the astounding and disquieting fact that no "*angle of research*" appears to include either chemical or physical investigations.

In an Age when chemistry and physics are the ruling force which dominates every trade and industry, an Age when the Mystery of Matter has at last been revealed, it is the more astounding that with the one exception of Dr. Warburg of Berlin, there appears little evidence of investigation resting on a scientific basis. The Scientific side of the question seems to have been ignored, and it is not too much to say, that it is due to this fact that the discoveries of Dr. Virchow, Dr. Fibiger and others have failed to justify the hope that they would advance our knowledge of the origin of cancer and of its treatment. These researches lack the essential foundation on which all the investigation of living Matter must ultimately rest, i.e., the sciences of Chemistry and Physics. Thus in spite of prolonged and elaborate investigations, co-ordinated research has failed to discover the cause of cancer or to determine a line of treatment.

It is to the great discoveries of the past united to those of the present that to-day we have given into our hands the key that unlocks the profound and mysterious processes that underlie generation, energy and evolution.

For over eighty years research has been practically if not wholly confined to the *local* manifestation of the disease, instead of investigation into the chemical and physical factors which induce and control the growth of Matter.

From time to time suggestions of a more or less hypothetical nature have been advanced usually unsupported by medical or scientific data. For example, recently an American writer has suggested that an increasing prevalence of cancer amongst motorists is due to the presence of tar on the roads. Another writer attributes cancer incidence amongst mill hands to the stricture caused by tight clothing. In no case do the hypotheses advanced appear to be linked by any common causal factor, or to be based on any scientific foundation.

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Very recently the Press and Medical Journals announced that the British Medical Association had launched a "*new War on Cancer*" which it was hoped would have the effect of solving the cancer problem. It was stated that between September, 1929—September, 1930, 20,000 doctors would be engaged in a special watch on cancer cases, and from the Reports to be sent in great hopes are built.

It was, therefore, with feelings of profound disappointment, indeed of dismay, that a perusal of the Forms to be filled in showed that this investigation is limited to what is known as "*the accessible regions*," and further that the *questionnaire* contains no enquiries in regard to the bio-chemical and bio-physical aspects of the cancer problem. Neither

is there any reference to the chemical and physical changes that may be expected to follow the introduction of intensive heat such as X-ray and radium on living cells and tissues.

This omission indicates that up to the present the chemical and physical aspects of the cancer problem have not been seriously considered and **the writer suggests that until extensive research into the chemical and physical effects of intensive heat on cells and tissues is undertaken, it is impossible to venture any opinion as to the beneficial effects following the application of Radium or X-ray, on the contrary its application seems to be fraught with considerable danger.**

A Medical correspondent recently announced in the Press that while admittedly the cause of cancer remained unknown, it was nevertheless fortunately possible to treat malignant growth successfully by radio-therapy. This optimistic belief is surely opposed to the commonly accepted dictum that the antedote to a poison can only be successfully administered when the nature of such poison is determined. **The belief that a remedy of such a nature as radium can be safely employed in the treatment of a disease, the origin of which is unknown can only be regarded in the highest degree dangerous and indeed subversive to the principle on which for countless ages the science of Medicine has been built up.**

A survey of cancer research extending over a period of some eighty years shows that extensive as investigation has been, it has been limited to one aspect of the problem only, that is to the *local* aspect of the disease as manifest in its final stage, i.e., *cellular proliferation*.

The present writer ventures the opinion that to this cause must be ascribed the total failure to discover the origin of cancer. Investigation convinces that to understand the principle of excessive growth there must be primarily an examination into the nature of the causal factors chemical and physical, by which all organic growth, whether healthy or unhealthy, is built up.

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Since the beginning of this century great strides have been made in our knowledge of bio-chemistry and bio-physics. There is a more general appreciation of the part that chemistry and physics play in regard to organic life, yet the logical application of these sciences to the processes by which the living body is built up has not as yet been seriously considered. **Yet surely there must be an ever-increasing perception of the necessity of co-ordinating the twin sciences of physics and chemistry if progress is to be made in comprehending not alone the *composition of protoplasm*, but of comprehending the particular processes and conditions which dominate the chemical exchange of the body.**

The importance of protoplasm as the foundation of all Cancer research is indicated by the fact that it forms the physical and material basis of all life, whether it be the human body, the amoeba or the vegetable world.

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Growth, development and reproduction are the phenomena which distinguish every form of life. Healthy growth and development are the result we must conclude of an ability to attain and maintain the necessary equilibrium which procures in the body chemical exchange. If this is so, then abnormal and unhealthy growth must be ascribed to a failure to achieve this equilibrium.

Cancer appears to be an extreme instance of the unhealthy conditions which arise from an inability to maintain the chemical balance which is the essential factor of perfect cellular development. The key to the origin of cancer, would seem to have been too long sought in *local* factors, the microscope has been relied upon to disclose secrets which can only be revealed in the laboratory of the chemist and physicist. If we would determine the nature of cancer, inquiry must be lifted from *local* investigation and must be transferred to the fundamental processes, chemical and physical, which are the basis of all organic growth.

For the past three years, the writer has been engaged in traversing the truly monumental results of eighty years of cancer research. The great discoveries of Professor Virchow, in 1848, turned all attention to cellular pathology, and since that date cancer research has focussed almost entirely on the *local* aspect. For eighty years co-ordinated research has centred on the pathological, microscopical and bacteriological aspects of cancer. Not alone in Great Britain and in the Continent of Europe, but in the United States, in the Colonies and in Japan exhaustive researches are being undertaken on these same lines, yet in spite of the hopeful statements which constantly appear in the Press, in spite of serums, grafts and widespread experimental investigation, the result of nearly a century of research has been a complete failure to determine the cause and origin of cancer, or to decide on any form of treatment. To-day those who are best qualified to judge tell us that research has thrown no light whatever on the origin of cancer.

Does this mean that cancer is a scourge fastened on humanity from which there is no escape? Or does it mean that research has centred in the wrong direction and that the time has now come when *local* investigation must give way to investigation of the *constitutional* causes by which all organic Matter is built up?

* * * * *

A New Property in Matter.

This century has been illuminated by the most startling flood of light that has ever been flung on scientific research. The amazing discoveries of a brilliant group of scientists among whom stand pre-eminent: Sir Ernest Rutherford, Sir J. J. Thomson, Niels Bohr, H. C. J. Moseley, G. N. Lewis, I. Langmuir, Professor Andrade and Sir William Bragg, have ushered us into a new World and given us a new conception of the Elements of which Man and the Universe are alike built up. I refer to the discovery which will rank for all time as the most outstanding in the history of Science—the discovery of a “*New Property in Matter.*”

This profound discovery has revolutionised science, yet strange to

say it has not as yet accomplished its true objective, the explanation of the growth of Matter. So far this discovery appears to be largely confined to the laboratories, yet the "*New Knowledge of Matter*" not only revolutionises our conception of Organic life, but it affords an insight into the nature of the vital force of the Universal Law, by which Matter is evolved and growth controlled. It throws a new light on the problems of the body; it furnishes an explanation of disease notably of cancer; and provides a logical explanation of some of the most complex questions that man has ever been called upon to solve.

By the light of the new knowledge of Matter, we now perceive the causal factors at once simple and profound by which from simple Elements all organic life is built up and by which *cellular growth* and *proliferation* is accelerated. We perceive also in what direction lies the hope of prevention and cure of disease. The new knowledge of Matter brings home with peculiar force what we already knew that the living body is a miniature laboratory and that every process, function, and activity is the direct outcome of chemical combinations and interactions as exact and precise as those on which the chemist relies for his simplest as for the most complex experiments.

The new knowledge provides an explanation for those "*bio-chemical adaptations*" of which Professor H. F. Osborn has said "*we have at present no conceivable explanation as to causes.*"

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The Atom.

The modern hypothesis concerning the structure of the Atom, the increased knowledge of the Atomic numbers and weights, the discoveries of the ratio-activity of substances, and the apparent relation existing between certain Elements, but above all in the startling discoveries of Rutherford and other pioneers of science in regard to the structural arrangement of the Atom, suggested to the writer in 1927 that it was in the Atomic structure that the clue must be sought to the problem of vital activity and that in the Atomic Universe must be concealed the explanation of the eternal riddle of *chemical exchange and chemical constancy.*"

The writer believes that the great discovery of *Atomic energy*, the discovery that the Atom is a complex body and not as had been believed—*indivisible*; the extended knowledge of atomic weights and numbers has brought us at last to the threshold of those fundamental processes which determine the nature of life and the evolution of Worlds.

The writer suggests that the most recent research into the *dual nature of the Atomic structure* obliges us to reconsider this opinion. The structural peculiarities of the Atoms of every element appear to very conclusively indicate that the "*vital energy*" that builds up protoplasm is the inherent and inalienable constituent of every atom, and that thus each single chemical substance must be considered "*living*" in the sense that it has vital force since

research has revealed the amazing fact that each single atom possesses its own precise, unchanging, and individual charge of electricity and that it is as a result of this electric charge assigned separately to each atom that the eternal mystery of energy and of chemical combination is achieved and maintained in every living organism. It is due to the new knowledge of the electric charge that accompanies the Atom of the several elements, that the writer postulates has provided a new insight into the fundamental processes which build up all organic life. This great discovery the writer believes, provides also the clue to the origin of cancer.

The clue which the microscope was powerless to reveal, the chemist and physicist have laid bare.

The hypothesis first formulated in February, 1927, has been confirmed by two years of plodding investigation, what in 1927 was hypothesis may to-day be regarded as a reasonable and logical conclusion based on the mathematical ratio which exists between the atomic numbers and the atomic weights of elements and which receives further confirmation from the researches of recognised pioneers of Science. In the structure of the Atom is found the missing link that unites with definite and irresistible logic the chain of evidence that binds together under one Universal Law all living organisms. In the Elements and in the Atoms that compose the elements, we perceive the Alpha and Omega of Life; Evolution past, present and future, Material evolved through the slow cycles of Time, living forms moving onward and upward in progressive stages to fulfil an ordered Design. Worlds past and Worlds to come built up and furnished with living forms, in obedience to the hidden Law of Energy. The "*vital force*" whose law we read in the Atomic structure would seem to know no confines to include all Systems, Worlds and Substances. The designed causes that control material things, the force that provides heat, that gives to *chemical constancy* its *stability*, and to the body its laws.

The Atomic World has shed a new light on the human body in the fundamental factors that provide health, it furnishes the logical explanation of the problems of malignant growth and with it a reasonable hope of cure.

We have long known that each delicate process of the body must be the direct outcome of combinations of great chemical exactitude, processes by means of which growth, virility and fertility are procured, but the new knowledge of the conception of Matter presents yet another aspect of the problem of growth.

We now perceive that all growth is procured by the combination of certain simple elements and that chemical interchange and transformation may be hindered, accelerated or even destroyed by association with certain elements foreign to the body's needs more particularly of elements possessed of high radio-activity such elements introduce changes of temperature. The writer's investigations lead to the conclusion that all chemical transformations are dependent on the vital question of temperature, i.e., the maintenance of definite balance between heat and moisture,

The new knowledge has indicated that all Matter, living or inert, is endowed in a greater or less degree with radio-activity and the Atom which has been regarded as a negligible particle is now found to be a complex and divisible body, the activity of which determines all chemical processes, hindering or accelerating as the case may be. The discovery is one which must for all time rank as one of the greatest in the history of the human race. The portentous discovery that the Atom is possessed of its own powers of radiation, whether it be the Atom of Hydrogen with its one Electron or whether it be Uranium with its ninety two electric units it is the Atom that rules both the Universe and Man.

The Atom reveals to us a new picture of organic life in which every Order and Species is determined and controlled by the power of radiation with which it is endowed. At the head of organic life stands Man, an individual possessed of great radiological powers, a being which while allied in basic composition to every other form of life, however lowly, is differentiated from all other species by the fact that he is endowed to a greater degree with those particular elements which are possessed of high radio-activity, i.e., vitality. From these facts the writer has been led to formulate the theory that in the new discovery is disclosed not only the direction in which fundamentally the evolution of Species and Matter have proceeded, but further it suggests that the failure to establish evidence by experiments on the lower forms of life is due to the fact that the analogy between Man and the humbler Orders is too remote to provide a basis on which to rely for exact conclusions. Thus experiments on fowls, mice or rats, the eggs of the sea-urchin, etc., though biologically interesting can never provide a basis for exact conclusions in regard to a problem as complex as cancer. That all forms of life have a fundamental affinity is evidenced in protoplasm, but exact conclusions cannot be drawn from experiments on species which are chemically and physically remote.

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The momentous discovery of the radio-activity of Matter both organic and inorganic, did not become known to the writer until February, 1927, it fell with peculiar force upon a mind, prepared by fifteen years plodding research into the mysteries of the evolution of Matter and Metabolic change. It was perceived that **in the perfectly astounding fact of the *New property in Matter* a vast revolution, not merely in science, but in the treatment of disease was at hand.** The nuclear theory of the Atom afforded not only a new insight into the properties and activities of elements, but it suggested an explanation of the chemical and physical changes which occur in the living body more particularly into the problems of growth and fertility.

The writer realized that the new knowledge of the radio-activity of Matter opened up a new channel of research, more particularly into the processes which determine growth, both normal and abnormal, and that in particular it might provide an explanation of the peculiar influence exercised on the living body when brought into contact with elements of high radio-activity.

The present paper is an attempt to draw attention to these facts, more particularly to invite research into the effects and influences

exerted by radium, X-ray and indeed of all elements possessed of high radio-activity on the chemical processes of the body. In the light of the new knowledge it seems evident that the failure to discover the *origin of cancer* is due to the fact that research has concentrated on the final stages of the disease, *cellular proliferation*, rather in research into the *constitutional* causes by which all Matter is made up.

The electrical "*constitution of Matter includes practically the whole of the twentieth century physics.*" The history of the slow development of the idea, is one of the romances of Science. As long ago as 1756, Franklyn conceived the idea of the electric particle, Farraday, Crooks, Thomson, Milligan, Rutherford, Niels Bohr, and others have followed and built up by experiment a definite foundation, but the full force of this discovery is only appreciated when we view its bearing on the problem of the growth of living tissue.

It would appear that the chemical and physical properties of all Matter is determined solely and only by the number or mass of the electron particles it carries.

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The utility and final test of all research admittedly lies in its ability to solve problems. Reference to the Cancer Research Records of the past eighty years show that the outstanding problems of the disease remain unanswered.

We have, therefore, to ask ourselves whether this failure is not due to the fact that the wrong line of investigation has been pursued. It is difficult to believe that nearly a century of earnest investigation should prove a total failure unless an entirely wrong line of research has been undertaken. Can we be content to see the alarming increase in this disease and to hear of the millions of money expended on treatment which is unquestionably a failure, if we may judge by the Statistics and Reports annually published by the Cancer Research Organisations.

Let us take some of the commonest questions which remain unanswered after nearly a century of research :—

Is cancer hereditary ?

Is cancer infectious ?

Is cancer contagious ? And if not—why not ?

These questions *local* research have failed to answer.

The new line of investigation shows, that cancer is neither infectious nor contagious, because it is a disease which depends entirely on the individual state of the blood.

Again, the important question as to what constitutes immunity and susceptibility remains unanswered.

Here, again, we find it is a question largely dependent on the condition of the blood.

Again, research has failed to determine or explain the question of 'site,' and while it is stated that in both men and women the commonest 'site' is found to be the 'digestive organs,' for this no explanation is advanced,

The new line of research indicates that cancer is commonest in the digestive organs, this is due to the fact that it is here that the greatest amount of chemical exchange takes place, and it is due to this strain, coupled with an inadequate blood supply, that this 'site' is most common.

Again, Statistics show a high cancer incidence prevailing in certain occupational industries, notably in the lead trade, why is this? Research has provided no answer.

The new knowledge proclaims without hesitation, that not only in the lead, but in all metal trades and others, where elements are employed of high radio-activity, the same harmful influence on the chemical changes of the blood prevails.

Here, again, the 'site' is found to be in the part of the body which is brought into closest contact with the metal and element.

It has been observed, that not only in the metal trades, but amongst paraffin, petroleum and aniline dye workers, a high cancer incidence prevails as also amongst those engaged in handling substances as widely different as salt and soot.

The wide divergence in these cancer-inducing-agents has proved the great stumbling block to determining what are precisely *the inducing factors*, so much so that many investigators have been led to believe that they cannot be regarded as cancer-inducing-agents. The knowledge of a "*new property in Matter*" has, however, provided the solution of the problem.

The writer's researches indicate that those agents, though apparently diverse and dissimilar, are in reality united by a common root-factor. Each is endowed with the power to induce heat and thus to withdraw moisture from the tissues.

The writer's investigations lead to the conclusion that the withdrawal of moisture from the cells and tissues is a definite and irresistible cancer-inducing-factor.

Again, comes the all important question of the value of radio-logical treatment of cancer. Is it of value or is it the reverse? The considered opinion of experts in regard to this question appears to have been answered by the fact, that in this country alone, the sum of over £300,000 has been already subscribed for the purchase of Radium and that the radiological treatment has been universally adopted.

Yet with the new knowledge of the radio-activity of elements, it is impossible to resist the conviction that the application of intensive heat to the delicate tissues of the body, though temporarily relieving pain by removing growth, must inevitably by withdrawing the moisture upon which every chemical change of the body is dependent, procure a far-reaching danger. This condition, commonly referred to as "*spread*," is an inevitable result of the application of radium to living tissue.

The new knowledge provides the simple explanation, "*Spread*" has been brought about by the withdrawal of moisture, the nodules which commonly appear in the surrounding fibres are due to the fact that the blood has been deprived of its essential moisture,

In this connection the writer conceives is found the answer to another of the important but unsolved problems of cancer, viz.,—Why has the radiological treatment of facial cancer and cancer of the mouth and tongue proved more favorable in its result than the radiological treatment of cancer in other parts of the body?

The answer is, that in the face, mouth and tongue continual contact with the oxygen in the air, and in the mouth the moisture continuously provided by the saliva, serves to counteract the danger inflicted by intensive heat—whereas the withdrawal of moisture from those regions of the body in which the most extensive and delicate chemical exchanges continuously take place, such as in the breast, digestive organs and cirvex, radium exerts an influence which can only accentuate the conditions which procure and spread malignant growth.

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The writer is advocating that cancer research shall be removed from the *local* to the *constitutional* point of view, this is supported by the fact that the New Line of Research has already furnished logical answers to most of the unsolved problems of cancer. A few of these problems are touched on in this Introduction, but, others of profound importance are dealt with in the Paper to which this is the Introduction. Most will agree that since *local* research has failed to solve any one of the vital problems of cancer or to devise means curative or palliative to deal with the disease; the time has come to turn our attention to a more fruitful line of Research.

Up the Stairway of the Ages men have pressed, content to pass out of sight unrecognised, might they but build one grain of Knowledge into the Step by which those who come after should find Truth.

PART I.

A New Line of Cancer Research.

*THE ATOMIC STRUCTURE.**A NEW PROPERTY IN MATTER.*

"Chemistry" has been defined "*as the Science which deals with Matter and its Changes.*" The line of investigation here followed is based on Bio-chemical and Bio-physical research. It is believed that this line of investigation has not been hitherto approached.

In presenting it, therefore, the writer must ask indulgence since the disadvantage is suffered of following an uncharted track, errors and mistakes are therefore inevitable yet, notwithstanding that much which is here put forward is of necessity tentative, this Paper is presented with the conviction that investigation of a new line of enquiry provides the long sought explanation of the origin of cancer, and with it must follow a new conception of its treatment.

That the new knowledge of the Atom, its structure, its properties and activities, must throw a startling light on Matter and with it on many of the hitherto obscure and baffling problems of organic growth cannot be doubted. The writer's endeavour has been to co-ordinate the newly discovered facts and to apply them to the elucidation of some of those problems of biology and physiology which have hitherto lacked interpretation.

The New line of research, the writer perceives, provides a clue to the riddle of growth more particularly abnormal "*cellular proliferation,*" i.e., cancer. It provides a logical interpretation of the "*vital force*" that accelerates the growth of cells and tissues and of metabolic phenomena generally an interpretation which is found to be in perfect harmony with what is already known of the operation of Natural Laws.

The writer ventures to go further and suggests that the great discovery that marked the dawn of the twentieth century—the "*divisibility*" of the Atom provides the direct explanation of the age-long mysteries of "*chemical exchange*" and of "*chemical constancy.*"

The mystery of the vital forces of heat and energy now stand revealed. It is, then, on the established facts embodied in these great discoveries that the new conception of cancer is based, and it is because the conception rests upon the discoveries of such pioneers of research as

Sir Ernest Rutherford, J. J. Thomson, Professor Andrade, Professor Soddy, H. G. J. Moseley, Sir W. Bragg, the Curies, Rontgen, Becquerel and other* notable scientists, that a theory radically differing from those at present adopted is here put forward. The theory owes its birth to the new knowledge of the *Atomic Structure*.

The problem of growth viewed in the light of the knowledge thrown on Matter by the *dual structure of the Atom* and the Nature of the principle which endows Matter with Heat and Energy, makes growth intelligible. It provides the link in the chain of events which has hitherto been lacking, and we are enabled to trace the principle by which heat is generated and elements are combined.

The electron ceases to be an inscrutable conundrum and becomes a logical and integral part in the chain which unites living and inert Matter. **It emerges as the directed principle which energises every form of life and Matter.**

The writer's knowledge is too limited, the ability too circumscribed, to carry this investigation to its final conclusion, the endeavour can but be made to draw attention to the importance of the new Discovery in its relation to the problem of malignant growth. To-day we are confronted with the ominous fact that after nearly a century of co-ordinated research the origin of cancer remains unknown. The latest Authoritative Cancer Reports, both British and Foreign, state that the origin of the disease is still undiscovered. So long as the cause of a disease remains unknown, it is clearly obvious that no treatment, preventative or curative, no remedies, medicinal or dietetic, can be prescribed with any hope of success. What is the reason of this total failure to discover the origin of cancer? **Is it not due to the fact that investigation has hitherto been concentrated on the local aspect of the disease and no research has been undertaken in regard to the causes which induce growth.**

The Atom.

The advance in Modern Science suggests that such is the case and that the time has now come when research must be lifted from *local* effects and directed to the wider question of *constitutional causes*. **The causes which procure, control, accelerate or retard growth.**

This line of research seeks to determine the Nature of those first causes which procure *stimulations* and *inhibitions*. The problems of malignant growth which from the days of the Ancient Greek until the present has baffled man's research, finds explanation at last, not by the aid of the microscope, but by the application of the new Discovery to biological and physiological phenomena.

Is it too much to say, that a knowledge of the Principle that accelerates growth is as essential to the understanding of the body, as is a knowledge of steam to the understanding of the locomotive. In each case a knowledge of the principle which generates heat is necessary to the proper understanding of the force which procures activity and just as no critical examination of an engine can reveal the mystery of steam, so no investigation of cellular growth has served to reveal the principle that accelerates cellular activity.

* Other names might be included. I name, however, those whose researches suggested to me the vital meaning of a "*New Property in Matter*."

Up to the present no explanation has been afforded of the fact that response to the radiological treatment of cancer, differs widely in different sites of the body. Again no explanation has been offered for one of the commonest features of the after effects of radiological treatment, i.e., "*spread*" and "*recurrence*."

These and other questions of fundamental importance if cancer is to be irradiated, it is believed find a logical explanation in the new line of research.

The new Discovery appears further to supply an explanation of many of the chemical and physiological reactions of certain drugs which have hitherto rendered their application in cases of malignant growth of a more or less experimental nature. It is believed that many of the chemical actions of drugs on cellular growth now receive interpretation and the reason why their reactions on individuals, and on animals differ so widely, finds explanation, we may trace also a simple explanation of *stimulation*, *depression* and *tolerance*—problems which have hitherto proved baffling. It suggests an explanation also for what is perhaps one of the most remarkable features of cancer and one which the writer believes has so far not been explained. It must be a matter of common observation amongst doctors and others that the tubercular patient does not contract cancer. Why is this? The new line of research clearly suggests an explanation.

Thus, much that has been obscure in the treatment of cancer becomes plain. More particularly is it **valuable as showing the peculiar effect on the blood induced by the absorption of certain metals, and makes clear why metals such as lead re-act so disastrously on the nervous and muscular system giving rise to disease such as cancer.**

The great advance in our knowledge of physics brought about by the researches of the twentieth century has done more to enlighten us in regard to Natural Laws that govern the metabolic processes of living Matter, than have the researches of any preceding Age. Nearly three centuries ago the discoveries of Newton encouraged investigation into the Laws governing chemical processes. Modern pioneers of research have carried this knowledge further, in man's mind a burning desire is evoked to penetrate further into the mysteries with the hope of establishing the particular influence of certain elements on the activities of the living body. In less than a quarter of a century the whole world of chemistry and physics have been transformed, yet while the discovery of radium and X-ray have been widely applied to the treatment of disease, the new knowledge of Matter does not appear to have wrought any fundamental change in our conception of the energies of the human body or its physical functions. Neither has this great discovery vitally accelerated research into the fundamental antecedent causes by which the body is built up.

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The modern hypotheses concerning the structure of the Atom, the increased knowledge of the *Atomic numbers* and *weights*, the discovery of the *radio-activity of substances* and *the relation existing between certain elements*, suggested to the writer in 1927 **that it was in the Atomic**

structure that the clue must be sought to the problem of *vital activity* and that in the Atomic Universe must be sought the explanation of the eternal riddle of chemical exchange and chemical constancy, but in the electric charge that energises the Atom is surely found the designed and universal Principle which actuates all Matter.

Normal growth and equally abnormal growth are surely the response to stimulation provided by this vital force, a force at once natural and formidable.

Here is surely found the Principle which moulds into order and loveliness what else must be lawless, chaotic and capricious. The ordered rule which transforms Matter and controls Form we now see proceeds from the vital principle which rules in the atomic Structure.

The new knowledge of the Atom is built up by exact chemical physical and mathematical processes and by the profound reasoning of the greatest scientific minds of the Age. It has revealed the existence of an unsuspected principle, a principle which transforms elements and procures heat.

Every process of the body, its *stimulations* and *energies* are derived from this principle.

Thus the writer is led to believe that the discovery of the electron unlocks the door to Nature's profoundest secret—Organic Growth, i.e., the chemical evolution of Matter, from simple elements, and if this is so, must not it provide explanation of abnormal and malignant growth.

Cancer is recognised as a condition of abnormal *cellular proliferation*. The problem is surely rooted in a question of energy. What then is the principle that procures energy? And what is the principle that controls it?

Two years of diligent investigation into the Medical Records and Reports issued by the several Cancer Research Organisations clearly showed the writer that these *local* lines of research did not lead to the solution of the problem of cellular growth, and that the long failure to solve the mystery of cancer lay in the fact that investigation had omitted research into the constitutional principle that actuates growth. It was felt that research into the dynamic and in fundamental principles that procure growth rather than in investigation of the growth itself, must the solution of cancer be sought.

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The New Line of Research.

The new conception of cancer is, therefore, concerned with investigation into :—

- (1) The elements that form the basis of all organic life.
- (2) The effect on the body of a deficiency in the essential elements.
- (3) The result of introducing into the body elements foreign to its needs: (a) metallic, (b) non-metallic.
- (4) The indispensable element in chemical exchange.
- (5) The chemical actions and reactions that transmute elements to organic substances.

- (6) The nature of 'the energy or force' that procures chemical exchange.
- (7) The secret of chemical constancy.
- (8) The nature of the relation that exists between the internal chemical and physical forces of the body and the external chemical and physical cancer-inducing-agents.
- (9) The effect of heat on chemical exchange.
- (10) The particular action of radium and X-ray on living tissue.

It will not be supposed that the solution of the problem as here set forth is claimed as the effort of one mind, but is built up, upon the great discoveries of many minds linked throughout the Ages by a common search for Truth.

The New Line of Investigation and the Old.

Before attempting to advocate further a new line of investigation, it is necessary to briefly refer to the lines of research that have hitherto been followed.

It is more than half a century since Cancer Research was placed on an organised basis, yet, notwithstanding exhaustive investigation, we are to-day faced with the fact that neither research or experimental methods have been successful in discovering the origin of cancer, its treatment, preventive or curative.

To Great Britain belongs the honour of inaugurating the first "*Society for the Investigation of the Nature of Cancer.*"

At that time (1801) the disease seems to have been treated both *locally* and *constitutionally*, but when in 1848, the great discoveries of Professor Virchow focussed attention on *cellular pathology*, the *local* line of investigation became almost universally adopted, and for over eighty years the *constitutional* view has received little attention.

Yet researches of Professor Virchow and of Dr. Fibiger and others, and in spite of the extensive experimental methods of research, which have included *inoculation*, *artificial infection* and *grafting*, no fresh light has been thrown on cancer.

A perusal of the vast Literature that has grown up around malignant growth testifies to the exhaustive researches—microscopical, anatomical and bacteriological, that have been undertaken, yet the verdict to-day is that these researches have yielded no clue to the origin of the disease. This complete failure forces us to reconsider the old controversy. Is Cancer to be regarded as a *local* or *constitutional* disease? If a *local* disease, would not such extensive research have discovered its origin? If on the contrary it is a *constitutional* disease, no *local* research, however exhaustive, will reveal its cause. Removal of the growth with the knife can only afford temporary relief.

The view adopted in this Paper is that cancer is a *constitutional* disease and that *cellular proliferation* is the outcome of deep-rooted *chemical* and *physical conditions*.

It is believed that research, therefore, must be concerned primarily with the *constitutional causes*, which procure, accelerate, or retard growth, rather than with the growth itself. All living Matter, we know, is in

essence—chemical, built up of simple elements which are transmuted in the living laboratory to the compounds, substances and structures that constitute organic life.

Thus, the writer conceives that research must be concentrated on an endeavour to discover what is the peculiar energy which combines and energises chemical elements and transforms them into living Matter.

The new conception of cancer is entirely based on the recent scientific discoveries in regard to Matter and the Nature of the Force that energises it.

There are in the body, many bio-chemical adaptations for the precise cause of which no explanation has hitherto been found. We must look to Modern Science to throw light on the problems of the body that have hitherto lacked explanation. The value of scientific facts increase in proportion as they become connected links in the chain which unites *Cause and Effect*.

Does modern science provide an explanation of the vital principle which stimulates growth? Emphatically yes. The startling discovery of the electric properties of the Atom furnishes us with the secret of "*vital force*."

Within the last twenty-five years the sciences of chemistry and physics have emerged from a long obscurity and have become the controlling factors in the economic and scientific world, but can it be said that they have, as yet, taken their rightful place in Medicine?; or that the more recent scientific discoveries have been applied to solving the problems of disease?

One of the greatest living scientists, Sir Ernest Rutherford, has said, "*the new physics dissipate our last doubt about the reality of Atoms*."

Is it, indeed, too much to say, that the discovery of the electron has brought about a complete change in our conception of Matter, and if in Matter then in living as much as in inert Matter. Atoms, we are told, can no longer be regarded as indivisible particles of Matter; they can be broken up. They are found to have a very complex structure to possess in addition to a nucleus or "*proton*," an outer universe or "*shell*," consisting of pure electricity. "*The Atom*," says Sir William Bragg, "is a highly complicated structure, possessing an enormous store of potential energy, an energy which varies greatly in degree and intensity in the several elements." The writer is led to postulate that energy is determined by the electric units.

We learn that not only a few, but nearly all substances are charged with a greater or less degree of electricity and the power of emitting rays—that is of being radio-active. Atoms we are told, are continually and spontaneously giving out fragments of themselves—nearly every form of Matter can be stimulated to radio-activity* and while some substances are of very moderate activity, others are possessed of great force, energy and velocity.

This amazing discovery, which has revolutionised the whole world of science, seems to have passed without practical application to the problems of living growth. Its value in medicine has not as yet been dealt with, but it is in its application to the

* "*Outline of Science*," by J. J. Thomson.

growth and functions of the living body that its fundamental significance must appear.

The discovery of the electron concerns biology and physiology more than any other branch of science, since surely in the electron is disclosed the system that procures *vital force*, the energy by means of which substances and functions are built up and are controlled. The epoch-making discovery of the electron completely shatters the conception of Matter as previously held; it has opened up a line of research and suggested possibilities more profound and far-reaching than any that has preceded it.

The electron has given a new name to our Age, the Age of electricity. The electron has unfolded to our astounded gaze the meaning of vitality and the secret of electricity. So startling has been the appearance of the electron that it has blinded us to its true import. We cannot doubt its reality since the laboratories of Europe, nay, of the whole whole civilised world have concentrated on the electron and have confirmed its existence. Yet it has not, as yet, taken its true place; its vital principle is still unknown. Its real value—namely, its application to the problems of the living body remains undeclared.

What at present is the recorded verdict of biology and physiology on the facts that *all Matter has electric properties*? Has the new knowledge been as yet applied to elucidate the mystery of growth? Has it been recognised as "*the vital force*" that energises the growth of living cells and tissues? Has it influenced our conception of the body and our treatment of disease—above all, cancer?

It is nearly a quarter of a century since the electron made its appearance. It brought with it the clue to Nature's profoundest riddle, the explanation of the continuous change and growth of living substance which has been termed "*the fundamental fact of life.*"

How often has the hope been expressed that some day, some fundamental truth might be discovered which should give the clue to the growth of substance, perhaps to "some primordial substance from which all varying forms of Matter have been built up." The discovery of the electron, the disclosure of a *New Property in Matter*—brought about by the revelation of the Atomic Structure and the radio-activity of Elements, surely provides the clue which science has awaited through long decades. Yet, by its very simplicity, the truth the Atom revealed has passed unnoticed and to-day, more than twenty years after its discovery, the electron remains without any practical application to the growth of living substance and the treatment of disease.

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The fact that the body is composed of Atoms, each consisting to a larger or smaller extent of electricity, furnishes a new system of diagnosis, for not only does it supply the logical explanation of the principle which procures those precise chemical exchanges which proceed continuously in the body, but we are enabled to diagnose the value or the reverse to the blood of certain elements and, moreover, it reveals the existence of a common basis in

those causal factors of cancer which have hitherto been baffling and bewildering.

We are at last enabled to link in logical sequence causes and effects hitherto unconnected, and to trace the genesis of living substance from simple elements by the operation of a Universal Principle.

We can now trace cancerous growth to *constitutional* conditions, chemical and physical.

The cancer-inducing-agents hitherto believed to possess nothing in common are now discovered to be rooted and united in the same basic Principle. Each of the cancer-inducing-agents has a fundamental affinity. Each possesses the power to emit heat and create energy. To this dominant characteristic the creation of Heat and consequent absorption of Moisture must be ascribed the fatal influence of certain elements of high atomic weight, elements which induce the condition that is in its final stage manifested in cellular proliferation or cancer.

The discovery that every element is distinguished by the fact that its Atom possesses its own particular number of electric particles, is surely the most vital discovery ever made in regard to Matter, since it provides, the writer conceives, the clue to the eternal secret of chemical exchange and chemical constancy, it furnishes the logical interpretation of the "*vital force*" or "*energy*," which stimulates growth, showing that these are no mere hypothetical terms, but potent facts. The designed Principle which procures and regulates the temperature by which the chemical processes of the body are achieved.

It is in this question of 'energy,' that we find the factor of growth, and it is to an excess of energy that we must look for an explanation of that condition—commonly known as '*irritation*.' It explains that all elements that induce excess of energy have the effect of interfering with the chemical and physical equilibrium of the body. The whole body is dependent for normal growth on its ability to preserve its equilibrium.

The high cancer incidence in all the metal industries is explained by the fact that these powerful Agents interfere with the chemical changes of the blood, just as the presence of such agents interfere with the chemical changes in the laboratory—their effect is to destroy chemical balance.

It is, then, by research into the properties and characteristics of elements, with a view to determining their precise influence on the chemical and physical processes of the body, that this Paper seeks to draw attention by inviting research into the vital principle that energises Matter, by inducing conditions of temperature favourable or unfavourable to the cellular activity that is the characteristic of cancer.

It explains, not only the vital importance of certain elements in providing the essential nutriment to the blood and tissues, but it conveys a new conception of the vital part such elements play in procuring and regulating the essential temperature, the critical Heat and Moisture on which all organic life is dependent.

Equally it explains the disastrous effect on the chemical and physical processes of the body, of deficiency in any one of those elements which

constitute the basis of every form of life. The view of cancer here put forward may be summed up as follows :—

(1). Cancer is a disease of the blood—primarily due to a deficiency in one or more of the essential elements which constitute protoplasm. Such deficiency impairs the physical and chemical integrity of the blood and interferes with the critical temperature by which organic life is controlled.

(2). 'Site' is commonly determined by (a) internal strain ; (b) by a blow or injury, if the blood is lacking in the essential elements, it fails to perform the necessary functions of cleansing and nourishing and regulating growth.

(3). Association with elements foreign to the constitutional needs of the body not only poison the blood, but raises the blood pressure above the normal in this condition the equilibrium of the living laboratory suffers.

(4). Normal cellular growth is achieved by the power to maintain a critical and stabilized temperature. Normal stimulation and inhibition are achieved by exact conditions of temperature.

(5). (a) Thus, deficiency in an essential element involves disturbance which interferes with the chemical and physical routine of the body ; (b) the presence of foreign elements more particularly of the heavy metals creates acute disturbance, chemical and physical, uncontrolled *cellular proliferations*—is a direct outcome of such disturbance.

(6). The most valuable element as well as the chief factor in all chemical combinations is Oxygen. A deficiency in oxygen* is believed to be a primary causal factor of cancer.

To sum up, all cancer-inducing agents (1) generate excessive heat, (2) the generation of Heat absorbs Moisture, (3) Moisture is the dominant need of all organic life.

It would appear that the destructive influence upon cells and tissues—both cancerous and non-cancerous of such potent forces as radium and X-ray is due to the fact that these powerful agents induce excess of Heat, thereby withdrawing Moisture.

The general term "*irritation*," may be summed up as a condition in which essential Moisture is absorbed by Heat with the result that acute activity is induced—Moisture, the controlling factor, being absent.

Thus it is postulated, that the very starting point of cancer research (1) lies in investigation into the Property and Nature of the elements that form the basis of all living Matter ; (2) research into the extent of the vital force or energy that characterises elements essential and non-essential to organic growth.

(3) Investigation into the effect on living tissue of abnormal heat, and the resultant effect on organic processes.

A comparison of the dominant characteristics of the elements that form the basis of life with the elements which induce cancer, show that the essential elements are of a moderate radio-activity. The many contradictory and puzzling features of cancer become reconciled when viewed as the outcome of interference, with the delicate

* The researches of Dr. Otto Warburg of Berlin in regard to Oxygen and Cancer cells appears to support this view.

chemical conditions by which in the living laboratory, normal growth is maintained. The writer believes, the new knowledge of Matter, unfolded by the discoveries of Sir Ernest Rutherford, Sir J. J. Thomson, H. G. J. Moseley, Professor Soddy and others, have been gradually leading to the Solution of the age-long problem of cancer.

Protoplasm.

The basis of all organic life, we know, is Protoplasm ; it comprises wholly, or in part, all living cells and tissues ; it is the basic substance of all life, both animal and vegetable. It is, therefore, regarded as the *primary living substance*.

Protoplasm is an Albuminous substance of great chemical perplexity and consists of from 70% to 90% of water.

This preponderance of moisture gives us a clue of fundamental importance, since it provides an insight into the dominant need of the body and the conditions that procure normal healthy cells and tissues. This need of moisture which is so universally recognised in plant life is owing, possibly, to Man's great powers of resistance, very commonly lost sight of. Moisture is, however, the dominant need of all organic life. The essential constituents of Protoplasm are Hydrogen, Oxygen, Nitrogen and Carbon, and to these, some authorities add Phosphorus and Sulphur. These we may consider as the primary elements, since from them and what they contain, the body and all living substances are built up.* They are the constituent from which the body derives its-essential nutriment, by these the blood is replenished, purified and stimulated and cells and tissues built up.

Thus, cancer investigation turns primarily on the nature and characteristic of these six simple elements, without which no living thing is formed.

In addition to these the basic elements, there are, however, found in the body, in smaller proportions, certain other elements which, however, appear to form no essential basis of protoplasm. These elements, some fifteen or sixteen in number, form a marked contrast to the primary group. (a) they are present in small and varying quantities and are frequently definitely absent ; (b) their purpose in body-building is for the most part undetermined ; (c) some are known to be definitely harmful.

The writer believes that these elements vary in the human body, according as the condition is one of health or disease, youth or age. It is significant that these elements are wholly absent in many Classes and Species, and thus exhibiting an important contrast to the primary elements which are present in all forms of organic life.

Thus, it is important to diagnose, not only the value and uses of the primary group, but also of the secondary group of elements, in order that we may determine whether the presence of these latter constitute essential factors in building up the body substance, or whether they are elements foreign to its essential constitution and consequently a source

* These same six elements form the greater part of the whole Earth's Crust, thereby proclaiming the common bond that unites all Nature, animal and vegetable.

of danger—(a) by introducing chemical compounds foreign to the body's needs; (b) by procuring conditions of temperature in excess of that required to preserve in the body, the essential equilibrium of chemical exchange.

Our first thought will naturally be, how far does the discovery of a New Property in Matter throw light on this problem? It throws a most valuable light, since it shows that the six basic elements are all of a very moderate radio-activity and all are non-metallic. While the secondary group are largely composed of metallic elements and are possessed of high radio activity. The Salts of Sodium, Chlorine, Magnesium, Potassium, Calcium and Iron and in smaller amounts, Manganese, Zinc, Copper, Tin and Silicon are stated to be found in the body. Thus we are at once arrested by the fact while the basic elements are of all of very moderate activity, the elements of the secondary group are of marked radio-activity.

From this we are bound to conclude that the secondary group of elements not only introduce fresh chemical compounds into the body, but that the temperature at which these elements fuse, volatile, or otherwise chemically combine, must introduce vital changes in the body. It appears that the secondary group of elements not only forms no essential basis of protoplasm, but that they form no essential part of the Lipins, Proteins and Carbo-Hydrates, and, although the beneficial influence exerted by iron, calcium, sodium and chlorine in minute quantities is recognised in the building up of the blood and bones, these elements in excess constitute a danger.

It is suggested, therefore, that Cancer research should be directed to the dominant characteristics of these two groups of elements, in order to more exactly determine their influence on the body processes, more particularly on cellular growth, with a view to determining how far cancer is a disease due to a deficiency in the basic elements and to an excess of the secondary or foreign elements, and to what extent such deficiency or excess affects the body temperature, and whether it is calculated to disturb, retard or accelerate activity in regard to cellular growth.

Temperature.

In the living laboratory, as in the Chemist's laboratory, we must conclude that chemical actions and transformations are achieved by very precise conditions of temperature. In the living laboratory, such transformations reach a precision and delicacy unknown in the chemists' laboratory, in spite of his knowledge and his instruments of precision, the chemist cannot achieve the transformations which ceaselessly proceed in the body, and even while he watches the body processes, he can but occupy the position of the assistant who knows nothing of the hidden processes and interim stages involved. For example, by subcutaneous injections of salt and water, the chemist knows that blood will be rapidly formed in the veins, but he cannot achieve the miracle he assists to procure. He knows the complex substances and compounds of the

body are made up of such simple elements as Hydrogen, Oxygen, Nitrogen, Carbon, Phosphorus and Sulphur, but the mysterious process which transforms these elements into flesh and blood remains an inscrutable mystery. The discovery of the radio-activity of elements gives us the clue to the vital force that achieves metabolic change, and it becomes increasingly apparent that the phenomena of the physical body are preserved, maintained and regulated by conditions of Heat and Temperature within the body itself, conditions which may be vitally influenced by the introduction of foreign elements.

To preserve an equilibrium would seem to constitute a first principle in every living organism and it is to this ability to preserve a stabilized temperature or equilibrium that uncivilized races, children and wild animals appear to owe their immunity from the disturbance that is the precursor to such diseases as cancer.

In the Atomic numbers and Atomic weights of the elements the writer is led to conclude that *the vital factor* in the body processes is revealed, and that this line of investigation if followed, will prove of fundamental importance to cancer research in the future. This line of *constitutional* research appears to be the one which alone can determine the beneficent or hurtful influence of certain elements in regard to cellular production.

The new knowledge of the Atomic structure has surely laid bare the nature of the *force* or *energy* that achieves the chemical and physical processes of organic life, and it surely indicates that it is the basic elements which provide within themselves the conditions, and also the *limit* within which the essential Heat, Moisture, and Air of chemical exchange are procured in the living laboratory. That it is indeed these elements that provide the "*vital temperature*", which procures chemical exchange.

Thus, a continuous supply of the basic elements is essential to the normal healthy growth of the body. That the range of temperature is confined within definite limits is evidenced by the fact that life ceases and chemical exchange stops when the blood rises above or falls below a certain temperature. Normal temperature and normal activity we now perceive are dependent on a continuous supply of *the essential elements*.

If normal cellular growth is dependent on the purity of the blood stream we must conclude that the stimulations are influenced by the temperature at which elements, whether gases or solids, attain solubility and expansion.

Thus it is inferred that the prime factor in normal cellular production is the maintenance of a continuous supply of the basic elements, of which Oxygen is chief. A deficiency robs the blood of its essential constituents and interferes with the temperature, the stability of which is the dominant factor in every living organism.

Relative Importance of Elements.

The fact that Protoplasm consists of 70 to 90% water, proclaims Hydrogen and Oxygen as the primates among the body elements.

The great preponderance of Moisture warrants the belief that it is the primary factor in all organic life; thus, deficiency in oxygen or

hydrogen robs the body of these elements, essential factors upon which its every process and function is dependent.

We learn that the affinity between oxygen and hydrogen is closer than between any other elements, they are, indeed, the indispensable parents of many chemical substances and combined with carbon in different proportions these elements form an astonishing number of compounds.

Hydrogen, we know as a non-metallic element of very low radio-activity and indispensable to most chemical exchanges but, it is in the fact that oxygen and hydrogen alone provide the Moisture that is the essential of all organic growth, that we perceive their vital and fundamental importance is the cosmogony of the body. **Every action and function is dependent on the co-partnership of these two elements. In the fact that they provide a preponderance of Moisture, we find their vital importance since the radio active nature of elements found in the body urgently demands the presence of Water.** Thus we realize contact with elements and metals of high radio activity constitutes a danger by the withdrawal of Moisture since we know that life is incompatible with the complete abstraction of water, but in addition such association increases *vitality*, making it impossible for the individual to maintain the physico-chemical stability which is the essential factor of all growth.

If this postulate is correct, the first necessity in Cancer research must be directed to ascertaining (1) to what extent "*vital force*" forms a definite integral basis of the system termed "*Organic Life*" or whether it is to be regarded as a vague term as many have believed, used to cover conditions based purely on hypothetical conjecture.

Up to the end of the eighteenth century, belief in a "*vital force*" supplied an explanation for most of the unexplained phenomena of the body, but with the discovery, by the great French chemist Lavoisier, of the inflammable nature of the elements constituting the body, and his further discovery that the body temperature was maintained by the combustion of food stuffs—belief in a "*vital force*" diminished, and later the theories of Wöhler and the researches of Claude Bernard finally shattered the old belief in a "*vital force*."

The latest scientific discoveries invite re-consideration of this question. Was belief in a "*vital force*" a mere vague hypothesis, or did it rest upon some tradition, based upon the profound knowledge of some ancient and now forgotten civilization?

Tradition handed down, misunderstood, misinterpreted, yet persistent. Must Lavoisier's discovery necessarily discredit belief in a "*vital force*," or does it indicate the existence of an unknown Law? Lavoisier's discovery stood out in the eighteenth century as an isolated factor, the most recent research proclaims it to be a link in the long chain of events that build up organic life, a pointer which led up to the valuable discoveries of Moseley into the characteristic X-rays of elements and to the exact researches of Rontgen, the Curies, Rutherford and that brilliant band whose investigations into the radio active forces, and structure of the Atom have thrown a new light on all Matter—living and inert. Lavoisier was not in a position to link up his discoveries with any definite

series of antecedent causes, it is for a later generation to reap the full reward of the discoveries, that have led to a clearer perception and fuller understanding of the physical influence, that control the chemical exchanges of the body, influences that furnish at last a logical explanation of the heat which is the inseparable concomitant of chemical activity.

The most recent discoveries point to an increased belief in "*vital force*" as a definite part of a universal system, by which in living organisms heat is provided, distributed, and regulated, and by which is procured in every living thing that critical condition of temperature which procures for the individual energy and systematic evolution. **Conditions which though constant, are not fixed whereby is secured the progress of Evolution in a harmonized and systematic sequence, without which could only result chaotic, lawless and fantastic growth.**

"The ultimate end of physiology," says Professor Max Verworn, "is to discover what this vital force is and what is the exact cause of these vital phenomena—a goal from which physiology is at the present day still very remote, investigation of the *vital processes* comes to be not merely a means, but a direct end of research. The conception to which physiological research has hitherto attained in this matter is of a more or less doubtful nature. The facts contained in them still require to be linked together by hypothesis if we are to obtain a vague outline of what lies behind the great riddle of life."*

Pure chemistry has no conclusive argument or explanation of the riddle of "*vital force*." *Metabolism* is manifested in the body, in all its functions, in reproduction, respiration, digestion, secretion, in degeneration, in reconstruction in the growth of cells and tissue, normal and abnormal, in all these chemical phenomena we perceive that transformation is associated with a distribution of energy. The continuous process of change that Matter undergoes has been termed the "*fundamental fact of life*." Must we not infer that in all *stimuli* there is a common basis which ever acts and re-acts in a specific way and that all phenomena of growth are dependent on the presence of certain explicit conditions based on heat of a given temperature.

From the foregoing it will be seen that the writer has grounds for believing that no investigation of the origin of cancer can be complete until there has been diligent research into the underlying *constitutional causes* which procure activity. In Part II. the writer carries this Investigation further, and it will be seen that the problems which have proved so baffling become clear when viewed by the light of the New Knowledge of Matter. Strange as it may appear, the greatest problem of this or any preceding Age finds its solution in the microscopic structure of the Atom.

* "*Physiology*," by Professor Max Verworn, A. E. Shafer,

The Old and New Line of Research Compared.

We turn now from this survey of a *constitutional* line of research to a consideration of the *local* line as at present adopted. During the past three years it has been the writer's endeavour to become acquainted with all the more important lines of investigation as carried out during the past sixty or seventy years, as recorded in the Medical and Hospital Journals and in the Reports of the Medical Research Councils in Great Britain and similar organisations in the Continent of Europe.

An examination of the vast Literature that has grown up testifies to the exhaustive nature of these researches into the origin and nature of cancer. Exhaustive pathological, microscopic, anatomical and bacteriological researches have been diligently pursued, yet in spite of this the verdict to-day is that these researches have yielded no clue to the origin of the disease. This complete failure obliges us to ask whether the time has now come to abandon the *local* line of research and to seek out some fresh angle of investigation, seeking to make use of some of the great scientific discoveries which have revolutionised modern thought. The line of research at present adopted is practically limited to cellular growth. The new line of Investigation is concerned with an endeavour to pierce the secret of the *vital force* that procures, and accelerates growth, and the Evolution of Matter.

Thus it will be seen that the New Line of Research approaches the subject from a totally different standpoint from that hitherto followed, a standpoint which indeed has only been made possible by the discovery of a *New Property in Matter*.

One thing which must astonish anyone who attempts to study this vast Cancer Literature, is the amazing amount of energy that has been expended during the past quarter of a century on *experimental research*. These experiments which have been carried out on a vast scale, mostly on domestic and laboratory animals, do not appear to have yielded any fruitful or satisfactory result. The Research Experts themselves holding widely divergent views as to the value of these experiments, which have included inoculation and grafting.

The writer does not, of course, propose to express an opinion on these Researches; in dealing, therefore, with this subject the opinions quoted are drawn from statements made by recognised authorities on Cancer Research. These may be summed up as agreeing "*that so far no research, experimental or otherwise, has revealed the origin of cancer.*" The outstanding problems of which one and all remain unsolved. Thus, the oft-debated questions of personal susceptibility, immunity and heredity remain unanswered. Cancer incidence in certain trades is recognised, **but the nature of the inducing factor has not been determined; a common root factor, uniting all cancer agents has not been recognised; the Agents are believed to "have nothing in common."**

Thus, (a) **no dominant principle connects the several agents that induce cancer.** (b) **no common root infection is recognised** (c) **a local view is taken of cellular proliferation, the origin of which is to be sought in the "internal mechanism of the cell."** (d) the line of Research at present followed presents a series of unconnected factors,

while the new Line of Research presents a chain of clearly connected events linking antecedent causes, bio-chemical and bio-physical, into a connected whole. (e) the present line of Research takes no account of the discovery of a "*New Property in Matter*." The New Research sees in this colossal fact the key to the mystery of growth and the explanation of the miracle of Evolution. (f) the old view does not take heed of the fact that all life is built up of simple elements of low potential. The new view sees in that stupendous fact the explanation of the phenomena of temperature in relation to growth. (g) the old view takes no account of the chemical changes induced by accelerated temperature. The new view sees in temperature the dominant factor that rules the chemical changes in the chemist's laboratory, and in the living laboratory alike. (h) the old view does not take into account the two fundamental causal factors of *metabolism*—the new view says that research into the growth of the body rests on two pivots, Heat and Moisture.

The Present State of our Knowledge.

These statements are all drawn as has been said, from the leading Research Councils and Medical and other Reports. In a Paper, recently published by Dr. William Cramer, the present position of cancer research is very clearly outlined. It bears the stamp of authority, since it is published under the auspices of the Imperial Cancer Research Fund, the Director of which Society in his Annual Report for 1927-1928 refers to it as "*presenting a clear and concise statement of the present state of our knowledge*." It may be objected that the Paper in question was written for the general public and not for experts, but that does not alter the fact that on the authority of the Director of the Imperial Cancer Research Fund it represents a clear and concise statement of the present state of our knowledge. Nothing that has been since published shows disagreement with this view.

Dr. Cramer* explains "*that the cancer Agents have nothing in common except that they produce at one particular spot a damage to healthy cells*" "*something happens at a certain moment that turns a normal cell into a cancer cell.*" What is this something?

He says "*By the process of chronic irritation the cell is stimulated to produce the necessary factor and thus becomes susceptible to cancer,*" and again, "*chronic irritation, leading to cancer can be induced experimentally by many different agents which have nothing obvious in common, except that they produce a continued damage to healthy cells.*" "*If the damage is too slight, no cancer arises, if it is severe, again no cancer arises, because the damaged cells die off. One cannot really say that chronic irritation is the direct cause of cancer. It is more correct to say that it is a condition that induces cancer.*" "*The cells of the body are individual living units, but their activities are controlled in such a way by inhibitions and stimulations that the activity of the individual cells appears directed towards the well-being*

* Dr. William Cramer, M.R.C.S., L.R.C.P. II. Article on "*Cancer Research*," May No. Nineteenth Century, Vol 72, continued from the April Number,

"of the organisation as a whole." "How this is brought about in the normal organism is as yet an unsolved problem of physiology, but its solution must be found in the internal mechanism of the cell."

"There are chemical agents such as tar and shale oil, and there are physical agents such as radium and X-rays, and there are certain worms which live as parasites" . . . "and through the irritation they produce in healthy tissues of the animal, give rise to cancer. In man, also, such agents have been known to produce cancer." . . . "Chimney sweeps cancer is the result of the irritating action of soot, a similar condition occurs amongst tar and shale oil workers. Mule spinner's cancer is the result of the irritating action of lubricating oils, with which the clothes become saturated."

"These very different conditions, have nothing obvious in common, except that they produce at one particular spot a damage to healthy cells." . . . "an alternative explanation which seems to offer itself was that cancer was due to some change in the internal mechanism of the cell," but, "the most careful research for any consistent alteration in the finer structure of the cancer cell, has failed to show any consistent alteration. The only evidence in support of such a view has been brought by the recent work of Professor Warburg, of Berlin, who has shown that the cancer cell can live in the absence of oxygen."

"This explains why cancer cells can live under very unfavourable conditions, such as an insufficient blood supply, under which they are often found, but it does not satisfactorily explain why they grow."

While recognising the value of Dr. Cramer's clear summing-up of 'the present State of our Knowledge' the conclusions pronounced do not appear to be supported by scientific data.

Between the Old Lines of research and the New there is marked divergence. Which view is correct?

Old Idea "The several cancer inducing agents have nothing obvious in common."
New Idea **The cancer agents are all fundamentally related by a common Principle.**

Old Idea "They produce at a particular spot damage to healthy cells."
New Idea **They procure by the common factor of Heat a fundamental change in the essential constituents of the blood. The damage is to be sought in the antecedent causes that procure growth, i.e., in chemical and physical factors, and in conditions of temperature.**

Old Idea "Something happens at a certain moment that turns a normal cell into a cancer cell. What is this something?"
New Idea **The change is not sudden, it is the result of gradual deterioration. The agent induces heat and dries up moisture. The 'something' that changes the growth is explained by the fact that heat accelerates chemical activity.**

Old Idea "By a process of chronic 'irritation' the cell is stimulated to produce the necessary factor and thus becomes susceptible to cancer."
New Idea **Irritation is defined as a condition of drying up moisture under the influence of heat. The accessory factor is not to be found in the cell structure, but in the condition of the blood that stimulates, regulates, cleanses and feeds the cells, skin and tissues.**

Old Idea "The cells are controlled by inhibitions and stimulations. How this is brought about is an unsolved problem of physiology, but its solution must be found in the internal mechanism of the cell."

New Idea The solution of the problem lies not in the mechanism of the cell but in the antecedent chemical and physical causes that promote and control metabolic change, and upon vital conditions of temperature.

Old Idea "There are certain worms which live as parasites and give rise to cancer."

New Idea (a) The belief that certain parasites give rise to cancer is not conclusively proved.* (b) Worms could not exist in the body unless the blood was chemically impure. The primary cause lies in the blood, worms if present are the result of blood conditions.

Old Idea Professor Warburg has shown cancer cells can live in the absence of oxygen, but it does not satisfactorily explain why they grow.

New Idea The discovery of Professor Warburg is of exceptional value, if it does not explain why cancer cells grow, it indicates that the condition of dryness which inevitably follows withdrawal of oxygen provides an impetus to growth by increasing heat.

Occupational Groups and Cancer Agents.

Old Idea "Chimney sweep's cancer is the result of soot; a similar condition occurs amongst tar and shale oil workers. Mule spinner's cancer is the result of the irritating action of lubricating oil. A man may be infected by eating pork infested with the worm 'trichina spirales.' These very different conditions have nothing obvious in common, except that they produce at one particular spot, damage to healthy cells.† The extraordinary effects of X-ray and Radium on living cells, both normal and cancerous, is as yet ill understood. "A study of their action is likely to extend the usefulness of these powerful agents in Cancer."

New Idea From the foregoing, it would appear that, although reasearch has been undertaken in regard to the several cancer agents, their chemical and physical attributes have not been isolated. To this must be attributed the view that the cancer agents "have nothing in common." Chemically, they are not, it is true, identical, but in the common power to disintegrate and destroy matter and generate abnormal heat, they are one. The effects of X-ray and Radium, it is said, "are ill-understood," yet it is now almost a quarter of a century since the startling discovery was made that the atom of radium carries a charge of no less than eighty-eight electrons!

The study of the action of rays of such stupendous force surely suggests that their sphere of usefulness is outside the living body.

From the foregoing, it would seem that the New View differs essentially from the Old.

The old idea is that the introduction into living bodies of elements of high potential, is, in the case of malignant growth, beneficial and curative.

* Refer to Experimental Research. † Dr. William Cramer, M.R.C.S., L.R.C.P.

The new view is that the association of every form of organic life with forces of high potential is provocative of disastrous results, and that while these potent forces destroy malignant growth, it is impossible to isolate them so that they do not at the same time penetrate and destroy healthy tissue, and disintegrate essential compounds. Thus their introduction violates every natural law of the body, interferes with the critical temperature that governs chemical exchange and destroys the essential balance that procures the physical, mental and nervous equilibrium of the body as a whole.

Which of these two views claims our consent ?

In view of the new knowledge of the *Vital force*, locked up in the *Atomic structure*, can we longer cling to the old view of Matter and its growth.

The Evidence of Cancer Incidence in Certain Trades.

Let us turn now to the Statistics, as given in the Industrial, Government and Medical Research Councils and Reports* as to Cancer Incidence in certain occupational groups, with a view to determining whether these cancer-inducing agents are recognised as the writer avers them to be, by a common principle, or have they, as commonly pronounced, "*nothing in common?*" Does chemical and physical research endorse the writer's conclusions that the highest cancer incidence and mortality is to be found in occupations dealing with elements and compounds associated with Heat.

Does investigation as to 'site,' confirm the view that irritation is directly connected with the blood and its activities ?

Do the conclusions, drawn from the statistics, confirm the postulate that elements of abnormal heat induce cancer and that 'site' is determined primarily by interference with the chemical purity of the blood ?

We find from statistics that it is precisely in those trades where elements that generate heat are employed, that the highest cancer incidence prevails—thus the writer's conclusion that agents that induce intensive heat procure in the blood violent chemical re-actions, receives powerful confirmation.

Whatever the causal factors, whether intrinsic or extrinsic, that withdraw from the blood the elements which furnish its curative and purifying qualities, that factor becomes an agent of disease and notably of cancer.

The recognition that a common principle unites the cancer agents must, it is believed, go far towards solving the baffling problems that have hitherto surrounded cancer. When once the root of an evil is discovered, treatment and cure must follow.

The writer claims that the conclusions arrived at by the New Line of Investigation are supported by the figures and data as recorded in Report No. 99, Privy Council, Medical Research Council, and in the

* Report No. 99 Privy Council, Medical Research Council. Investigation into Statistics of Cancer in different Trades and Occupations.

Reports and Statistics of cancer in various trades and occupations. At the same time the views held by the writer differ in many respects from those pronounced in the Reports.

This is shown, in the first place, by the fact that, although a number of agents are found to induce cancer : (1) the precise nature of the irritant has not been isolated ; (2) the cause of infection or susceptibility has not been discovered ; (3) a common root factor, uniting all cancer agents has not been recognised, they have '*nothing in common.*'

It is stated : That the agents may be classified roughly as chemical, mechanical, actinic, and infective—coal tar, pitch, petroleum, paraffin, lubricating oils of various kinds, soot, the nematode worm, arsenical and aniline dyes, X-ray, radium, and exposure to various forms of radiant heat, also in the distillation of products of organic matter, in tobacco, alcohol, and certain foods, fruits and drugs, and similar substances. Of this latter group it is stated that " data as to their producing liability or relative immunity has proved wholly inadequate and have been more or less discredited."

The Present State of Our Knowledge.

Lead.

Of the metal groups, it is stated " that while the injection of metallic substances over a considerable period of time has been advanced by more than one observer, as a predisposing cause of cancer, it may be mentioned that Blair Bell (1924), having found the administration of lead salts apparently of value in the treatment of malignant disease, has suggested that, those who are exposed to lead poison, show a reduced mortality from it"—(cancer).

The opinion that lead poison can be regarded as an agent in reducing cancer mortality is not borne out by the cancer statistics, which show that of all the Occupational Groups, the Lead trades have a cancer incidence and mortality far exceeding that of any other trades.

With reference to injection and cancer, it is of interest to observe that the Report* says : " These data do not reveal the connection suggested between cancer and lead poisoning."

The question of the toxic properties of lead, the writer conceives, has now been isolated, thanks to the discovery of a "*New Property in Matter.*"

The whole question is one of the profoundest importance, especially in regard to its influence on organic life ; the writer has, therefore, devoted a Chapter to a fuller discussion of the properties of Lead and its particular influence on living cells and tissues. The consideration of Lead will therefore be continued after brief consideration of the less well-known cancer-inducing-factors.

The prevalence of cancer in *all the allied lead trades among plumbers, glaziers, painters and potters, and among tin and coppersmiths, zinc and*

* Report No. 99, Privy Council, Medical Research Council. Investigation into the Statistics of Cancer in different Trades and Professions. Dr. Young, M.D., W. T. Russell, T. Brownlee, M.D., Dr.Sc., E. L. Collis, M.D.

bronze workers, and file makers, though attested by statistics and Medical Reports alike, does not appear to have awoken attention to the fact that all the elements composing the Metal Group share the common feature of a high atomic number, i.e., power of inducing heat.

That the existence of this common root is not inferred may be gathered by many references ; to quote one in regard to the excessive oesophageal cancer among metal workers, those engaged in the liquor trade, labourers, hawkers and others "this excess may probably be regarded as statistically significant" . . . "the consumption of an excessive amount of alcohol predisposes and is an intimate causal factor to the frequency of and mortality from cancer of the oesophagus." "That this is not the whole truth seems to be evidenced by the excessive amount of oesophageal cancer in other occupational groups, among which may be numbered many workers in metal, for which no apparent association with alcohol can be postulated" . . . "The injestion of hot tea should also be thought of."*

It is evident that the old view does not connect the causal factor ; it does not perceive a common root in the heat inducing properties of metals.

The new view that heat is the inducing factor is confirmed by analysis of the Metals referred to, their Atomic Number, at once proclaims them as united by a common-causal-factor.

		<i>At. No.</i>			<i>At. No.</i>
Lead	...	= 82	Zinc	...	= 30
Thallium	...	= 81	Copper	...	= 29
Mercury	...	= 80	Iron	...	= 26
Tin	...	= 50			

Cancer and the Textile Trades.

When we turn to the high cancer incidence in the Textile groups we are again confronted with the same root factor. Aniline dyes are products of coal tar, arsenical dyes of arsenic. Arsenic is an element whose Atomic Number is 33, thus it has a greater activity than the Elements which form the basis of all organic life, but they present a heat inducing power greater than even zinc, iron and copper, thus we seem justified in assigning to the arsenical and aniline dyes the same root cause of infection as found in the metal groups.

The fact that a high cancer incidence does not seem to prevail in the vegetable dyes such as the products of indigo, raspberry, mulberry or the common earths, **cannot fail to confirm Heat as the root factor of infection.**

Cancer in Mill Operators.

The frequency of cancer among Mill operators, especially mule spinners is suggested "as being due to the presence of shale oil and lubricating oil, with which the clothing becomes saturated."

Some authorities have attributed the cause "to the stricture of too tight clothing" but as in the foregoing groups, though oil is suggested

* Ibid.

as the inducing factor, the particular nature of the influence exerted by oil has not been determined, or the nature of the irritation set up.

The new view is that oil is a heat inducing factor and that its particular influence on the skin is to withdraw moisture and exclude oxygen. Petroleum, paraffin and lubricating oils are therefore included in the Heat inducing group.

Chimney Sweeps Cancer.

Of the prevalence of cutaneous cancer among chimney sweeps and others who constantly handle soot, the Report* states "the pre-determining factor in regard to soot was formerly thought to be the retention of particles of soot" . . . "in the interstices of the skin" . . . "it is now regarded as improbable that the soot acts merely as a mechanical irritant." . . . "The specially harmful constituent of soot has not been isolated, but Dr. Leitch (1924) has carried out experiments which suggest that the oily secretion of the sebaceous glands of the scrotum acts as the solvent of the active principle" . . . "incidence of cutaneous cancer is also associated with cotton manufacture" . . . "especially among mule spinners" . . . "an excessive mortality from scrotal cancer is found among manufacturing chemists," . . . "Textile dyers, also, show an excess of cancer in this region" "but it is not certain that this can be regarded as significant. In these cases although the data are not sufficiently detailed to locate the offending irritant, possibly the risk only exists in one industrial process carried out in each group, thus manufacturing chemists include coal tar; chemists exposed to pitch, and textile dyers are in contact with coal tar dyers."

From this it is evident that the principle which lies at the root of "irritation" has not been isolated. Soot is believed to be an irritant, but in what way?

The writer believes that the inflammable nature of soot suggests that it may be regarded as belonging to the Heat-inducing group.

Soot is highly inflammable, thus it dries up the moisture which is the essential condition of healthy tissue, just as oil by excluding oxygen, drives out essential moisture.†

Tobacco—Cancer of the Lip.

A high cancer incidence of the lip is pointed out in several groups—which groups "possess one characteristic in common, and that is prolonged working in the open air." In this group are included agricultural labourers, merchant seamen, dock labourers, railway men, masons, farmers and graziers. The smoking of clay pipes is suggested as the causal factor. "Attention is directed to the possibility of smoking exerting its influence in a similar way to coal tar and soot; they contain distillation products of coal; tobacco smoke contains distillation products of similar form of vegetable matter."‡

* See Report No. 99, Privy Council Medical Research Council.

† The experimental research of Mr. Marshall in regard to the Mosquito, by which he has shown that by spraying water with paraffin, the mosquito is deprived of oxygen, and thus exterminated, is an example of the effect of excluding Oxygen from organic life.

‡ See Report No. 99, Privy Council, Medical Research Council.

Here we see that while smoking is indicated as a causal factor in cancer of the lip, tongue, jaw and oesophagus "the precise nature of "the irritant is not determined, attention is drawn to tobacco smoke as "a product of coal and vegetable matter."

The true cancer inducing factor in this group, as in the metal, textile, oil and soot groups appears to be heat. The heat generated in smoking appears greatest when a clay pipe is used.

In none of the foregoing occupational groups has the true inducing factor—heat, been recognised.

Iron, Lead and Tin Miners and Cancer of the Stomach.

The percentage of excess of cancer of the stomach over what might be expected, is shown in Table VI.* to be among *iron miners, lead miners, tin miners and slate quarriers*. The report says: "What "special environmental feature, if any, in these occupational groups pre- "disposes to excessive incidence of gastric cancer must be left at present as "a subject of conjecture. There is no definite evidence that the methods "of work or habits or diet provide a predisposing cause of the disease."*

The writer's investigations lead to the contrary conclusion, namely, that there is definite evidence that the predisposing cause in these groups is to be found in the high radio-activity shown in iron, lead and tin; the causal factor in slate has yet to be determined.

The constant absorption into the lungs and intestines of atoms of matter highly charged with electricity, is sufficient to explain the prevalence of cancer in these groups. The relation of syphilis and cancer cannot be ignored, but this does not concern the present enquiry into cancer and occupational groups.

The point to be determined is: Does or does not a common root factor exist between the several agents, groups and sites? Do the facts justify the conclusion that a common root factor exists in Heat?

This, however, is not the conclusion arrived at in the Report, which states "so far as is known there does not appear to be any common agency "that predisposes to cancer, that though confirmatory evidence has been "obtained of some views already more or less generally accepted as to the "close association of some types of cancer, with exposure to particular risks" . . . "evidence in support of such a connection between the nature of the "employment and other forms of cancer" . . . "cannot be regarded as more "than suggestive" . . . "occupational risk is only one of several predisposing "causes of cancer which are operative in different instances, or under different "circumstances and supports the view, that the discovery of any one specific "factor is not likely to provide a solution of the origin of the disease."

The writer's conclusions, based on the evidence furnished by the occupational groups and analysis of the nature of the material associated with high cancer incidence is, that grave risk exists in all groups where elements of high radio activity are handled, and that the specific inducing factor has not been isolated. It is Heat. Every agent that generates heat in excess of the body's requirements predisposes to cancer.

* See Report No. 99, Privy Council, Medical Research Council.

Individual resistance and susceptibility to this influence lies primarily in the condition of the blood.

Site is in every case influenced by internal conditions such as strain, or other injury, or by external influences, primarily heat, and the consequent withdrawal of moisture from the tissues.

Throughout the Occupational Groups, conditions which induce heat are without any doubt the cancer-inducing-factor.

Skin Cancer and Open Air Workers.

Salt.

Reference so far has been chiefly concerned with cancer in the indoor occupations. We have now to see how far the conclusions stated above, find support in the *Open-Air Groups*.

"The incidence of skin cancer among out-door occupations is stated to be highest among fishermen, who frequently develop cancer of the face, particularly of the ear." The Report goes on to say that, *"this high incidence may be due to the wearing of sou'-westers often contaminated with tar, and contact with tarry ropes and nets. Exposure to salt water and sun while exerting an influence is unlikely to be the sole factor concerned, since facial cancer occurs also amongst fishmongers and salesmen, who, at the quayside, handle tarry ropes . . . this group, however, does not experience any cancer of the ear."* . . . *"Facial cancer is also found in excess among bargemen and lightermen, and in less degree, among navigating seamen."**

The fact that the particular groups of seamen who most frequently handle tarry ropes, i.e., fishermen and navigating seamen, show a higher facial cancer incidence than those who do not seem, at first sight, to point to tar as the causal factor. Tar, however, does not sufficiently explain the incidence of cancer of the ear, or facial cancer amongst fishmongers. Tar may be to some extent a factor, but it is a secondary, and not the prime factor. The more important factor and it is one which cannot possibly be excluded when investigating the high incidence of cutaneous cancer in these groups is—Salt.

Not only among fishermen and seamen who are constantly exposed to salt, both in water and in air, but among fish salesmen and those engaged in the salting of fish, a high cancer incidence has been recorded. Again, among those who subsist largely on salted foods, we find a high cancer incidence.

The fact that cancer incidence is marked among fishermen and salt packers and those who subsist largely on salt diet, suggests that, notwithstanding the beneficial and curative properties of salt when employed in moderation, its excessive use constitutes a very real danger. **Salt, when absorbed in excess, interferes with the chemical requirements of the body.**

Why is this? And what is there in Salt that could induce cancer? In what way is it hurtful?

The answers to these questions must be sought in research into the chemical and physical attributes of Salt. Salt, whether sea-salt, rock-salt, table-salt or aperient-salt is obtained from the metal *sodium*.

* See Report No. 99, Privy Council, Medical Research Council.

Common salt, we know, is composed of sodium of chloride, and both sodium and chloride are elements that give rise to the generation of Heat.

‡ The Atomic number of Sodium = 11

Chloride = 17 thus, from the conjunction of the two metals, we deduce that the denominating character of salt is Heat. Moreover, both sodium and chloride are distinguished by pronounced chemical peculiarities, which are calculated when present in excess, to procure violent chemical re-actions. **Salt, therefore, comes into the category of the metallic elements which generate heat and which, unless absorbed in moderation, induce severe chemical re-actions.**

The fact that in fishermen it is the face and ears that are attacked, rather than the hands, points to 'salt' as the primary, though tar may be a secondary, inducing agent. The face and ears are constantly exposed to the brine; the sun and wind rapidly absorb the moisture, and the skin, especially the ears, are at the mercy of the irritating factors.

Dr. Hoffman* has shown that, in districts and countries where salted foods form a large part of the diet, a high cancer incidence prevails. He states, "that in selected areas in the United Kingdom the highest "cancer mortality is found in the Isle of Man, where salt fish forms a large part of the diet."

This same authority has pointed out that the highest cancer rate in Europe is to be found in the cities of Denmark. Dr. Hindehede supplements this with the statement, that the Danes are large consumers of *salt fish* and that "in Denmark, cancer is the cause of death approximately of every fifth person who dies after the age of forty-five." †

Another writer has remarked that "cancer is rare among North American Indians, Eskimos, and other primitive races who are not salt eaters, and that cancer is on the increase among races who have adopted salt among other Western habits." ‡

From these and other recorded observations, it is inferred that excessive consumption of salt is a predisposing cause of cancer and this inference is supported by analysis of the constituents of salt. Many other predisposing causes could be cited, in which the determining factor is plainly located in the generation of heat in excess of the chemical requirements of the body.

From the various statistics, it will be seen that the inducing factors may be absorbed through the mouth, by the skin, or by the lungs. The fumes of alcohol, of arsenical dyes, of ethyl petrol and other spirits, convey the same danger as agents absorbed by the mouth. The excessive consumption of alcohol predisposes to and is intimately related as a causal factor to the frequent mortality from cancer of the oesophagus among barmen, cellarmen and others engaged in the liquor trade, but, it is remarked, *that this same cancer incidence is shown in other trades not associated with liquor, particularly among metal workers, among plumbers, brass and bronze workers, scissors and file makers, electrical apparatus makers and others.* † **From this, we must infer that the predisposing**

* Dr. Hoffman—Mortality from Cancer, 1915.

† Dr. Hindehede—Cancer and Diet, 1915.

‡ F. T. Marwood—What is the root cause of Cancer.

† See Report No. 99, Privy Council, Medical Research Council.

cause, Heat, reaches the living laboratory by many channels, and that these influences, whether they enter by the skin, mouth, nostrils or lungs, are equally potent in deteriorating the blood and clogging or inflaming its action.

Statistics Confirmed by Analysis.

The result of investigation confirms the belief that every element whose electric charge exceeds that of the elements which form the basis of organic life, constitutes a menace to the normal chemical activities of the body and while statistics alone cannot be regarded as affording conclusive evidence, we find that these carefully compiled Tables, showing cancer incidence in various Occupational Groups, receives direct and definite confirmation on analysis of the elements in question. When, further, the dominant factor in each Occupation is found to be Heat, the conjunction of cause and effect surely forbid any conclusion but, that in Heat and its attendant Energy we find the true cancer-inducing-factor.

Spasmodic observation and speculative opinions cannot solve the problem, but when to carefully authenticated figures, we can bring scientifically attested facts which explain the fundamental connection between cause and effect, our belief rests on a logical basis.

The knowledge of a "*New Property in Matter*," the discovery of the radio-active forces locked up in the several atoms, provides not only the interpretation of many biological and physiological processes, which have hitherto defied research and baffled analysis, **but they show us the intimate relation which subsists between organic and inorganic matter and above all it provides us with a solution of the complex problem—the origin of Cancer.**

Why Elements that Generate Heat are Dangerous.

Why should Elements that generate excessive heat, predispose to cancer?

Take, for example, the abnormally high cancer incidence and mortality shown in the lead trades; **why does lead predispose to cancer? Can Heat be considered as a reasonable causal factor?** All lead compounds are recognised as strong cumulative poisons. Danger is incurred in using 'lead' in any form internally, the distribution of water through lead pipes and cisterns has been shown to be injurious. What is the particular property in 'lead' that renders it poisonous to living Organisms. Does the danger lie in the chemical or in the physical properties of lead?

Every atom of lead is accompanied by no fewer than 82 electric particles. (The combining weight of lead is 207). **Thus each Atom of lead carries with it a tremendous charge of electricity. A charge, greater than that of all the basic elements, hydrogen, oxygen, carbon, and nitrogen combined.**

Thus, one grain of lead carries a terrific charge of electricity —In other words, it generates abnormal heat and thus creates abnormal chemical conditions.

Does not this fact provide the explanation of the danger set up in the body by the introduction of lead. It creates conditions to which the living laboratory is totally unsuited, and to which it is wholly unable to accommodate itself.

New and bewildering phenomena must inevitably follow the introduction of an element of such potency into the living body.

We have many examples of what happens when even half a grain of arsenic or other such poison finds its way into the system, not alone does it penetrate to the internal organs, but to the skin, the hair, the nails. The blood becomes saturated with poison. The chemical and physical re-actions, induced by the presence of an element such as 'lead,' appear to be less generally recognised.

Lead readily unites with oxygen and other elements and forms an extensive number of compounds, lead acetate, lead phosphates and other compounds which, if they find their way into the blood, cannot fail to set up profound and far-reaching complications. **By the absorption of lead, metallic compounds are formed in the body, which not only possess no nutritive value, but which sooner or later set up abnormal conditions.** Violent and destructive re-actions follow, paralysis of muscles, nerves and brain are recognised as a common feature of lead poisoning.

These conditions are, it is inferred, due not alone to the chemical, but the physical properties of lead. Metals of high radio activity must generate increased heat and the fact that each atom of lead carries a charge of 82 electrons is sufficient to explain the abnormal conditions that follow its introduction to the living body, and when we further reflect that the melting point of lead is 322° - 334° c., it becomes evident that the absorption of this metal must procure a condition of revolution in the living laboratory.

We have to recall the fact that the basis of all life—*protoplasm*, is built up of a few very simple elements whose atoms carry but a moderate charge of electricity, for it to be apparent, that such an element as 'lead' must set up far-reaching complications and that the *normal temperature* which controls the growth of cells and the functions of the blood must suffer acceleration by association with such a potent force.

Thus, the writer conceives, every element of high atomic weight generates 'heat' and heat deprives the body of its essential moisture. In this condition the blood thickens, and finally coagulates. The life-giving stream that should feed and regenerate the cells can no longer circulate through the finer capillaries, paralysis of muscles, arteries and nerves follow. In these simple causal factors, it is believed we find a predisposing cause of cancer, as of *plumbism*.

The whole organic system, built up by simple and very gradual processes, is subjected to violent and radical chemical changes by the introduction of a metal of high atomic weight, conditions to which no present form of life would seem able to accommodate itself.

Statistics and recorded observations, the writer suggests, alike point to the conclusion that (1) the causal factor in all the cancer inducing agents is heat; (2) that 'site' is determined by the part that is exposed to heat, and where there is no direct causal

factor, the 'site' is found to be in such regions of the body where strain or injury make a prolonged demand on the curative processes of the blood.

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The Relation of Temperature to the Life Processes.

Is the importance of heat exaggerated as a causal factor of cancer? To that, it can only be asked, Does the temperature determine health and disease, life and death?

The fact that human life is compatible only between a certain fixed and limited range of temperature, indicates that temperature is the fundamental fact in all life. The fact that life is so conditioned is a commonplace of medical science.

What, for example, do we understand by the fact that in man the normal temperature is 98.4°F., and that in health, despite radical changes in habits, clothing and climate, the temperature fluctuates but little, yet in sickness it rises and falls rapidly, and the difference of but a few degrees and life ceases.

The fact that life ceases if the temperature is not kept within the prescribed limits is surely one of the most remarkable phenomena of organic life. Life cannot continue if the blood is above 107° or below 95°. What does this precisely convey?

The explanation appears to be that the chemical and physical processes are achieved solely within this particular range of temperature, above or below this temperature the chemical processes by which the body is nourished cannot be achieved.

The substances and compounds that constitute life are evolved in the living laboratory by means of a fixed range of temperature, above this temperature or below this temperature, compounds would be formed that would not nourish life. The life-giving substances are evolved, and the functions are regulated by a strict adherence to the prescribed temperature.

The fact that life ceases above 107°F., suggests that above this temperature no compounds are evolved which nourish the blood. **Dare we go further in conjecture and postulate that compounds formed at a higher temperature would be largely metallic? While compounds formed at a lower temperature would lack the vitality necessary for the performance of the physical functions.**

The all important fact of temperature is brought home when we consider the large and varied number of substances and compounds formed in the body by the combination of the simple elements that constitute protoplasm.

It is a logical inference that, as in the chemist's laboratory, the chemical processes of the body are procured by conditions of temperature, and that the temperature is so regulated as to furnish the compounds and peculiar requirements of Orders and Species. Elements, we know, combine only in certain fixed proportions; we know, also, that all life, vegetable and animal, is constituted of the same small group of basic elements, thus we are driven to conclude that in temperature, lies the key to the physical and chemical life processes of the cold blooded and warm blooded Species alike,

Life is Conditioned by Temperature.

The fact that the self-same elements clothe man and beast, bird and flower, provides eloquent testimony to the difference achieved by a Principle, the root of which appears to lie in conditions of temperature.

And while it may be objected that such a view is purely speculative, it is speculation based on conclusions drawn from the ascertained facts of temperature as the dominant factor in all chemical exchange. Thus it is not illogical to assume that, on some Universal Principle involving the control of temperature, the growth of the body and the evolution of Species, Classes and Orders, are procured, **and may we not go further, and ask if the temperature of the body could be indefinitely raised or lowered, would not normal compounds, functions and processes give place to the abnormal? Could the systemised and ordered progress that makes the evolution of species be maintained if conditions of temperature were not confined within certain fixed limits?**

Would not a heterogeneous assemblage of forms and substances result from an uncontrolled temperature?

Could life be sustained; could reproduction of species and fixity of type be procured, by any system but by that of a controlled temperature, limiting chemical combinations and vitality?

Are we not driven to infer that life is conditioned by temperature, and that on the maintenance of temperature within a defined limit lies the key to the Principle that controls healthy normal growth.

Temperature is something more vital than a mere question of heat and cold; it is concerned with the vital and fundamental chemical processes by which the body is systematically built up, the maintenance of normal temperature and the avoidance of association with elements which procure abnormal heat, must be regarded as the vital essential to the growth of cells and tissues.

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Temperature and Blood Constituents.

The difference in the temperature of the blood which marks the cold blooded from the warm blooded Orders affords important evidence as to the effects of temperature on the chemical composition of the blood, since the same elements form the basis of all life, the fundamental differences between the several Orders, appears to be based on a System of temperature.

The difference in the chemical properties of the blood of the Amphibia and of the Mammalia, are it is inferred, due to condition of temperature.

In Mammals, the red corpuscles which yield the two chief proteins; haemoglobin and nuclei proteins form, we are told, 40% to 50% of the total volume of the blood, while in the lower vertebrates the volume is far less; in Frogs, some 25%, and in Fishes even lower. Thus, in the lower forms of life, not only is the number of red corpuscles small, but the amount of the haemoglobin (iron) each corpuscle contains is relatively small.*

* Thomas Gregor Brodie, M.D., F.R.S.

*The concentration of haemoglobin in the corpuscle attains the maximum in the mammal and bird.**

Haemoglobin is, we know, a source of energy, thus, it is concluded that, with a raised temperature, the blood becomes charged with constituents which provide increased vitality. This would seem to explain the greater vitality of the Mammal, as compared with the Amphibia. Not size, but energy appears to determine the survival of the fittest.

As we ascend the scale the oxygen-carrying capacity of the blood increases, e.g., with a higher temperature come more varied and accelerated chemical processes, cells are more rapidly formed, as energy increases the demand on oxygen becomes greater.

The fact that in the lower vertebrae the blood pressure is low and the haemoglobin content is low, while in man the blood pressure is high and the haemoglobin content of the blood is high, the writer infers that temperature is the dominant factor in determining the chemical composition of the blood.†

In certain diseases, notably cancer, the potassium content of the blood‡ has been observed to be higher than in persons in normal health. If the question of temperature is intimately connected with the chemical content of the blood, then any agent or element that tends to accelerate chemical routine, must be regarded as a source of danger.

The writer infers that **all life enjoys a natural immunity from the danger of a too high temperature by the fact that the elements which constitute the basis of life are of low atomic weight and comparatively low combustibility, and that it is due to this fact that man is able to maintain a normal temperature, and can even approach within certain degrees of intense heat without incurring the danger of conflagration. A danger which it may be assumed, would be inevitable were the body composed of metallic elements of high radio activity. We may even venture to postulate that the fact that, in a thunderstorm, in a group of persons, some are more highly susceptible to the effects of lightning than others, who merely suffer shock or are entirely immune, while another is killed outright, is due to a difference in the vitality of the person concerned and not entirely to the fact that they may be carrying metal on their person.**

* * * * *

To sum up, Cancer and Plumbism alike appear to be closely connected with chemical changes and temperature of the blood. To safeguard the body from contact with any element or agent that exerts a disturbing influence on temperature, would thus seem a first principle of organic life. Contact with, or absorption of any element of high radio activity, the writer suggests, presents an acute danger. Not alone because an

* Thomas Gregor Brodie, M.D., F.R.S.

† Similarly the variations in number and shape of the blood corpuscles in the several orders may, it is suggested, be determined by temperature. The difference in shape in the numbers and the chemical properties of the blood of the amphibia, it is suggested, may be due to conditions of temperature—E.W.H.

‡ Dr. R. Ross—Blood Content,

element is introduced which is chemically unfitted to nourish the body, but because such elements induce abnormal chemical activity.

Recorded observation of the effect of metal poisoning shows that, whether the poison is absorbed slowly, when there is gradual deterioration of the powers, or whether there is sudden contact with a current of high potential procuring instantaneous death, the smallest effect is due to the chemical and physical changes which are induced by elements of high potential.

Thus, whether absorption of an element of powerful radio active properties is gradual, or whether there is sudden contact with such a force the chemical equilibrium of the body is placed in jeopardy.

There is, perhaps, no more striking proof of the terror that cancer has inspired than is shown by the methods which have been adopted to combat the disease. Of all the methods recently adopted, none perhaps is more remarkable than the treatment of cancer by the intravenous injection of lead. This new treatment has achieved some prominence since its introduction (1924) by Dr. Blair Bell and his colleagues. Much has been hoped from this treatment which has been practised in England, America, and other countries and has, it is stated, met with some success.

The discovery of a "*New Property in Matter*" must, however, invite a very serious reconsideration of this experiment.

The writer attempts later to set forth some of the reasons which appear to render the value in cancer therapy of the intravenous injection of lead highly problematical.

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The Present State of our Knowledge.

Experimental Research.

From experiments in elements of high radio activity, we must now turn to consideration of the value of the experimental researches which have been carried out on laboratory animals in the various research centres during the past five and twenty years. For this purpose it is proposed to quote from the Reports issued by the various Councils and Societies, as giving an unbiassed account as to what has been accomplished. For this purpose, I will again refer to the Article issued under the auspices of the Imperial Cancer Research Fund, of which the Director says, "presents a clear statement of '*the present state of our Knowledge.*'"

It appears a matter of common agreement that none of the Experimental Researches which have been carried out in the past twenty-five years have led to "conclusive results" or "to definite agreement," as to their influences.

Further experiments are in progress, *which it is hoped, may throw light on these divergent and apparently contradictory results.* The Director of the Imperial Cancer Research Fund says, "in my own experience "all attempts to induce cancer by tar-painting in mice, have failed "completely"; the same authority places it on record "that the "experiments have not thrown any light on the origin of the disease."

It is pointed out that "Cancer cuts clean across our general conception of disease." Generally speaking, there are two groups of disease, "those directly due to germs, such as tuberculosis, measles and

" typhoid, and those due to change or damage in a definite Organ . . . they rise *de novo* in each individual—they cannot be transmitted, they are not contagious."*

Now Cancer falls into neither of these two groups, and further, if cancer cells from an individual A are introduced into a healthy animal B, these cells continue to grow " out of their own resources." They remain the individual cells A grouped in B ; they do not infect the cells in the individual B and " transform them into Cancer Cells." " When they are removed by operation, after they have grown in B sufficiently long to produce a large tumour, the animal B remains perfectly healthy and does not have a recurrence of the disease." " Experimental transmission does not throw light on the origin of the disease."

" Something happens at a certain moment that turns a normal cell of the skin into a cancer cell. What is this " something."

There have always been two Schools of thought, the first school held that cancer was the result of an extrinsic Agent, a germ, which produces cancer as its specific disease, as the diphtheria bacillus causes diphtheria, or the bacillus of tuberculosis causes consumption ; the experimental evidence which has accumulated makes it clear that such a view is untenable.

The second School of thought looked to an intrinsic factor for explanation. As stated, the cells of the body are individual living units, but their activities " are controlled in such a way by inhibitions and stimulations that the activity of the individual cells appears directed " towards the well-being of the organism as a whole."

" How this is brought about in the normal organism is as yet an involved problem of physiology, but its solution must be found in " the internal mechanism of the cell."

" Since a cancer cell has freed itself from these controlling inhibitions and stimulations, the only alternative explanation which seemed to offer itself was that Cancer was due to some change in the internal mechanism of the cell."

The most careful search for any alteration in the finer structure of the cancer cell has, however, failed to show any consistent alteration.

The only evidence in support of such a view has been brought by the recent work of Professor Warburg of Berlin, who has shown that *the cancer cell can live in the absence of oxygen.*

" . . . This explains why cancer cells can live under the very unfavourable conditions, such as insufficient blood supply under which they are often found." But it does not, as yet, satisfactorily explain " why they grow."

†Dr. Cramer goes on to refer to the theory of Dr. Gye, who holds, " that in the causation of Cancer there is concerned an extremely minute germ. His conception is based on experimental evidence, which has " been subjected to critical examination by a great many workers." Some have confirmed part of his observations, others have obtained negative results. The subject is, therefore, *subjudice*. But Gye's conception has the great merit that it is the first theory of the disease which explains

* Dr. William Cramer, M.R.C.S., L.R.C.P. II. Article on Cancer Research. May No. Nineteenth Century (Vol. 72) continued from April Number.

† Dr. William Cramer, M.R.C.S., L.R.C.P. *ibid.*

all the essential features of cancer and which corrolates a number of observations which have hitherto seemed contradictory. All previous theories of Cancer have failed in that respect and it is significant that of all criticisms to which Gye's work has been subjected, not one has indicated where the explanation is theoretically inadequate.

"The study of the factors determining resistance and susceptibility opens up another line of attack—the extraordinary effect of X-rays and Radium on living cells, both normal and cancerous, is as yet ill understood, a study of their action is likely to extend the usefulness of these powerful agents in Cancer."

It may be objected that this paper, presenting "the Present State of our Knowledge," was published some two years since, but nothing that has since been issued by the Research Societies would appear to negative this opinion.

Reference to the Papers published within the last two years by the Imperial Cancer Research Fund shows how largely Research is pre-occupied with cellular pathology.

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*List of Publications under the Auspices of the
Imperial Cancer Research Fund. 1927—1928.*

- "Staining and Structure." J. A. Murray.
 "Fever, Heat Regulation, Climate, and the Thyroid Adrenal Apparatus" W. Cramer.
 "Ergebnisse und Ziele der Krebsforschung." W. Cramer.
 "Recent Work on Cancer," W. Cramer.
 "Effects of Alteration of Oxygen Pressure in the Inspired Air upon Cancer Growth and Body-Weight of Rats and Mice," W. Cramer and J. A. Campbell.
 "The Metabolism of the Trophoblast," W. Cramer.
 "Pellagra-Like Lesions associated with Deficiency of Vitamin B in the Rat," G. Marshall Findlay.
 "A Note on the Cultivation of the Virus of Fowl-Pox," G. M. Findlay.
 "Immunological and Serological Studies on the Viruses of Fowl-Pox and Vaccinia." G. Marshall Findlay.
 "Histamine and Infection." G. Marshall Findlay.
 "The Carbo-hydrate Metabolism of Certain Pathological Overgrowths." H. G. Crabtree.
 "The Vital Staining of Normal and Malignant Cells: I. Vital Staining with Trypan Blue, and the Cytoplasmic Inclusions of Liver and Kidney Cells." R. J. Ludford.
 "Studies in the Microchemistry of the Cell: I. The Chromatin Content of Normal and Malignant Cells, as demonstrated by Feulgen's Nuclealreaktion." R. J. Ludford.
 "Cytological Studies on the Viruses of Fowl Pox and Vaccinia." R. J. Ludford.
 1926—1927.
 "Nuclear Degenerations following Multipolar Mitotic Cell Division." J. A. Murray.
 "Multiple New Growths." J. A. Murray.

- "The Action of Tumour Extracts on Tissues in Vitro." A. H. Drew.
 "A Transplantable Fibro-Sarcoma of the Fowl." A. M. Begg.
 "A Filtrable Endothelioma of the Fowl." A. M. Begg.
 "Mitochondria and Cell Injury." G. M. Findlay.
 "The Golgi Apparatus in the Cells of Tissue Cultures." R. J. Ludford.
 "Secretion and the Golgi Apparatus in Cells of the Islets of Langerhans."
 R. J. Ludford and W. Cramer.
 "On the Cellular Mechanism of Bile Secretion and its Relation to the
 Golgi Apparatus of the Liver Cell." W. Cramer & R. J. Ludford.
 "The Requirements of the Population in Milk Fat and of the Available
 Supply." W. Cramer.
 "The Investigation of Cancer." W. Cramer.

The fact that Authorities are not able to report that Experimental Research has been successful in discovering the origin of cancer, is the more disappointing when we consider that since the year 1900 special laboratories have been established for the study of cancer, which have been developed by the Imperial Cancer Research Fund, with an endowment of £120,000. Meanwhile, similar Institutions of which the British Empire Cancer Campaign is chief, have been established in other parts of the country and abroad, notably in Berlin, Frankfort, Heidelberg, in France, Sweden, United States and Japan. New workers are continually coming into the field, and a review of the various Reports shows that a vast amount of Research has been carried out at every centre.

In perusing these Reports, we cannot fail to be struck by the fact that the work appears to have been confined to one line of research—the *local manifestation* of cancer in abnormal cellular growth. The Papers published by the Imperial Cancer Research Fund deal almost exclusively with the *local* aspect of the problem as the title indicates.

The experimental transmission of cancer by grafts has been very extensively practised, but neither (1) grafts, (2) inoculation by filterable virus, (3) infection, (4) tar-painting, have up to the present, thrown any light on the origin of cancer.

We have the authoritative statement that "the experiments on laboratory animals have not thrown any light on the origin of the disease," . . . "that they have not led to conclusive results," or "to any definite agreement as to their usefulness." "Further experiments are in progress, it is hoped they may throw light on these apparently contradictory results."

"Attempts on the curative side have not been successful and the original cure for cancer remains in operation in the earlier stage of the disease."

Thus, so far as the cure of cancer goes we remain, on the authority of the Research Councils, in the position occupied by the Greeks more than 2,000 years ago.

A consideration of the foregoing facts suggests that cancer is a disease which we may suspect has followed in the wake of every great civilization, as the result of artificial conditions which have deprived the individual of the natural powers of resistance and which preserves immunity in uncivilized races, wild animals and young children. Cancer is due to an individual condition of the blood and it is for this reason that it is not infectious or of necessity hereditary.

The Investigations of Professor Fibiger.

The investigation of the late Professor Fibiger of Copenhagen has been described as "the greatest contribution to experimental science in this generation." His discoveries of the cockroach worm is well known; how, by feeding cockroaches on the larvae of the worm and then feeding rats with the bodies of the infected cockroaches, he succeeded in inducing cancer in the stomach of rats. Dr. Cramer quotes an American writer, who refers to the discoveries as due to "the astuteness of observation, "the prepared mind, the fertility and method of attack and patience of "Dr. Fibiger." It may, perhaps, be questioned whether "the prepared mind" is a trustworthy guide in regard to research, although the patient investigations of Dr. Fibiger cannot fail to excite respect and indeed it won for him the honour of the Nobel Prize.

Let us for a moment consider the conditions under which these experiments were made.

Dr. Fibiger succeeded in inducing cancer in laboratory rats by feeding them on cockroaches infested with the nematode worm. In regard to these experiments, three observations occur: (1) no animal except the rat was susceptible to the cancer-producing process of the nematode worm; (2) the rats on whom the experiments were made were animals living on a special and unnatural diet; (3) that wild rats seem to be immune and in this connection it will be remembered that Dr. Fibiger "killed and examined over 1,000 rats, but failed to find either a cancer or a nematode, and finally, when the flicker of hope had almost expired, "he heard of a large sugar factory, where both rats and cockroaches "swarmed; an examination of the rats in the sugar refinery revealed "many cases of stomach tumour, and in them the long-sought-for "nematode was found . . . "by feeding laboratory animals on artificially infested cockroaches, he induced gastric cancer in over 50 per cent."

We infer that all laboratory animals are animals living under conditions foreign to their constitutional needs, thus there will be inevitably a deficiency in some element or condition of wild life that makes laboratory and domestic animals susceptible, where wild animals are immune, and it cannot be doubted that some of the experimental transmissions on laboratory animals owe their success in a very high degree to artificial conditions and the consequent deficiency in some elements necessary to their constitutional needs.

In the case of the rats which form the subject of Dr. Fibiger's experiments, we see that they were all animals whose diet consisted of sugar; they were, thus, already in a condition which predisposed them to disease.

Where generations of animals such as mice and rats have been bred in captivity for laboratory purposes, it is believed a primary condition for cancer has already been set up. The conditions of captivity in animals, like the condition of civilization in human beings, would appear alike to induce susceptibility to disease. The wild animal and primitive man alike, obtains a continuous supply of oxygen, not only from the air and his food, but from a free and abundant supply of unpolluted water.

The discovery of Dr. Warburg of Berlin, that cancer cells can live without oxygen is of great importance.

A further reason suggests itself for the failure of laboratory experiments in transmission. It may arise from inherent differences in the constitution of the two individuals, the one is healthy, the other is unhealthy; the very conditions that have induced cancer in the one are wanting in the other—thus the conditions afford no common ground for comparison. If cancer were a *local* disease and not a *constitutional* one, the writer concludes that laboratory experiments might afford conclusive evidence.

A deeper reason why experiments on laboratory animals have proved so inconclusive may lie in some obscure and fundamental difference in the rate of "energy" that procures chemical exchange in living organisms.

Up to the present, we have not known the system or "energy" that controls chemical exchange in living bodies; in this "energy" must lie the crux of the problem of evolution, for while the system that procures chemical exchange must be universal, the precise Law that differentiates the activity between the several Orders and Species has not been revealed.

The widely different results achieved by evolution, as manifested in Orders, Species, Families and Individuals, leads us to assume that, though all share a common origin in protoplasm, there is some system or rate of exchange which, though fixed, varies in different Orders and which the writer conceives, provides the difference of Species.

The fact that all Orders and Species, while proceeding from the same primary elements, evolve in so many directions suggests that the stimuli in several Orders, while obeying the same law, are operating at a different ratio, and thus experiments made on Orders so widely separated from man as the mouse, the cat, the dog and sea-urchin, form no basis for exact conclusion, and it must remain a question how far the analogy between man and the lower animals can be made to serve as a basis for experimental research.

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Failure of Research.

It is agreed that research has failed to establish an answer to any of the most pressing problems of cancer.

(1) *Individual Response.* It is shown that individuals do not respond to causal factors with equal readiness, but the reason for this remains unknown. Children are commonly immune. It is considered a disease of middle age, though the tendency to cancer appears to be on the increase among younger persons.

Cancer incidence is higher among civilized than uncivilized nations—no reason for this is suggested.

(2) *Immunity.* Some persons, it is observed, remain immune—the reason for this is not determined.

(3) *Infection.* Cancer, it is believed to be non-infectious, but the reason for this is unknown.

(4) *Inherited.* It is believed that cancer is not transmitted—here again no reason is offered.

(5) *Cancer Houses and Localities.* There is a divergence of opinion upon this point. No evidence appears to have been collected which would settle this point.

(6) *Cancer Site.* It is stated that the most frequent site in both sexes are the digestive tracts, and in women, the uterus and breast. No suggestion is made as to the cause. In men the tongue, mouth and larynx are frequent sites and here it has been recorded that the response to radium treatment has been more successful than in any other part of the body. No suggestion has been offered as to the reason of this.

(7) *Dietetic and Medicinal Treatment.* We are told that none has been supported so far by evidence that can be regarded as sufficient to warrant its serious consideration, and such has now been commonly discontinued.

(8) *Cancer-Inducing Agents.* A large number of agents are believed to induce cancer, but no connection has been shown to exist between them, or any root factor which might form the basis of research; it is definitely stated that these agents have nothing obvious in common.

(9) *Radium and X-ray.* The general opinion has been in favour of this treatment which is now indeed the only one adopted in regard to cancer, at the same time we cannot fail to observe that authorities differ widely in their opinion as to its value in cancer treatment. Some state, "the results vary in a capricious and inexplicable manner. In some cases there is marked benefit and in others the disease is markedly "aggravated." Until more is known of cancer and X-ray, their use must be considered not only experimental, but risky. Notwithstanding these opinions, radium has become universally adopted in the treatment of cancer. The extraordinary effects of X-ray and radium on living cells, normal and cancerous, is ill understood; a study of "their action is likely to extend the usefulness of those powerful agents of cancer."

While the line of *local* research at present adopted has admittedly failed to answer these questions, it is believed that **the new line of investigation gives an answer which is both sound and logical.**

(1) **Individual Response.** The reason individuals do not respond to causal factors with equal readiness is solely dependent on the individual state of the blood. Children are commonly immune on account of a greater purity of the blood. The tendency to cancer in middle age is due to a lack of essential elements in the blood. The increase of cancer amongst younger persons appears to be attributable to the fact that increasing civilization has deprived them of the essentials of immunity, i.e., blood purity.

Cancer Incidence. The absence of cancer incidence among uncivilized races is due to the greater purity of the blood and an open air life.

(2) **Immunity** is entirely dependent on the individual condition of the blood.

(3) **Infection.** Cancer is non-infectious, since it is purely a question of the individual condition of the blood.

(4) **Inherited.** There seems no reason to believe that cancer need be considered hereditary, though certain tendencies might possibly be transmitted. On the whole such transmission does not appear to be by any means inevitable.

(5) **Cancer Houses and Localities.** There appears to be a

considerable amount of evidence in regard to the existence of cancer houses and localities, these appear to be definitely associated with (1) a deficiency of pure water supply, or with the presence of polluted wells; (2) they may be found to receive contamination from certain Industries.

(6) **Cancer Sites.** The fact that, in women, the uterus and breast are the most frequent sites, and the digestive tracts in both sexes, seems to point to a *constitutional* cause arising in those parts where chemical combinations are most active, coupled with a deficiency of oxygen.

(7) **Dietetic and Medicinal Treatment.** The fact that no dietetic or Medicinal treatment is now adopted in cancer cannot fail to be a matter of surprise. It seems almost incredible that no treatment of this nature can effect improvement, especially when we consider the almost inexhaustible character of the Vegetable Pharmacopoeia. In a list of vegetable compounds, compiled by an ancient writer, there are no fewer than seven hundred vegetable prescriptions. There can be no doubt as to the value of these for the purpose of purifying the blood. In the eighteenth century the treatment for cancer was largely dietetic, and included blood-letting; there is no doubt that, by these means, a greater purity of the blood was achieved. The blood-letting so universal in that day it is believed, must have had a distinct influence on a cancerous body, and from the valuable results recently recorded of blood transfusion in the case of boils, it is believed that this might be beneficial.

(8) **Cancer-Inducing-Agents.** The fact that the new line of investigation has established, without any doubt, the existence of a common root factor, uniting all the cancer-inducing-agents, must be regarded as a factor of fundamental importance.

It has shewn that the inducing factor is, in each case, Heat, which absorbs the essential moisture on which the chemical routine of the body and the purity of the blood are dependent. Bio-chemical investigation supports the view in no uncertain manner, that chemical disorder is greatly increased when brought into contact with all physical agents of high potential, more especially radium and X-ray. That there exists a strong fundamental basis of agreement between the different causal factors is established by the great discovery which has marked the century of a "*new and vital Property in Matter.*"

(9) **Radium and X-ray.** The fact that radium has become the universal, indeed the only treatment adopted now in cancer, can only be regarded with astonishment. The loss of many valuable lives among X-ray surgeons and operators as the result of handling these powerful electric forces must be regarded as an alarming proof of their fatally vital influence. The extreme precautions which are adopted in Hospitals and Clinics when handling radium, or during its transit from one part of the building to another, witnesses to the dangerous consequences that are recognised may follow contact with the agents even when enclosed within a lead and oaken case. Yet the official Reports on the use of radium in cancer treatment issued by the several Research Councils show that radium is now universally adopted in cancer treatment.

Can it be said that the extraordinary effects of X-ray and radium on living cells is yet understood, and would not a more extended study of their action be likely to increase their usefulness?

Can it be said that research in this direction has been carried on as might have been expected, in the light of the illuminating knowledge of a "*new Property in Matter*" as disclosed by the great discoveries of Sir E. Rutherford and others.

PART II.

The New Line of Research.

A Brief Consideration of the Elements Essential to the Purity of the Blood.

Oxygen.

Oxygen. (Non-metallic, At. No. 8 ; At. Wt.=16). The requirements of the body for oxygen are, in fact, practically limitless, this is in general, insufficiently realized. Oxygen is at once the Universal Provider, and the Prime Minister of the entire body. In every function, in every metabolic change, it is oxygen that exercises a paramount influence.

The indispensability of the basic elements in all organic growth is perhaps more commonly recognised in Plant Life than in any other. The gardener freely recognises the fundamental need of his plants, for the very elements in which he stints himself. He is careful, from time to time, to nourish, invigorate and fertilize his plants, by feeding with the essential phosphates, sulphates and nitrates ; his practised eye pronounces growth poor, plants infertile and disease rife, because of an insufficiency of some one of these stimulating foods, above all Water, Air, Heat, often regarded as mere adjuncts to human life, to be taken or left at will, are recognised as vital and indispensable conditions of all plant life.

To man, these primary Elements are equally indispensable, though his greater powers of resistance enable him to longer sustain life with a deficiency than is the case with vegetation. Man requires a continued supply of oxygen, hydrogen, nitrogen, carbon, phosphorus and sulphur. In plant life, we recognise each as having a specific action on growth and fertility, because we remember they are the basis of plant life, but, they are equally the basis of animal life and man's greater demands on the energies of the brain and body means he requires, beyond all other forms of life, a continuous renewal of these Elements. Yet among all Orders and Species to-day, none suffer such a perpetual privation of the essential Elements as does Man. Elaborate and ingenious precautions are taken to avoid disease and infection, but with too little reference to the provision of the constituents which form the fundamental necessities of life. (1) Pure Water ; (2) Fresh Air ; (3) Moderate Heat.

Temperature.

It is in regard to this last condition that a new and critical problem presents itself. Civilized man is required to accommodate himself to frequent, sudden and even violent changes of temperature, to conditions which it would seem violate the first Laws of health, e.g., *the balance of chemical exchange*

Extreme heat entails general deficiency in oxygen and hydrogen, conditions incompatible with that stability which chemical exchange demands.

In respiration, circulation, assimilation, distribution, secretion, excretion, locomotion and in reproduction, oxygen plays the chief part.

Oxygen restores life to the blood and lymphatics and in short, *normal cellular production* is primarily dependent on the supply of oxygen to the cells and tissues.

Oxygen is at once the essential element in all chemical exchange, and in all the body's functions, and is further an indispensable element in combining to furnish the body with its primary requirements—Water, Heat and Air.

The recognition of the overwhelming need of the body for a sufficient supply of oxygen is emphasised by the important investigations recently recorded by Dr. Otto Warburg of Berlin, whose discovery *that Cancer cells form an exception to the general rule, e.g., that "Cancer cells can live in the absence of oxygen."*

This discovery affords strong confirmation of the conception, here advanced, e.g., **that Cancer is a disease largely caused by oxygen deficiency. A deficiency which has vital re-actions on chemical exchange, on the blood content and thus on cellular activity.**

* * * * *

Carbon, Phosphorus, Sulphur, and Nitrogen.

The more deeply we enquire into the proportions of the basic elements, the more must we be convinced of the danger entailed on the body, by a deficiency in anyone of their number. Not alone hydrogen and oxygen, but carbon, phosphorus, sulphur and nitrogen play each an indispensable part in the processes of the living laboratory.

Carbon: (At. No. 6; At. Wt.=12) not only provides fuel, but without it the body is deprived of its essential compounds. It combines, we know, with hydrogen and oxygen to form sugars, starches and fats, and those celluloses that build up membranes and tissues. We have, indeed, but to turn to the great groups of the carbon compounds, to assure ourselves of its fundamental value and not less important than the albumins and proteids are the phosphates, sulphates and nitrate groups.

Phosphorus: (non-metallic, At. No. 15; At. Wt.=31) is an essential constituent of the brain and nerve cells, a builder of bone and tissue, and a nourisher of the blood.

Sulphur: (non-metallic, At. No. 16; At. Wt.=32) is a vitalizing and stimulating agent. From its medicinal properties, it would seem to be a purifier of the blood stream of no ordinary value, both phosphorus and sulphur conduce to the essential Heat of the body.

Nitrogen: (non-metallic, At. No. 7; At. Wt.=14), an inert gas, incapable of supporting combustion or respiration, it combines with hydrogen to form ammonia and other compounds. The fact that, in combination with carbon, hydrogen and oxygen, nitrogen forms a high explosive, may suggest that it provides high combustion in the body. Medically, Nitrogen is used as an anaesthetic, sometimes producing a condition of hysteria, whence it is known as "laughing gas." Nitro-glycerine is valuable as a preventive in cases of cardiac pain, it is also used to reduce arterial tension. From this it may be, perhaps, inferred that *Nitrogen is an element* which serves to stimulate and, at the same time, regulate the potential energy of living Organisms, a deduction which appears to find confirmation in the value to plant life of the Nitrogen compounds.

Indeed, we have only to search into the activities of these six basic elements to recognise that each plays a vital part in the building up of the body and in maintaining the essential conditions of chemical exchange—Moisture, Heat and Air.

As we follow the endless activities in the body of these elements it becomes increasingly evident that many forms of disease that have overtaken civilized man are attributable to the fact that the body is stinted of these elements which are the vital need of all living Organisms.

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Chemical and Physical Properties of Elements.

So far, we have considered briefly the characteristic properties of the Basic Elements and their influence on the growth and processes of the body. We have seen why they are indispensable and universal. We see that they are the essential foundation and energisers of the blood, the bones, the cells, the tissues, the glands, and that the various metamorphes that take place in the substances and compounds of the body and its adaptations are achieved by chemical processes. We have also noted that these elements provide the body, not alone with essential substance, but with the essential of chemical exchange.

Each one of the basic elements takes a prominent and essential part in building up, maintaining and regulating the body which has been termed "*a city of cells*," but which appears rather a City of miniature Industry, furnished with all the needful apparatus of laboratories, incinerators and store houses.

Thus, the six simple elements are regarded as the essential basis of life, each acting "for the good of the whole."

* * * * *

The Secondary Group.

Turning to a secondary group of Elements present in the body, usually in minute quantities, we ask, how far do these elements minister to the good of the body?

Are they components of essential substances and compounds and, further, in what measure do they contribute to the primary essentials of chemical exchange—Water, Heat and Air?

The first point in reference to this secondary Group to arrest attention is the high Atomic weight of these Elements. The next, that the greater number of these Elements are metallic.

Thus, at the start, we have indication, that the secondary group presents fundamental difference, both chemical and physical, from the basic elements, and that consequently, their presence in excess, is calculated to interfere with the equilibrium of the body as a whole.

This hypothesis is confirmed by the fact that these elements generate much Heat, thus absorbing essential moisture, this must interfere with the critical temperature of the body.

It will not be necessary to do more than very briefly refer to some of the more characteristic features of the elements of the secondary group, such as Sodium, Potassium, Chlorine, Calcium, Silicon, Magnesium, Iron, Copper, Zinc, and Tin ; as they appear to affect the living body, to realize that these elements in excess are as injurious to the body as is a deficiency in the basic elements. Since their place, if any, in body-building is unknown to the writer, their effects are here judged by their Medicinal and Therapeutic uses.

(1) *Sodium* : (metallic : At. No. 11 ; At. Wt. 22) combines with chloride to form salts, which are recognised as valuable constituents of the blood, but harmful when present in excess. Sodium, if it comes in contact with water, at once combines with oxygen and sets free, hydrogen.

Sodium combines to form certain metals, such as magnesium and potassium. The value of salt in the body in small quantities is recognised ; its introduction in any large quantity appears to set up certain chemical complexities, due to its peculiarities. This applies also to chloride and potassium.

The presence of these elements in the body in any considerable quantity may possibly be a predisposing cause of cancer.

(2) *Chlorine* : (non-metallic, At. No. 17 ; At. Wt. 35), the pharmacological and therapeutic value of chlorine is recognised in certain cases, in excess it paralyses and depresses the heart and reduces the body temperature ; combined with Sodium Chlorine [Chloride] forms common salt.

(3) *Potassium* : (metallic, At. No. 19 ; At. Wt. 40) the salts of potassium are largely used and valued in medicine. In excess, potassium has a depressing effect on the heart and nervous system, especially on the brain and spinal chord.

(4) *Calcium* : (metallic, At. No. 20 ; At. Wt. 40), a constituent of bone, does not occur in nature in the free state, but in combination it is widely diffused. It is present in most natural waters, conferring "temporary hardness," excess of calcium in the body is believed to be a cause of acute disorder.

(5) *Silicon* : (non-metallic, At. No. 14 ; At. Wt. 28), this element seems to be somewhat widely distributed in the body in minute quantities, excess of this element is believed to be a contributive cause of diseases of the rheumatoid and pulmonary groups and of the digestive organs.

(6) *Magnesium*. (metallic, At. No. 12 ; At. Wt. 24). In medicine the salts of magnesium are recognised as useful purgatives. They are not absorbed into the blood in any appreciable amount and "therefore

exert little action on the functions." The result of injecting magnesium salts into a vein is rapid poison. The presence of this metal in excess is a cause of acute disorder.

(7) *Iron* : (metallic, At. No. 26 ; At. Wt. 56), in small quantities is recognised as a valuable stimulant of the blood and tissues, in excess is a cause of disorder.

(8) *Copper* : (metallic, At. No. 29 ; At. Wt. 63). Traces of copper have been discovered in the liver, kidneys and the blood of man "*as an entirely adventitious constituent, however.*" Copper combines with other elements to form several compounds "*all copper compounds are poisonous.*" In medicine, sulphate of copper, sometimes employed in small doses ; in large doses it is an irritant, its action causes serious damage to the mucous membrane.

(9) *Zinc* : (metallic, At. No. 30 ; At. Wt. 65), combines with other elements to form several salts, some of which are used in medicine for external application ; *Zinc Chloride*, when taken internally, is a corrosive irritant ; *Zinc sulphate* is used as an emetic in case of poison. The presence of zinc in the body seems to produce effects similar to those of lead-poisoning ; its place in the body is not easy to determine.

(10) *Tin* : (metallic, At. No. 50 ; At. Wt. 118). The place of tin in the body is like zinc, difficult to determine ; it appears to be an active irritant. *Tin poisoning* sometimes occurs when food is eaten, preserved in tin vessels. The soluble salts of Tin often used by dyers, calico printers and tin workers, act as an irritant poison ; similar to the effects induced by lead, and other metals on workers in the metal industries.

From a preliminary enquiry into chemical activities of the group of secondary Elements, it appears that, with the exception of 'iron' in small quantities, the metallic elements in excess constitute a source of danger to the body, its processes and functions.

This group of metallic elements, all of a high Atomic energy, seems indeed to form no part in the General Plan of the body, which appears to be constructed of and regulated by the "Basic elements," all of which are of comparatively low Atomic energy.

Not only do these secondary elements appear to form no part in the "General Plan," but they appear for the most part to form no part of the basic life substance or to yield any nutriment, rather do they appear to be the waste products of the body or elements evolved by powerful chemical and physical forces, acting within or without the body.

The large amount of common salt (chloride of sodium), potassium, calcium and magnesium present in *Urea* would appear to be indicative that these elements are largely waste products and that their presence in excess is the forerunner of persistent and finally fatal disease. Such elements as Tin, Zinc and Copper may conceivably be reductions or attenuations of primary elements evolved by chemical and physical conditions within the body by rapid increase of Heat, and by the consequent abstraction of Moisture and Air.*

* The question as to whether these particular elements are reductions of primary Elements or stages in the development of Elements is, of course, outside the scope of this Paper, but that Science of the future will make startling discoveries in this direction which will greatly enlarge our understanding of organic bodies is suggested by the relation of Elements as shown by their atomic Numbers and Atomic weights

A third and common cause of excess of foreign elements in the body must, without doubt, be ascribed to prolonged contact with external physical and chemical Agents, which influence chemical exchange and are absorbed by the mouth, lungs or skin.

That many of these foreign elements of high atomic weight are highly injurious to living organisms there seems little room to doubt, or that the morbid growth called Cancer is directly due to deficiency of essential elements and to the presence of foreign elements which not only introduce harmful products which interfere with chemical exchange, but which, by their high Atomic number or "energy," induce in the body vital stimulations, which are finally manifest in abnormal and uncontrolled cell production.

Thus, investigation of the causes of Cancer is directed, not only to the Chemical characteristics of the basic elements that are present in the body, and which contribute to the structure, the substance, the compounds and the nutriment of the body, but equally, enquiry must be focussed on physical peculiarities of elements, the stimulations they procure, in short, to all that contributes to energy in the body.

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The Body Substances and non-essential Products.

From the foregoing, it is deduced that the basic elements form not only the essential substances, compounds and nutriment of the body, but that they also provide the requisite amount of heat, demanded for the chemical solubility, expansion and fusion of the body elements, which are of comparatively low atomic weight.

Thus it is inferred that, in addition to their chemical and physical values, the generally low atomic weight of the basic elements achieves the purpose of controlling the temperature and thus keeping chemical exchange within certain defined limits—in other words, the simple elements not only procure the critical temperature of the body, but control it within certain defined and stabilized limits. From this, the writer argues, that the essential value of the six basic Elements is not confined to the body building and functions, but that they furnish the stabilizing factors of chemical exchange.

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and by the relative solubility, expansion and melting points of certain groups of Elements. That there is a progressive System in the development of Elements as there is of organic Matter throughout the whole realm of nature seems to find confirmation in more than one direction, the transformation of vegetable growth to mineral deposit as evidenced in Coal is but one instance of many of the evolution of Elements, it would seem indeed impossible to disassociate evolution from every form of Matter, organic and inorganic.

The relation of such Elements as Gold (At. No. 79) and Lead (At. No. 82), Silver, (At. No. 47) and Tin (At. No. 50), Platinum (At. No. 78) and Mercury (At. No. 80), Radium (At. No. 88) and Uranium (At. No. 92) may suggest that these elements have some close relationship and it is conceivable that they are reductions, developments or evolutions of primary Elements as much as organic life is the outcome of earlier formations. Coal is no isolated example of the evolution of organic Matter, and must we not conceive of it as part of a Universal System?

Evolution of Matter points to the operation of a Universal System operating alike, whether in the making of Men or of Mammals. Metabolic change can be no isolated factor, but a principle part of a Universal and coherent Design, by which is built up "a uniform and enduring pattern."—E.W.H.

If this argument is sound, a factor of vital importance in Cancer research is disclosed, for if, as it indeed appears, Cancer is a disease of the blood, which has its very roots in the stability of the chemical exchange of the body, abnormal cellular growth is due to a condition in which abnormal activity is induced by deficiencies in essential, and excess of non-essential elements, whereby conditions of temperature are induced which accelerate cellular activity.

Thus, it is postulated, that the presence of the basic elements concerns not alone the problem of body building, but also of the causes which induce the stimulations and inhibitions which are the vital factors in all organic life.

A consideration of the properties and activities of the secondary group of elements leads to conclusions as to their value and relative importance in the body, widely different to that of the primary group.

Few of these elements appear to constitute an essential part of the body substance and compounds, while the presence of others constitutes a menace, since chemical compounds of doubtful value are formed which interfere with the essential chemical and physical functions of the body. The high Atomic weight of these elements, the writer deduces, procures variations in and accelerations of temperature which are calculated to seriously interfere with the normal temperature at which chemical exchange is effected in the living body. The blood, invaded by foreign elements, becomes loaded with impurities, and from a deficiency in essential constituents, it no longer possesses the means of disposing of these waste products, and infection is carried to the weakest parts of the body. With an increase of heat there appears to follow acceleration of cell production and with over production, anarchy spreads in a System governed normally by stabilized conditions of chemical exchange.

It is suggested that the crux of the Cancer problem is bound up with the vital principles that govern the chemical exchanges of the body.

Can these be less refined, less exact than those which govern the chemist's laboratory?

Can we for a moment suppose that the refined, elaborate and delicate structures and substances of the body are the result of chance intermingling of gases and solids, or of promiscuous association of chemical compounds?

Clearly, every substance and structure is the result of directed processes of a very precise nature, based on conditions of precision that man, with his imperfect knowledge and rude and makeshift appliances, strives in vain to counterfeit.

* * * * *

The Principle of Chemical Exchange.

What, we ask ourselves, is the principle that in the body, unites a few elements in proportions so exact that the production of structures and compounds of endless variety is eternally assured?

What is the Law which maintains these operations according to some Estimated Plan, whereby not alone the individual body, but Classes, Orders, and Species are evolved in a defined, yet withal progressive order?

Again, we ask ourselves, what must be the effect on a system based on unchanging precision of the introduction of foreign elements of chemical peculiarities and atomic weights, differing fundamentally from those which form the basis of the body?

If in the chemists' laboratory, elements and compounds outside the desired formula are added, or if moisture is abstracted and temperature raised, what is the result? Must not frustration of his operations follow and must not similar frustration attend the chemical exchanges of the living laboratory, if unlooked-for chemical additions and adaptations are continually introduced. Must not chemical conditions and substances procure fundamental changes in the body, its processes and functions?

It may be argued that, although certain elements form no essential basis of protoplasms, the assumption that they are harmful is not proved.

It will, however, be admitted that the essential purpose of the greater number of these elements in the body is not known, and that their high Atomic weight presents a vital contrast to the basic elements. It will be the endeavour of the writer to show, in the following pages, that elements that induce abnormal conditions of heat constitute a danger by inducing fundamental constitutional changes of a vital and far-reaching character. Such a statement may appear, on the face of it, exaggerated and fantastic, but investigation shows it to be founded on attested facts of science.

Within the last few years, Scientific research has made a fundamental advance. Truths of a startling nature have been disclosed and, as a result, we are forced to re-adjust and fundamentally remodel our conception of the body, its vital forces and functions.

To sum up, the New Line of Investigation suggests that to treat the disease of cancer with any hope of success, it is essential to determine the place in the body and the relative importance and value of each element, together with the chemical and physical properties, actions and functions of each. Further, it is necessary to ascertain the manner in which elements which appear to form no essential basis of life, find their way into the body: (1) whether they are formed internally as waste products of the body; (2) whether they are external elements absorbed through the mouth, lungs or skin; (3) whether they are the result of contact over a long period with external or physical forces; (4) or whether foreign elements present in the body represent transitional stages, developments, transformations or reproductions of the basic elements by processes unknown within the body, but which may be formed as the direct result of abnormal conditions of temperature, akin to those processes by which the Alchemists of old reduced Gold to Lead.

Since there occurs in inorganic Matter stages of transition and developments which are in some measure comparable to those which

occur in organic Matter,* transformations which, in both are effected by conditions of Heat, Moisture and Pressure, it is inferred that, between organic and inorganic Matter, there exists a basic affinity which cannot be ignored.

Extremes of Heat, Moisture and Pressure produce startling effects on both organic and inorganic Matter. The combustion of Elements, the transformations effected in the laboratory afford examples of the effect of Heat and Moisture on Matter.

The writer suggests that extremes of temperature produce, in living bodies, changes equally far-reaching and affects with equal force, transitions and developments in organic as in inorganic Matter. The hypotheses of a peculiar affinity between organic and inorganic Matter appears to find confirmation in the relationship displayed by certain groups of elements, more particularly the metallic, between all of which an affinity is apparent.†

The Atomic numbers and Atomic weights, melting and expansion points and conductivity all seem to indicate some fundamental connection some root factor of which each is the logical development.

At present the precise place and value of "foreign elements" in the cosmogony of living organisms cannot be gauged until research has determined the relative distribution, extent and place of such elements in the several Orders, Classes, Species and Individuals, together with particular reference to their preponderance in healthy and unhealthy bodies, in children and in adults, in civilized and in uncivilized races. As a preliminary to such research, brief enquiry is made into the part played by the Atomic numbers and Atomic weights of elements with a view to arriving at some indication of the possible influence on the body, its functions and processes by the introduction of metallic elements of high Atomic weight.

* * * * *

The Secret of Chemical Exchange.

Reference has hitherto been chiefly directed to the chemical aspect of the elements which compose organic life, and the part they play in building up the fabric of the body, in furnishing nutriment for the blood, and in providing and maintaining at necessary strength the various compounds which the body requires for the performance of its several functions.

Reference has been made to the conditions of temperature at which normal chemical exchange is achieved in the miniature City which has been termed a "city of cells," but which is rather the living prototype of "a city of industry," equipped with workshops, storehouses and laboratories in which an ordered industry ceaselessly proceeds, controlled by some mysterious System which works for the good of the whole body.

* It was in the course of research in this direction that the writer was led to infer the influence on the chemical exchanges of the body of an increased temperature

† A consideration of the characteristics of such Elements as Iron, Nickel, Copper, Zinc, Silver, Tin, Platinum, Gold, Lead, Radium and Uranium, furnish examples of this fundamental relationship. These Elements are given in the order of Atomic Numbers and Weights.

A peculiar and precise System that makes for the Unity of the whole fabric, and ensures that the design of Nature is complete, since otherwise neither individuals or species could maintain their identity or achieve hour by hour, century after century, the punctual miracle of evolution. Is the miracle by which reproduction and progress is achieved in all living bodies from the amoeba to Man, founded on some precise system of chemical exchange. If this be so, what is the principle that dominates chemical exchange, giving to evolution a stability, which yet is not absolute fixity?

What is the real *media* of chemical exchange?

If we reply—the combustibility of elements, we have but a partial explanation, since mere promiscuous association and combustion of Elements could not insure the precise and undeviating processes by which exchange alone is effected.

If we say—by the generation of heat, by energy, by presence of moisture or air, we have a general answer, but one which provides no essential principle by which alone precise and directed chemical combinations are achieved.

That the generation of heat must be a ruling factor in the chemical exchanges of the body is apparent, but what is the principle that so controls and regulates each element, so that enough and no more is chemically united, and what provides the exact temperature so that conditions of solubility and expansion are achieved in correct measure? Heat generates “energy,” but energy alone cannot procure the controlled and regulated conditions by which chemical exchange, whether it be in the laboratory, or in the living body is achieved.

Is there, wrapped up in the Elements themselves, some controlling factor, or some system of energy which stimulates or governs the processes of chemical exchange?

If this be so, where shall we look for the hidden system that controls with such infinite precision, the chemical exchanges of living bodies?

What is the secret of the energy that supplies and, at the same time, regulates the temperature of the body, so that each element attains the critical heat necessary for the individual solubility or expansion of each.

What is the System that operates in every living body to ensure that the combination of elements is effected in the proportions that builds up the several Species and which procures normal healthy growth instead of abnormal and freakish growth.

The text books tell us that “*elements combine when presented to one another in certain fixed proportions by weight.*”

It has been the study of chemists of the Ancient and Modern World alike, to discover precisely *what* is the peculiar weight in which elements combine. Modern America and ancient Assyria, the Europe of the Middle Ages, have each sought to contribute to the discovery of the peculiar weight at which elements combine.

In every age and in every country this peculiarity of the fixed combining weights of elements has been universally recognised as the ruling and unchanging factor in chemical exchange, but it has never yet been explained.

The secret has not been probed. We have to accept the fact that from whatever geological region or strata or organisms, elements are derived, each will combine, ever and always, in certain fixed proportions.

If we can solve this Age-long Secret, shall we have reached a clearer perception of the causes and conditions which promote healthy growth? Or, equally, of those that induce disease?

What is the System which procures, in all living bodies, *the exact proportions* which, in the laboratory, are achieved by weight?

On this peculiar factor the attainment of a precise combining weight, the healthy growth of the individual and the Evolution of Species, is surely alike dependent.

To solve the secret of the peculiar System that unerringly combines in the body simple elements in exact proportions, whereby transformation into compounds and substances is ceaselessly achieved, must surely have been the goal of every Chemist all down the Ages. Is the answer to this eternal riddle locked up in the Atomic structure? Will the Atom reveal to us the secret of "*chemical constancy*."?

* * * * *

The Law of Chemical Constancy.

Professor T. W. Richards has said, "*the law of combining proportions is one of the few known laws of the Universe,*" . . . "*the atomic weight is recognised as among the peculiar and basic attributes of elements.*"

That the vital processes of the body are dependent on some System of chemical exchange, every chemist is aware, but what is precisely known of that System? And what keeps inviolate the fixed combining weights of elements?

The chemist, with his 'instruments of precision,' weighs each element and because the weight in which each element combines is known to him, he can unerringly unite them to form the compounds he desires.

But how is this accomplished in the living laboratory without the aid of weights and standardized measures, and again, elements not only combine in fixed proportions, but in multiples of their fixed proportions, when they combine to produce compounds differing essentially from the parent compounds. How are multiples achieved, unless the living laboratory is equipped with some precise system of weights and measures.

That some precise system must exist we know, by the great group of chemical compounds and substances that the body ceaselessly manufactures for its nutriment, that such compounds are produced not alone by precise combinations but by critical conditions of temperature, is illustrated by the precise conditions by which alone these transformations are achieved in the chemist's laboratory.

The fact that elements combine to form the same chemical compounds in the living laboratory, that they form in the artificial laboratory, suggests that all elements, however diverse, are united by some peculiar and fundamental system, which operates throughout all Nature, proclaiming that the Principle which unites elements is based on a Universal Law.

The great group of the carbon compounds formed in the body are equally formed in the laboratory because the chemist, by precise combining

of hydrogen and oxygen can obtain—water ; and by the combining of hydrogen, oxygen and carbon he as easily forms sugars, starches and fats. It is because of his ability to secure exact proportions, that the chemist unerringly obtains the same results ; but by what means are those exact proportions, this “*chemical constancy*” achieved in the living body ? How are the conditions regulated and maintained without standardized weights to insure the critical and intrinsic conditions which are the essential factor of chemical exchange ?

Does the secret lie in one or two Elements ? In the presence of oxygen and hydrogen, elements which combine to form five-sixths of the entire body substances ?

Or does it reside in some Principle present in varying degrees in each element ? Does each element and atom carry within itself the controlling principle of exchange ?

Are the chemists’ weights and measures but the rough and ready substitutes of a system of perfect balance inherent in each Element and carried by each Atom ?

The ‘hourly evolution’ within all living Organisms of chemical substances and compounds is the living Witness of Universal Law procured by an unvarying principle of precise proportions which unites every Element under the common Law of “*Chemical Constancy.*”

The great fact of “*chemical constancy*” which runs through each one of the nine-two elements at present known to us, points to some system hitherto obscure. “*It is in the nature of a God to conceal a thing, it is the glory of man to find it out,*” said Bacon, and all down the Ages, man has been seeking for the truths that should finally lead to the unravelling of “*the secret of chemical exchange.*”

Elements cannot be combined as the cook mixes her pudding, in proportions dictated by chance, circumstances or individual caprice. They combine only when brought together in “*precise proportions of weight.*”

Has the searchlight of Modern Science thrown a light on this obscure problem ? Has the recent advance in the knowledge of the Atomic structure by such pioneers as Rutherford, J. J. Thomson, Niels Bohr, Mosely, Rayleigh, Rontgen and others thrown a light which serves to illuminate the profoundest of Nature’s secrets ?

Unhesitatingly the answer comes—it has.

That the solution of the eternal riddle of *chemical constancy* is at last in sight, we owe to the brilliant discoveries of this century, and to the great achievements of generations of men who, throughout the ages, have persistently sought the truth. By linking the truths of the past with those of the present, we are at last enabled to form a chain of connected links that unite cause and effect. It is to the great discoveries of the past, united to those of the present, that to-day we have given into our hands the key that unlocks the profound and mysterious processes that underlie generation, energy and evolution.

The key that unlocks the secret of the nature of that *vital force* that is the directed means by which, throughout the whole realm of Nature scattered elements, and energies are harnessed

and directed to the accomplishment of one coherent and harmonious Design.

Truths undreamed of even at the beginning of this Century are now revealed, and surely, in all the long history of Scientific discovery, none has ever equalled the revelation of the *dual nature of the Atomic structure*.

It is due to this epoch-making discovery that at last we find an explanation of the mystery we call "vital force," that "elan vital" (Bergson), that is the secret energiser of all living Matter.

It is due to these discoveries that the writer was led to a perception of the fundamental causes that underlie the interchange of matter. The causes that operate to procure healthy growth and the causes that lead to disease and to malignant growth, such as Cancer.

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Vital Force.

All the chemical interchanges that are effected in the body are, we must believe, due to some Universal System co-operating alike in every living thing. This is variously termed "energy," "vital force," "stimulus," but of the System that procures energy, nothing has been known. The discoveries of the nature of the Atomic Structure affords evidence that this Energy is present in ascertainable proportions as electric units in every atom, and the writer is led to postulate that it is this electric charge that procures and regulates chemical exchange in all living Organisms and, further, that excess or diminution of this "elan vital" is a direct menace to chemical exchange, and that any interference with this force hinders the individual from maintaining the physico-chemical stability which is the essential factor of all growth.

Reference has been made to the fact that, in all metabolic changes of the body, *Oxygen* plays an indispensable part, but oxygen alone cannot be regarded as the "vital force" that procures the energy of the body.

"The two possible explanations that are most commonly accepted," says Professor Verworn, "are (1) concerned with the decomposition of food-stuffs; (2) the second explanation of metabolism is confined to one single class of chemical combinations undergoing spontaneous decomposition and regeneration. This latter theory was founded by Ludimar Herman and F. Flüger, and has met with universal recognition because of its naturalness, simplicity and clearness."*

Can we regard either of the foregoing hypothesis as furnishing a sufficient explanation of the stimuli that controls metabolic change? And can "the fundamental fact of life" be adequately interpreted by reference to "one single class of chemical combinations?"

"The fundamental fact of life" it is believed, can only find adequate explanation as the expression of a Universal Law; the "vital force" that brings about the recurrent chemical transformations in every living organism must, it is believed, be inevitably based on a Universal System and cannot be explained by any one expression or manifestation, however

* "Physiology."—Professor Max Verworn

simple. The belief in a "*vital force*," however, is considered by many authorities as no longer tenable. "The theory of *vital force* was definitely "overthrown to make way for the natural methods of explaining vital phenomena which, down to the present time, has continued to spread "and flourish with unparalleled fertility." . . . "it may be convenient to "use the terms "*vitality*" or '*vital force*' to denote the causes of certain "groups of natural operations as we employ the names '*electricity*' and '*electrical force*' to denote others; it ceases to be proper to do so, if such "a name implies the absurd assumption that '*electricity*' and '*vitality*' "are entities playing the part of efficient causes of 'electrical or vital "phenomena."**

The researches of the ancient world, the hypothesis that engaged the philosophic minds of Greece and Rome, the investigations of Galileo, Bacon, Newton, Dalton, Berzelius, and of the brilliant band who hold aloft to-day the torch of Science, have alike revolved round the problem of energy and the Atomic System, and can we, in viewing the most recent discoveries in regard to the Atomic structure, longer entertain the proposition that it is mere assumption to believe that electricity and vitality play the part of efficient causes in vital phenomena?

By the new light thrown on Matter by the discovery of the dual nature and structure of the Atom, we are at last brought face to face with the true explanation of the riddle—"vital force."

The peculiar relation between *Matter* and *Energy*, *Cause* and *Effect*, the secret of *chemical constancy* and of *atomic weights*, the mystery of generation, and of growth, healthy and malignant; these, the riddles that all down the Ages man has sought to pierce, are made plain at last by the revelation of the duality of the atomic structure.

Here we find explanation of the common Law of Energy that unites all Matter, organic and inorganic, in one all-prevailing System.

In the structure of the Atom† is found the missing link that unites with definite and irresistible logic the chain of evidence that binds together under one Universal Law, all living organisms.

In the Elements, and in the Atoms that compose the elements, we perceive the Alpha and Omega of Life; Evolution past, present and future; material evolved through the slow cycles of Time; living forms moving onward and upward in progressive stages to fulfil an ordered Design. Worlds past and Worlds to come, built up and furnished with living forms, in obedience to the hidden Law of Energy. The *vital force*, whose law we read in the *Atomic structure* would seem to know no confines, to include all Systems, Worlds and Substances, the designed cause that controls material things, the force that provides heat, that gives to chemical constancy its stability, and to the body its law.

The Atomic World has shed a new light on the human body in the fundamental factors that provide health; it furnishes the logical explanation of the problem of malignant growth and with it a reasonable hope of cure.

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* Biology—Professor E. Chalmers Mitchell, Dr. Sc., F.R.S. and Sir John Holdich.
 † Sir Ernest Rutherford, Lord Rayleigh and others.

*The Elements that Compose the Body.**Protoplasm further Considered.*

The importance of *protoplasm* as the foundation of all Cancer research is indicated by the fact that it forms the physical and material basis of all life, whether it be the human body or the vegetable world.

This fact suggested, to the writer, in 1927, that investigation into all growth of the body, whether retarded or accelerated, healthy or malignant, should start, not with the growth itself, but with the antecedent causes of growth, e.g., investigation of the *constitutional* elements of protoplasm, the affinities and activities of these elements and physical peculiarities; since in the elements themselves must assuredly be hid the explanation of all metabolic, anabolic and katabolic changes of the body; it was further postulated that in the same basic elements was determined the heat, energy and electrical phenomena of all organic life.

"Protoplasm," says Professor E. A. Minchin, "from whatever source, is similar in appearance and properties." It is described by Dujardin as "a greyish viscid, slimy semi-transparent and semi-fluid substance."*

This similarity of protoplasm throughout all organic life urges that it is in the Atoms that constitute Elements that the secret of the chemical and physical activities of the human body must be sought, whether normal or abnormal, and that it is in the fundamental principles that characterise the Atoms of all Elements, that the antecedent causes of all organic growth is determined.

Thus, the writer was led to the conception of Cancer as a disease that had its root in the chemical and physical activities of the elements that compose the body, a conception which further investigation indubitably confirms.

The great advance in our knowledge of physics which has been brought about by the researches of the twentieth Century, has done more to enlighten and assist perception of the natural Laws that govern the metabolic processes of living bodies than have the researches of any known preceding Age.

Nearly three centuries ago the discoveries of Newton encouraged investigation into the laws governing chemical processes; to-day the startling discoveries of Rutherford, J. J. Thomson, Moseley, the Curies, Niels Bohr and other pioneers of research have carried knowledge further, and evoked in man's mind a burning desire to penetrate further into these mysteries with the hope of establishing the particular relation of the Elements and to the activities of the living bodies.

In less than a quarter of a century, research has transformed the whole world of Chemistry and Physics, and it may constitute a matter of surprise to future generations that, while the discovery of radium and X-ray have been widely applied to the treatment of disease, these great discoveries have hitherto wrought no fundamental change in the conception of the energies of the human body, its physical changes and

* Professor E. A. Minchin, M.A., F.Z.S., London University.

functions. Neither have these great discoveries vitally accelerated research into those fundamental antecedent causes by which the body is built up.

The modern hypothesis concerning the structure of the Atom, the increased knowledge of the Atomic numbers and weights, the discoveries of the radio-activity of substances, and the apparent relation existing between certain Elements, but above all, in the startling discoveries of Rutherford and others in regard to the structural arrangement of the Atom suggested to the writer (1927), that it was in the Atomic structure that the clue must be sought to the problem of vital activity, and that in the Atomic Universe must be concealed the explanation of the eternal riddle of *chemical exchange* and *chemical constancy*.

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Living Substance and Vital Energy.

What is meant by vital energy? Are we, in the light of the new discoveries, called upon to re-adjust our ideas as to its real nature?

Such authorities as Professors E. A. Minchin, Köllicker and Verworn, agree in ascribing "the activities of protoplasm to the mutual interaction of many substances, no single one of which can be considered living in itself, but only so far as it forms an indispensable constituent of a living body." . . . "From this point of view, life is to be regarded not as the property of a single definite substance, but as the expression of the interchanging relations existing between the many substances which make up—protoplasm."*

* * * * *

The Atomic Structure and Cancer Research.

The writer suggests that the most recent research into the dual nature of the Atomic structure obliges us to reconsider this opinion. **The structural peculiarities of the atoms of every element appear to very conclusively indicate that the "vital energy" that builds up protoplasm is the inherent and inalienable constituent of every atom, and that thus, each single chemical substance must be considered "living," in the sense that it has vital force, since research has revealed the amazing fact that each single atom, possesses its own precise, unchanging and individual charge of electricity and that it is, as a result of this electric charge, assigned separately to each atom that the eternal mystery of energy and of chemical combination is achieved and maintained in every living organism.**

This conception of the root factor of chemical exchange and chemical constancy, was arrived at by the writer, as the result of the recent discoveries in regard to the dual nature of the Atom, a discovery which came on a mind prepared by sixteen years diligent enquiry into the causes and processes that antecede metabolic change in bodies living and non-living.

* "Protoplasm"—Professor E. A. Minchin, M.A., F.Z.S., etc.

The hypothesis first formulated in February, 1927, has been confirmed by two years of plodding investigation, what then was hypothesis may to-day be regarded as a reasonable and logical conclusion based on the mathematical ratio, which exists between the atomic numbers and the atomic weights of elements and which receives further confirmation of recognised pioneers of Science.*

In the relation between the proton and the electron, the writer postulates, is revealed the explanation of all energy, and further, it supplies the clue to the antecedent causes which procure the stupendous facts of Evolution, Organic growth and Fertility and provides a new line of investigation.

"We have seen that all things are made up of about ninety kinds of atoms and that in them is wrapped up the mystery and infinite variety of the material world."†

The discovery that the atom, instead of an indivisible particle of Matter is a highly complex structure, comparable to the Stellar Universe in its arrangement, has startled the whole world of Science ; such a revelation must needs cause the reconsideration of many hitherto accepted facts. **If, however, the epoch-making discovery has affected Science, even more must it shake the bulwarks of the Medical World ; for in this new Knowledge is presented a truth which, the writer ventures to assert, must fundamentally change our conception of matter above all living matter, which composes all organic life and consequently of disease and its treatment.**

The discovery of the dual nature of the atom furnishes the rational explanation of many hidden causes, by its light we may diagnose causes hitherto more or less conjectural. The new knowledge is bound for all time to radically influence our conception of disease and of its treatment. It has provided the key to the *modus operandi* of the body functions and growth, and it must inevitably enlarge our perception of the eternal miracle of organic growth ; it shows us the atom, as part of a Universal System, which has for its objective the evolution of Worlds and of Men, not as we had supposed by the outcome of individual acts, but as part of a Universal System in which each Atom plays a vital part in the Design of Creation.

Speculation as to the nature of the Atom, is we know, no new thing. Two thousand years before the Christian era, Greek and Latin philosophers disputed theories inherited from a long past civilisation, and from that day to this speculation as to the atom has recurrently engaged man's mind, but it was not till the nineteenth century that Dalton advanced the theories which the twentieth century has so triumphantly explored and completed.

The discovery that the entire Universe is composed of a limited number of kinds of atoms, in all about ninety, is not the only arresting fact, but the further fact that the basis of all living substance is identical, composed of the same few elements, which same elements also constitute three-fourths of the whole Earth's Crust, is a fact of startling significance, since it suggests that within the atom may exist some specific quality

* See "The Atom and Radio-activity"—E. Rutherford, J. J. Thomson, Rontgen, Niels Bohr, Soddy, W. Bragg, Andrade and others.

† "Concerning the Nature of Things"—Sir William Bragg.

which acts and re-acts to procure the amazing diversity of substances which proceed from such a limited number of elements.

"The Universe," says Sir William Bragg, "is so rich in its variety, the earth and all that rests on it, and grows on it, the waters of the sea, the air, the clouds, all living things that move in earth, or sea, or air, our bodies and every different part of our bodies, the sun, moon and stars, every single thing is made up of these few kinds of atoms . . ."

The Atomic Universe, miniature in size, shows itself Universal in System — its activities know no confines, it compasses the evolution of Worlds and of substances living and inert. By some system within itself, a system punctual, alert, undeviating, it supplies the material for all animal and vegetable life, it is at once the exponent and the explanation of the Laws of Heat, of Moisture and of Chemical Constancy. In the structure of the Atom, the writer postulates, is disclosed the true nature of the *media* of chemical exchange and of chemical constancy, and the answer to the riddle of interchange between matter and energy.

Every element we learn, has its own particular sort of atom. The atoms of the several elements are distinguished by the curious fact that each has its own fixed number of electron attendants. The atom, once believed to be an indivisible particle, is now shown to be a complex structure, composed of a nucleus or proton, which nucleus has in attendance a larger or smaller number of particles of electricity, known as electrons. The number of these electrons vary with each element, starting with the one electron of the Hydrogen atom, a number which gradually increases in the several elements, till at last Uranium is reached with a total force of ninety-two electrons.

In this unique discovery of the electrons and their fixed numbers, varying with each element, the writer postulates, is found the key to the only logical explanation of the eternal mystery of chemical exchange.

"The plans of the structure of nature are locked up in the atoms themselves. They are full of wonders and mystery, because from them alone and from what they contain grows the infinite variety of the World." (Sir Wm. Bragg).

What, we ask, does the atom contain? What is it "that makes things to grow"? We have, in the atom, some peculiar condition which not only procures or causes "*chemical interchange*," but which further induces all things to grow? Is this peculiarity due to the chemical composition of the nucleus? Or is it due to the action of the particles of electricity that surround the nucleus and which re-act on it?

Can we possibly regard these electric particles as being the *media* of chemical exchange? Are they the agent that generates Heat in living bodies and that produces radio-activity in elements? And combustibility in substances?

Can such a genesis of Heat and Chemical action be considered practicable? Logical? In harmony with the accepted fact of science? Such an explanation does indeed find confirmation in accepted facts of science, and no other hypothesis hitherto advanced has provided a logical explanation of the mystery of chemical exchange.

* "Concerning the Nature of Things"—by Sir Wm. Bragg.

"The atom is regarded as a miniature Solar System, with a positive material nucleus as the Sun, round which are the individual electrons as Planets . . ." " . . . The unchanging feature of any particular sort of atom is the positive charge of electricity on the nucleus, it is due to this that the proper number of electrons gather round."*

The vital importance of the discovery that every atom is accompanied by a certain number of electric units, is increased by the further fact that the atoms exhibit a determined purpose to preserve always their own particular number of electrons and should one or more of these number be lost, the remainder exert great force to pull to themselves an electron from another group.

This determination to ever adhere to the same fixed number of electrons is not the only remarkable feature in the conduct of these miniature Electric forces, for not only do they work for the completion of their fixed number, but what is even more remarkable, to maintain the particular arrangement, and grouping of their forces, an arrangement which we are told, never varies or alters, a further fact of transcendent interest is that certain elements show a similarity in grouping, although the actual number of their electrons vary,† all show the same determination to group according to plan and to preserve their correct number intact.

"There is some force, we do not understand its origin, which works for the completion of the external shell of the electrons."—(Sir Wm. Bragg).

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Atoms and Electrons.

The writer advances the theory that the explanation of this determination to work for the completion of the external shell of electrons is to be found in the postulate that all chemical exchange is accomplished by the agency of electricity, and that this is achieved by the electric particles or electrons which accompany each atom; the fixed number of electrons, that surrounds the nucleus of the atom is the *media* that effects and regulates chemical exchange.‡

To the unvarying charge of electricity that accompanies each atom, we trace the logical explanation of chemical constancy.

The electric particles that distinguish the several atoms, are adjusted by a principle of such refinement, that to each element is accorded the

* "Rays"—by Professor F. Soddy.

† The most recent researches of Sir J. J. Thomson, Niels Bohr, R. A. Millikin and others suggest a possibility that these electrons may be "not particles but waves." (Is it possible that under certain conditions they are particles, and under others they are waves of electricity, *i.e.*, when in a live combustion—E.W.H.)

‡ Sir Ernest Rutherford explains that "the atom is composed of a massive positively charged nucleus of minute dimensions surrounded at a distance by a compensating distribution of negative electricity in the form of negative electrons" . . . "the magnitude of the nuclear charge and number of the external electrons are known for each of the elements" . . . "The positive electricity is concentrated within a nucleus of dimensions very small compared with the total space occupied by the Atom. The whole problem of the distribution and motion of the electrons in a complex atom is a very difficult one . . . The disintegration of an Atom is accompanied by the explosion of an *a particle*." . . . On this view the nuclei of all elements is made up of positively charged protons and electrons." ("Matter")

precise number of electric units, that will procure the amount of heat required for the solubility, fusibility and interchange of that particular element.

Thus, to ever maintain the fixed number of electrons that effect the combination of that particular element is the paramount principle of the atomic world.

By a fixed charge combination is effected, and by a fixed charge the stability or "constancy" that is the dominant characteristic of all chemical exchange is assured.

The writer believes that in this simple explanation (1) the mystery of the atomic numbers is solved; (2) adherence to a fixed number is explained; (3) and the definite grouping about the proton is interpreted. Moreover, it explains the sociability of some atoms, and the unsociability of others, and it further shows why, when atoms combine, it is the electrons—the agents of exchange—that first are drawn together.

The writer urges that the foregoing furnishes not alone a rational interpretation of the purpose of the electron; of its numbers and its grouping, according to plan; but that it further supplies a logical and consistent answer to the age-long question of energy or vital force, and shows that the electric particle is the media of chemical exchange and the guarantor of chemical constancy.

If, in the electric charge that accompanies the atom, we have not the explanation of chemical exchange, what is the meaning of the electron? And where shall we look for the answer to the riddle of chemical constancy?

Is it possible to follow the system of the electron numbers from the one of Hydrogen, the lightest of all gases; to the ninety-two of Uranium, the heaviest of all metals, without recognising that in these electric units, we are face to face with a mathematical factor of dynamic importance pointing irresistibly to chemical exchange.

Can we fail to behold in these infinitesimal particles of electricity the designed "*instruments of precision*," by which, throughout the whole realm of Nature, from the vastness of the Stellar Universe to the microscopic body of the amoeba, chemical combination is attained and chemical constancy is assured.

"Atoms," we learn, "differ in the number of attendants or electrons they can retain, for instance, the carbon atom can retain six electrons; every atom that can retain six electrons is a carbon atom; it is strange that the immense variety in Nature can be resolved into a series of numbers. It was once thought that the various sorts of atoms owed their variety to something more than this."*

The pregnant words "*it is strange that the immense variety in Nature can be resolved into a series of numbers*," struck with peculiar force on a mind prepared by fifteen years of plodding investigation, to recognise that, within this fact of the electron, its numbers and other peculiarities, might conceivably lie the missing link, so long sought, that should at last unite chemical cause with chemical effect, and which should explain the age-long mystery of "*vital force*."

* See Sir W. Crookes, Rontgen, Becquerel, Moseley, the Curies, Sir W. Ramsey, E. Rutherford, F. Soddy, W. Bragg, J. J. Thomson, Niels Bohr,

The writer's researches suggested that the electron must be a fundamental part of all Organic life, that in the number might lie the clue to chemical constancy, to the mystery of vital force and transformation of Matter. To reject the electron was not possible, for the most brilliant Scientific research workers of the Century had weighed, measured and accepted the electron as a real fact in the material Universe, their accurate investigation left no room for doubt.*

"The Atom that can retain six electrons is a carbon atom." Carbon with an atomic number of six has a combining weight of twelve. The combining weight is then just double its electron number? Is this pure coincidence, or do any other elements show a similar ratio between the atomic number and atomic weight?

Suppose, reflected the writer, one half of the basic elements or even one-third show this ratio, might it be taken as definite indication that the electric particle is the determining factor of chemical exchange? Is there sufficient agreement between the ratio of the atomic numbers and atomic weights to warrant the inference of a fundamental relation between the two? And if so, does the agreement point to a basic principle indicating a Universal Law. It has been said that "*ultimate success in penetrating these secrets appears so far off that almost any speculation is permissible.*" Is the amazing and basic agreement in the Atomic numbers and the atomic weights of every known Element mere coincidence? mere chance? Or does it indicate a Universal Law? Unless we adopt the interpretation here put forward, how can the enigma of definite proportions and multiple proportions be explained?

Professor T. W. Richard has said: . . . "the chemical atomic theory "initiated by Dalton and developed from the vague theories of the "ancient world has been strengthened by modern investigation and is "to-day entrenched in a well-nigh impregnable position." **Does not the perception of the relation between the Atomic numbers and weights entrench it in an even stronger position.**

From these and other indications, it appears that the function of the Electron is to protect and stimulate the atom that its activities are directed in a manner calculated to promote the well-being of the Organism as a whole.

It was found that every Element exhibited the same peculiarity, the proportion by weight in which it combined with other Elements was always just twice that of the Electron number or unit, a fact from which it appears reasonable to conclude that the electron is the deciding factor of exchange.

The remarkable relationship between the atomic weights and numbers, the writer believes, explains how the precise chemical combination in living bodies is achieved.

The electric units surrounding the nucleus appear to be what the gun charge is to the projectile, the charge is in accordance with the weight of the projectile.

The atom is a complete body, a nucleus or proton surrounded by electric units called electrons.

* Since the above was written in 1927, Professor Eddington, in an address to the Royal Society, January 17th, 1929, has called the electron "a dummy," "an imagined assistance to the human intellect."

This question of the electron numbers suggested to the writer that if these electric units were found to bear any fixed relation to the atomic weight, it might possibly indicate that these electric units were the vital force, the 'instruments of precision' that determined chemical exchange. "We imagine each atom to be like a solar system, there is a nucleus corresponding to the sun and round the nucleus there are planets which we call electrons—every atom is surrounded by a shell or cloak of electrons and when two atoms collide it is their shells that first come together."

Reference to the atomic numbers and atomic weights of the basic elements, showed that, not merely half, but five sixths of the whole exhibited the same ratio between the Atomic number and the combining weight. The one exception was hydrogen which alone of all elements shows the same atomic number and weight.

	At. No.	Comb. Wt.	Precise Comb. Wt.
Hydrogen ...	1	1	1
Carbon ...	6	12	12.000
Nitrogen ...	7	14	14.003
Oxygen ...	8	16	16.000
Phosphorus ...	15	31	31.027
Sulphur ...	16	32*	32.064

From these figures, the behaviour of the Electrons and other basic facts, the writer reached the conclusion that in the uniformity exhibited in the ratio between the atomic numbers and weights of the basic elements was found the true explanation of chemical exchange, and that in the determination of the microscopic units to ever retain their fixed number was revealed the true source of the constancy that is "the basic attribute of the elements," (T. W. Richards.)

Numbers, meaningless in themselves, become factors of fundamental significance, when in conjunction with other numerals they establish definite facts of mathematical exactitude.

"The Uniformity of behaviour" which the electrons exhibit and which exists independent of time, environment or geographical distribution, convinces that the electrons are no mere "dummy"† occurrences, but the expressly designed agents of an exact, precise and regulated System by which chemical exchange is effected, and the Equilibrium of the Universe held in equipoise.

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Atoms.

If we accept the hypothesis as we must, that each kind of atom has a specific and invariable weight, and if we find it bears a fixed and invariable ratio to the Electron number, are we not drawn to make the important inference that the Law of Chemical Constancy is determined by the electric units or charge that accompanies each atom.

* From the Tables given by H. E. Roscoe, T. W. Richards and others, fractions of decimals are not given, but the nearest whole numbers.

† Professor Eddington.

Dalton arrived at the conception of a definite Atomic weight by the quantitative analysis of compounds. When two Elements unite to form a compound, the weights that combine are in an invariable ratio, a ratio that is characteristic of that compound. May we not equally arrive at the Law of Chemical Constancy by the definite and invariable ratio between the Atomic numbers and their weights? Surely it must be recognised that these peculiar numbers have some very definite and close relation to the Laws that govern the evolution of Elements—mere numbers they cannot be.

Not by haphazard or chance mingling of Elements, but by the *media* of exquisitely refined charges of electricity is the miracle of chemical combination made not only possible, but purposeful.

In the investigations of Newton, Dalton, Bacon, Berzelius and Becquerel, in the discoveries of Rontgen, Wm. Crookes, and H. G. T. Mosely, and in the most recent researches and discoveries in radio-activity, and the Atomic structure by Rutherford, J. J. Thompson, F. Soddy, the Curies and others, we find corroborative evidence of the theory here advanced, that the secret of *vital force* and chemical constancy are wrapped up in the electrons.

The mathematical certainty conveyed by the uniformity of behaviour of the electrons and the ratio that subsists between the Atomic Numbers and Weights of the primary Elements convinces that this is no mere conjecture of the writer, but that in these electric particles is found the root principle of a dynamic and consistent Law, which provides in place of vague and undefinable theories of energy and *vital force*, a concept of potential energy, which is consistent in itself, and in harmony with what is already known of Natural Laws.

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Electrons and Uniformity of Behaviour.

The scientific method of research is to see "*uniformities of behaviour*" and to correlate them. It may be objected that, in the case of the ninety-two Elements, though it must be admitted that the electrons in each case exhibit uniformity of behaviour and though the energy exhibited by these particles of electricity provides a logical explanation for the phenomena of chemical exchange, yet the elements do not show the fixed ratio between atomic numbers and atomic weights, the distinguishable mark of the basic elements.

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Uniformity of Principle.

It is true that the greater number of the elements do not show the precise 50% ratio between the atomic number and weights which is shown by the basic elements. They do, however, exhibit uniformity of principle inasmuch as, with the increase in atomic numbers, i.e., weight,

the combining weight correspondingly increases in proportion, so that we find elements of very high atomic weight such as :—

	At. No.	At. Wt.
Lead ...	82	208
Radon ...	86	222
Radium ...	88	225.95
Thorium ...	90	232
Uranium ...	92	238

have each a correspondingly high combining weight, though the 50% ratio is not adhered to.

The fact that, between the basic elements, a fixed ratio persists is an experimental fact, the importance of which cannot be minimised. The writer advances the view that this factor points to the theory that **every form of organic life is dependent on some factor embodied in the principle of a 50% ratio between the electric charge and the nucleus.***

It is of fundamental importance to observe further, that this 50% principle is not confined to the group of elements that form the basis of all organic life ; it is found also to be the dominant principle in those secondary elements, which are found in living bodies.

An agreement so consistent between all those elements that take part in the formation of organic life cannot fail to point to some dominant principle in the evolution of organic life.

And the fact that “ *nearly ninety-nine hundredths by weight, of the whole Earth's crust* ” (J. Rice, E. H. Roscoe)—is composed of eight elements which conform to this principle, seems to offer overwhelming proof that, in this agreement to a common principle, we have the evidence of a Universal Law.

The Eight Elements that form Ninety-Nine Hundredth's by Weight, of the Whole Earth's Crust.

	At. No.	At. Wt.
Oxygen ...	8	16
Sodium ...	11	22.997
Magnesium	12	24.32
Aluminium	13	26.97
Silicon ...	14	28.06
Potassium ...	19	39.096
Calcium ...	20	40.7
Iron ...	26	55.97

The fact that all Organic life, animal and vegetable, and the greater part of the whole Earth's Crust, together with all the countless substances which furnish the essential nutriment and needs of all things living, are derived from a small group of Elements, all of which act in agreement with a common principle, the writer postulates, **affords convincing proof, that in this principle we behold a fundamental Law.**

* The writer, in 1916, formulated the theory that Evolution of Species was dependant on some factor which ruled the distribution of certain elements dominant in all Organic life. This opinion was based originally on recorded observation of the distribution of chemical elements in organic life and was first touched on in 1916 in a letter addressed to Sir Hercules Reed, F.R.S., re “ Transformation of Matter ” and is dealt with elsewhere.

The Basic Principle of Exchange.

The fact that all the other elements conform to the same principle of exchange, though not to the fixed ratio shown by the basic and secondary elements, cannot invalidate the postulate, that chemical exchange is affected by means of the electric units which attend the atom.

The fact that the ninety-two elements known to us show uniformity in the *principle* of chemical exchange is in itself remarkable evidence of the credibility of this theory and the fact that those particular elements which show conformity, both in principle and in ratio, compose not only all living things, but also ninety-nine hundredths by weight, of the Earth's crust, while the other and least common elements constitute altogether only "*about one ten-thousandth of the Earth's crust,*" must surely afford incontestible evidence that in the principles that rule the basic elements, we must look for the true interpretation of "*the fundamental processes which determine the nature and evolution of the Universe.*"

Indeed, we have only to apply the electric principle as it affects *chemical exchange*, whether in the living body, or in the Stellar Universe, to recognise that only by some such stupendous and uniform Design, could the system of evolution of Matter be consistently achieved.

Is all this pure conjecture? Or does it indicate a **root principle of vital import in which may be traced in definite sequence a logical and predestined development of all living things from simple elements?**

Can we doubt that the solution of "*the series of numbers*" finds explanation in chemical exchange and chemical constancy. The atomic weight, recognised as "*among the peculiar basic attributes of Elements,*" forbids us to reject the conclusion, that in the fixed ratio that subsists between these atomic weights and atomic numbers we behold the principle which forms the basis of a Universal Law of Life.

It affords explanation of the fact that, while the lightest of all gases has need of but one electric particle to effect movement and combination, the heaviest Elements, Gold, Lead, Radium and Uranium require charges of no less than seventy-nine, eighty-two, eighty-eight and ninety-two, respectively, to effect solubility and combination.

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The Gun Charge and the Projectile.

We may, indeed, aptly compare the relation between the electron and the nucleus with a gun charge. The electron is to the nucleus, what the explosive is to the projectile—a force that is regulated in accordance with the weight of the projectile. The number of the charge, decides not only the distance the projectile shall carry, but on it depends also, subsequent combination and disintegration of Matter.

Thus, the writer is led to advance the theory that the electric particles attached to the several atoms are neither more or less than the secret instruments of precision, employed to combine and energise otherwise inert matter and that in these infinitesimal particles of electricity we

behold at once the secret and the media of all chemical exchange ; the logical explanation of the energy that transforms chemical elements to vital, purposeful, living substances.

The electric particles are the balances by which, in Nature's unique laboratory, the materials are adjusted with exquisite precision, from which it is decreed the secret growth of men and worlds shall ultimately proceed.

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Cancer—The New Idea.

To trace the origin of Cancer, it is necessary to link up the predisposing causes, deficiency in essential constituents, and to trace their origin to a common root. It is necessary to enquire into the principle that determines susceptibility and immunity, and to search into the fundamental causes that induce energy and stimulate growth ; and to discover how far the energy of the atoms themselves explains the *inhibitions* and *stimulations* which, under normal conditions, procures systemised growth.

Protoplasm can no longer be regarded as composed only of chemical constituents, but as a body highly charged with radio active properties. The vital functions of the body depend for their action not alone on the chemical, but on the physical properties of the atoms.

This fact provides a clue to many obscure forms of disease, both physical and mental, it indicates that Cancer is a disease which arises from a deficiency of essential elements in the blood of which oxygen is chief, which deficiencies interfere with the chemical and physical equilibrium of the body.

For the first time in the history of Biology, it is possible to trace in connected sequence, chemical and physical changes that occur in the body. Facts hitherto seemingly unrelated, become links in the chain of definite events. The long-looked-for link between living and non-living matter is at last revealed.

Cancer is a disease which is the direct outcome of inability to maintain essential and fundamental conditions. The result of deficiency in essential elements must result in direct deficiency in the essential nutriment of the blood and its vital activities.

Of all deficiencies none re-acts so disastrously on the body as oxygen deficiency. Oxygen is recognised as the essential partner of almost all chemical combination and the element of fundamental importance in every action and function of the body. Oxygen is the continuous need of every living thing, and together with hydrogen providing the Heat, and Moisture, which are the fundamental fact of life.

The primary need of every individual is ability to maintain the critical temperature on which the operations of the living laboratory depends. Thus all cellular growth and its accelerations are dependent on a question of temperature.

If we divest the mind of the conception of the body as an organism only composed of flesh and blood, and instead regard it in its fundamental aspect, as comprehended in Genesis by the word "*dust*," e.g., a body composed of simple elements which by chemical processes of extreme

refinement is built up into living substance, we cannot fail to appreciate the results of deficiency in essential elements or of interference with conditions of temperature, since the processes which take place in the living laboratory are like those of the chemist's laboratory dependent on a sufficient supply of the essential elements and controlled by precise conditions of heat and moisture. Infinitesimal atoms are combined in proportions of unfailing exactitude. This exactitude, we now discover to be procured by a system of minute charges of electricity so regulated as to produce the solubility and interaction of the several elements. The electric charges of the basic elements we find are all low, and this charge, we may conclude, determines and stabilizes the body temperature and cellular growth. Thus the successful attainment of the chemical processes which take place in the living laboratory are like those of the chemist's laboratory, dependent for success on immunity from interference.

If the chemist lacks essential elements, if foreign elements are introduced, and if there is interference with the critical temperature, at which expansion of gases and solubility of solids is attained, his efforts are doomed. If heat is accelerated and moisture withdrawn the simplest experiment fails.

Yet it is in the face of constant interference with the chemical processes which build up living tissues that the body is expected to achieve healthy growth. Delicate processes which demand conditions of great chemical exactitude are the subject of continual interference.

Cells and tissues are built up under chemical conditions of infinite refinement; when these conditions are not fulfilled the blood stream fails to carry to the cells and tissues the essential nourishment.

The new idea of Cancer is of a disease of the blood caused by deficiency in essential elements and aggravated, we now learn, by interference by contact with elements whose high radio activity interfere with normal cellular growth. Thus the writer is led to conclude, the New Line of Cancer Research must be turned on Investigation into the new Knowledge of the Radio activity of Matter.

It is to this new Knowledge that we already know we owe our recognition of the peculiar relationship of the cancer-inducing agents and their basic relation.

The fact that all the cancer inducing agents generate heat and induce energy, proclaims their fundamental antagonisms to the elements that form the basis of life—the new discovery has shown us that the body is endowed with a natural safeguard from the danger of accelerated cellular growth by the simple fact that it is primarily composed of elements of a low combining weight—that is of elements that bear a very moderate charge of electricity and to this provision is inferred the fact that the body can approach with safety within certain ranges of great heat. That there is, however, a limit to this safety range is shown by the fact that living bodies cannot approach electric currents of high voltage or other emanations of great heat, without incurring vital consequences. "Shock" from high potential currents, we now recognise as due to the fact that a body of low potential is called on to encounter forces of high potential, thus the chemical and physical activities of the body become accelerated beyond the

limit it is capable of sustaining. Sudden contact with elements of high potential procures sudden death, but by whatever means the body is brought into close proximity with elements of high potential the chemical processes of the body suffer interference and deterioration inevitably results. This, it is believed, explains the high cancer incidence found in the lead trades, the complications associated with lead poisoning are attributable to the vital influence of powerful radio-active elements of the blood.

It is to the high potential of Lead and Radium and their emanation, that we must undoubtedly attribute the high cancer incidence and mortality amongst those who handle these elements.

* * * * *

Lead.

The Light Thrown on the Toxic Properties of Elements by the New Discoveries.

There is, perhaps, no more striking proof of the terror that cancer has inspired, than is shown by the methods that have been adopted to combat the disease. The treatment which one age regards as infallible, a succeeding age, views as fantastic and superstitious.

Of all the methods adopted to combat cancer, none is more remarkable than that recently adopted in the treatment of cancer by the injection of Lead. The New treatment has achieved much prominence since its introduction in 1924, by Dr. Blair Bell and his colleagues, and the treatment that has been practised widely both in England and America. The precise value in cancer therapy of injecting lead into the veins and its particular action on the functions and composition of the blood in relation to cancer growth has not as yet been explained. The treatment was widely discussed at the International Cancer Conference held in London, July 1928, and a Paper was read by Dr. Blair Bell on the value of this treatment.

The opinion of experts as to the value of this treatment appears much divided. Professor F. C. Wood (Columbia): "*thought no one would deny that lead would have an effect on malignant disease in the human subject, but he considered a greater effect followed X-rays.*" Professor W. Dilling (Liverpool): "*thought that no final estimate of the therapeutic value of lead was likely to be reached for some time.*" Mr. Basil Hume (St. Bartholomew's Medical College): "*gave details of treatment of 13 cases treated by lead alone; 11 died after an average life from commencing the treatment, of thirteen weeks. The two survivors had not improved. With reference to seven other patients, in none was improvement demonstrable while under lead treatment.*"

Dr. Stanley Wyard (Cancer Hospital, London) stated: "*56 cases had been treated with lead colloid; of 40 who received sufficient lead, 23 died, 10 were worse, 6 showed no change, 1 somewhat improved.*" Dr. G. Loewy (Paris) said: "*Lead caused grave intoxication—women were more susceptible than men. No cure had, however, been obtained with it, but its*

"inocuousness led him to resolve to continue its use." Dr. A. P. Thompson (Birmingham) said: "that in 55 cases treated by lead, the treatment seemed to influence the disease favourably in 15 cases, though in most only temporarily."

Dr. Blair Bell in reply, remarked: "little had been said on chemotherapeutical principles." . . . "In Liverpool, scientific curiosity was not allowed to outrun humanity, and for that reason attention had not been confined to lead alone, a goodly proportion of the 1,000 cancer cases treated there had been deep X-ray therapy in addition to lead. Why was it? Patients coming to him from London had been imbued with a fear of terrible reactions occurring . . . He had brought the treatment to the state that made reactions practically negligible. The size of the growth after treatment was no criterion of its malignancy . . . "Nature did not proceed by leaps."

The Chairman (Sir Thomas Horder) in summing up, dealt with three questions raised in the discussion. (1)—*Have any patients got well after treatment by lead and as a result of it? The answer, he thought was in the affirmative.* (2)—*Can we undertake the responsibility of advising patients to undergo lead treatment? I feel, he said, we have not yet arrived at the point of safety which will enable us to do this.* (3)—*What are the next steps to take? Further research should be undertaken for lead preparations less toxic than those now in use with the hope of widening the margin of safety at present dangerously small.**

The Report, unfortunately, contains no reference to the scientific aspect of the case in regard to the toxic properties of lead. The peculiar property which makes lead poisonous, does not appear to have been known. The radio active properties of lead do not appear to have been considered and the amazing discoveries of Sir Ernest Rutherford and his colleagues receive no mention—yet it is due to the researches of Sir E. Rutherford and other scientific explorers that we are at last enabled to isolate the peculiar attribute which renders metallic elements toxic. The discovery of "*a new Property in Matter*" is unquestionably the greatest contribution to scientific, and in particular, Medicinal research.

Lead, we may postulate, is lead, and radium is radium, because of the electric charge it carries—if it were possible to isolate the electricity which the writer suggests is the peculiar attribute which makes lead toxic, will that element still remain lead? And if the value of the medical application of lead lies in its potency to disintegrate bio-chemical combinations so that growth is arrested and dispersed which appears to be the logical explanation of the application of metals that generate heat to malignant growth—will not its essential characteristic be minimised? At the same time we must very seriously ask ourselves whether under any circumstances lead or any other of the heavy Metals should be introduced into the living bodies.

Analysis of the properties of Elements as recently disclosed by the researches of Sir Ernest Rutherford and other pioneers of science, show that all the metallic elements are distinguished by the possession of a power to emit heat. The generation of great heat is the dominant characteristic of all Metallic Elements and it is in this question of heat,

* Chemotherapy in Malignant Disease, with Special Reference to Lead. Paper read before the International Cancer Conference—By Professor W. Blair Bell, M.D.

that we find the fundamental difference between the simple elements that form the basis of all life and the metallic elements which by the emission of heat can destroy by the simple process of disintegration—the bio-chemical substances of which the body is built up.

What is called the *toxic properties of lead*, would appear to be its radio active force. All the metals that are called 'toxic' are possessed of a high radio activity, e.g., a power to disintegrate Matter. It is in this peculiar attribute that the writer conceives the danger of all metallic Elements resides.

We have only to compare the high cancer incidence and mortality in all the Metal Trades with the Table of their Atomic Numbers and Weights, to convince ourselves that the toxic properties of these metals consists in their power to induce heat. A heat which is greatly in excess of the temperature which controls the bio-chemical activities of living bodies.

When elements of high radio activity are brought into contact with living bodies, two re-actions inevitably result (a) the normal bio-chemical combinations which build up the body are not consummated (b) existing combinations are arrested and disintegrated.

The toxic property of every metal appears to be in precise ratio to the amount of heat it generates.

Thus, iron, with an electric charge of 26, *i.e.*, some three times greater than oxygen, may be assimilated in small doses, with apparently beneficial results, but Zinc with an At. No. 30; Tin, At. No. 50; Mercury, At. No. 80; Thallium, At. No. 81; Lead, At. No. 82; Radon, At. No. 86; Radium, At. No. 88; Thorium, At. No. 90; and Uranium, At. No. 92. are elements of such potency, that mere association, let alone absorption, suffices to gravely impair the chemical equilibrium of the body, and if persistently absorbed disintegration and annihilation of essential compounds must result.

Dr. Blair Bell stated "that it has long been known that lead arrests growth generally and causes absorption in the human subject" and again, "failing to discover the biological—that is natural bio-chemical regulations of differentiation, we must seek some chemical substance that will arrest growth as such, and endeavour to discover one that has also an inhibitory action on the essential functions of the cancer cell." . . . "to produce its effect the lead must be injected into the blood stream and it must reach the cancer cells." Lead in suitable doses causes "coagulation and absorption is the result."

The writer conceives that the primary objection to this treatment is that lead is a base metal, which forms no part of the basis, or essential constituents of living bodies. Thus its introduction into the body presents an acute danger and there can be no dose that can be regarded as "suitable." Lead is a metal which has not been hitherto employed in medicine, though many of its compounds as lotions, salts and ointments have been believed to be beneficial, in cases of ulceration and haemorrhage from gastric ulcer. A treatment, which consists of actual injection of colloidal lead in the blood stream establishes a precedent without parallel in the whole history of medicine.

The belief that to circulate in the blood a poison possessing the powerful characteristics of lead, though rooted in the sincere conviction that it will destroy the malignant growth, is discounted not alone by the chemical and physical attributes of lead but by the abundant testimony of medical men as to its resultant effects. The evidence of authoritative Reports on Cancer and Plumbism in the Lead Trades, must make it plain that the hope of curing cancer by the introduction of a metal that sets up chemical and physical re-actions of such acuteness is not justified. The effect of lead would appear to be that a purely artificial stimulus is induced. Such energy is not founded on the only healthy stimulus; and can only further vitiate the flagging energies of the patient.

To absorb and circulate in the blood a poison such as lead cannot fail to induce chemical and physical changes which affect not alone the cells, muscles, tissues and organs generally: but which gravely affect the higher nerve centres.

Thus, even if lead has power to destroy malignant growth (which Professor Blair Bell does not seemingly claim) the introduction into the system of this metallic poison must inevitably destroy the equilibrium on which chemical exchange is based.

To inject lead, thorium, thallium or any other metal of high radio activity into the body must adversely influence every chemical, physical and nervous process.

Even to those possessed of the safeguard of a pure blood supply, such a process is attended with considerable risk, but when a poison such as lead is deliberately injected into the already impure and impoverished blood stream, which is the particular condition of cancer patients, there can be small hope of anything but aggravation of the disease.

Dr. Blair Bell says: "*size of growth after treatment is no criterion of malignancy*" unless, however, treatment reduces growth, checks spread, and averts recurrence, in what does its value consist? "*Nature does not proceed by leaps.*" It is because it is recognised that the dominant principle in Nature's processes is that they are gradual that it is difficult to reconcile ourselves to a system which exerts violent and powerful re-actions. The chairman's reply to the question, "*Have any patients got well after treatment of lead and as a result of it?*" was in the affirmative, but he "*could not take the responsibility of advising the treatment, and recommended that research be undertaken for lead preparations less toxic than those now in use, with the hope of widening the margin of safety.*"*

It is due to the researches of Sir Ernest Rutherford and other scientific explorers that we are at least enabled to isolate the peculiar attribute which renders metallic elements toxic. The discovery of a "*new Property in Matter*" is unquestionably the greatest contribution to scientific research that has been made for many generations. The recognition that this discovery was of paramount importance to students of biology induced the writer to draw attention to the line of investigation which is here attempted, since up to the present the application of the

* Chemotherapy in Malignant Disease, with special reference to Lead. Paper read before the International Cancer Conference, July, 1928—By Professor Blair Bell, M.D.

new knowledge of matter does not appear to have been considered in reference to Medical Research.

The Reports of the International Conference of Cancer contain no reference to this important discovery. The premier Cancer Research Societies, e.g., the Imperial Cancer Research Fund and the British Empire Cancer Campaign are equally reticent in regard to the new lines of research that this epoch making discovery undoubtedly opens up.

Both the Cancer Conference, the Medical Councils and Research Councils devote very considerable attention to the Treatment of Cancer by Lead, by Thorium, by X-ray and Radium, but **analysis and investigation of the chemical and physical properties of those Elements appears to find no place in the records.** It is, however, to the **triumphant discovery of the electric property in Matter that we must surely look for the explanation of the phenomena of biology and physiology.**

Until the peculiar properties, i.e., the high radio-activity of such metals as lead, thorium, thallium and radium have been more fully explored by collaboration with the men whose triumphant discoveries have opened the door into a New World of research—it would seem that the therapeutical use of these agents of unknown potency should be definitely discouraged.

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Research Councils Reports on Lead Treatment.

From a perusal of the Reports of the several Cancer Research Committees dealing with the Lead Treatment we learn that "*the toxic effects of lead treatment may be immediate or delayed. The immediate toxic effect is apparently chiefly due to gross particles in the (lead) preparations. Organs show definite degenerate changes*" . . . "*with haemorrhage in many cases*" . . . "*The remote effects appeared in from 8 to 16 days, when the animals appeared ill, hair ruffled, and sluggish in movement.*"

"*In tumour bearing mice, no appreciable effect could be observed in progress of the tumours*" (after treatment).

"*From work carried on as to the toxic and depresser action of preparations of lead*" . . . "*it was found that the main depresser action was due to the gelatine used as a protective colloid.*"*

It is suggested that the depresser action may be attributable to the inevitable re-action that follows the artificial stimulus induced by the powerful activities of lead.

The Research Committee's Report of St. Bartholomew's Medical College gives evidence as to "*the Chemical and Bio-Chemical investigation undertaken. The principle object of this research has been to repeat the investigations on the therapeutic use of lead treatment in malignant disease according to the methods employed by Dr. Blair Bell and his co-workers.*"

* Report of the Cancer Research Department, Middlesex Hospital. British Empire Cancer Conference Report, 1928. Pages 38, 39 and 40.

"The number of patients treated was 20; (a) those treated solely with Lead; (b) those treated with Lead followed by Deep X-ray treatment. Of group 'a' 13 received Lead treatment alone, 11 died, 2 have survived but have not improved by the treatment. Of group 'b' combined Lead and X-ray treatment, 7 patients were treated, 1 improved, 4 are not improved, 2 have died. These results are somewhat less depressing than those obtained from Lead alone, it has yet to be determined whether the effect produced was by the Lead or X-rays.

"In many cases the growths increased rapidly under treatment. The results obtained in the series of cases treated by a combination of Lead and X-ray therapy have been somewhat more encouraging and warrant further trial." The report considers "it is highly probable that it is impracticable to administer a sufficiently large amount of lead to produce resorption of malignant tissue without causing death to the patient. This opinion must not, however, be taken to mean that the use of lead in conjunction with Deep X-ray therapy may not be helpful."*

This optimistic opinion is difficult to reconcile with the recorded toxic effects of lead. It is suggested that research into the properties of an analysis of the attributes of Lead render any such conclusion untenable and that chemical and physical research into the attributes of these elements might induce a different opinion as to their operative value.

The report concludes with the statement that "the duration of life after lead treatment was less than the expectation of life, had they not been so treated. In several cases immediate and grave deterioration in general health followed the treatment."

These results cease to surprise when it is realized that the effects of metal which generate great heat is to destroy the balance of chemical exchange by which the processes and functions of living bodies are maintained.

The report of the Research Laboratory of Westminster Hospital states that "a fair percentage of cases show some improvement has been obtained and that a demonstration given at the Liverpool Clinic was sufficiently convincing that definite cures had been effected by this agency." (lead).

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Colloidal Solutions of Radium and Uranium.

The report states that not only Lead has been employed but mixed colloids including the metals Thorium and Uranium.†

It is difficult to comprehend the theory that a highly sensitive organism whose composition is based on simple and non-metallic elements of moderate radio-activity, can be brought back into a condition of healthy vigour by the injection of high power metals. The whole crux of the problem of maintaining

* Abridged Report from the Standing Committee of the Council of S. Bartholomew's Medical College for Research on the Lead Treatment of Cancer. British Empire Cancer Campaign Report. Pages 49, 50, 51.

† Report from J. B. Carhill Research Laboratories, Westminster Hospital, British Empire Cancer Campaign Report, pages 59 and 66.

the body in a condition of health, rests on a question of a controlled temperature. The belief that the injection into a delicate and highly strung organism of Elements whose electric charges are respectively 82, 90 and 92 to each atom, is nothing less than amazing. The Atomic Table of Elements show the Atomic number of the three elements in question to be Lead 82, Thorium 90, Uranium 92, thus the injection of but one atom of each of these elements would mean a combined electric charge of 264 units!

The report states that a compound of the following elements was used, composed as follows:

Thorium	72	...	74%
Uranium	4/5	...	5%
Nitrogen	12	...	13%
Oxygen	10	...	11%

and "*This compound was found to be quite suitable for use.*"

Other preparations containing an even higher percentage of Thorium are recorded. Thorium Hydroxide is stated to consist of 1% Uranium and 15% Thorium colloidal solution. It is observed that "*a further difficulty was encountered at this stage, as quite unexpectedly the solution was found to have a powerful coagulating action upon the blood serum.*"*

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Treatment of Cancer by Uranium and Thorium.

Is not this the inevitable result which must be looked for from a treatment which induces abnormal heat and withdraws essential moisture. Coagulation of the blood, paralysis of muscles, nerves and functions is the logical outcome of a process so completely at variance with the Principles by which metabolism is achieved.

"*The dosage employed is stated to be 5ccs twice weekly no severe re-actions occur as a rule and attempts are now made to increase the amounts given. In addition to the 29 patients treated in Hospital, where it was found that the treatment was reasonably safe, doses were sent at weekly intervals to several General Practitioners in various parts of the country.*"†

Can it be reasonably hoped that there are any safe doses of metals of such potency as Lead, Thorium and Uranium.

Must not a force that has power to disintegrate and destroy the chemical constituents of malignant growth be equally potent to disintegrate and destroy the chemical combinations that compose the tissues and the every function of the body? These powerful electric forces cannot be entirely insulated; what margin of safety is there for these unprotected veins and tissues that convey the life blood? There is none. The coagulated blood and the electric force combined make resistance to this invasion impossible.

* Ibid.

† Report from J. B. Carhill, Research Laboratories, Westminster Hospital. British Empire Cancer Campaign Report, pages 59 and 66.

The Research Committee of the London Association of Medical Women do not report any treatment of Lead.

The Birmingham Cancer Committee report on the team work done in connection with Research into the *Value of Colloidal Lead Compounds*. This work involved the creation of a studentship in Bio-chemistry of the value of £350 per annum.

The report states "*that during the past year, 34 cases have been treated with Lead. As a rule patients in good condition on beginning treatment remain in hospital for 5 or 6 weeks and receive 3 or 4 large doses of lead in that time. They later come back for a few days for smaller injections . . . "Severe lead poisoning has followed the attempts to carry out an intensive course, it is proposed to try the effects of smaller and more frequent injections. The general results show that 2 cases out of 34 were markedly improved, 3 slightly improved, 5 remained stationary. On the other hand there were 3 deaths which might be attributed to treatment."*

"The fact that of 34 cases treated with lead, 10 derived benefit warrants the opinion that the treatment is of distinct therapeutic value and deserves further investigation."

It is difficult to accept the therapeutic value of any treatment that to be successful must induce sufficient heat to disintegrate chemical combinations and absorb the moisture which is the basis of all life.

Investigation of the chemical action of metals of high potential on living Organisms, has shown that the application of intensive heat can destroy life, actual and potential and that it has been resorted to in cases where such an object has been aimed.

Life cannot be nourished on Metals. The essential compounds that provide the nutriment of every form of life we know to be oxygen, hydrogen, carbon, nitrogen with possibly phosphorus and sulphur. Metals furnish no food. The powerful electricity contained in Lead, Thorium, Radium and Uranium may galvanise the body into a brief show of activity, but this spurious energy has no foundation in the essential elements that form the life of all created things.

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The balance sheet which accompanies the British Empire Cancer Campaign Report shows how great is the response to the Appeal for Research. The total income for 1928 is shown as £51,370, of which £18,158 have been exclusively devoted to Research.

The Report of the Imperial Cancer Research Fund for 1928 shows a total income of £161,529 0s. 9d. with £12,605 6s. 10d. devoted to Research.

Of these sums nothing appears as yet to have been directed to the scientific investigation of the properties of metals. The writer pleads for this as the essential preliminary to the therapeutic use of metals, with any margin of safety.

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The New View and the Old.

The vast sums of money expended and the tireless research of the past eighty years bears eloquent witness to the extent of the danger that threatens civilisation.* Perhaps there is no greater proof of the terror this disease has inspired in every class than is shown by the readiness with which a new and revolutionary Treatment has been adopted.

Belief that the new Treatment would bring rapid, harmless and almost painless deliverance, has blinded us to the fact that this treatment is a complete subversion of Medical experience and practice.

In less than twenty years after the accidental discovery by Dr. Rontgen, that X-rays inflicted burns, the entire civilised world has not only adopted a treatment of burning, but has devoted millions to acquiring the material which shall achieve the magical result.

The treatment of burning is diametrically opposed not only to all that we know of the bio-chemical and bio-physical processes of the body but, it is at variance to all that is known of the practise of medicine, ancient and modern. It is a startling innovation, is it a sound one?

The conquest of disease in the Past was founded largely on the Mosaic Law, supplemented by a profound and practical knowledge of the medicinal and curative properties of the herbs and plants which contain in infinitely delicate proportions the self-same elements which form the basis of life.

It was believed that these plants contained wholly essential life-giving nutriment and that they possessed the curative properties which form a definite corrective to disease. They were universally regarded as natural health inducing agents.

It is not the purpose of this Paper to attempt to discuss the merits of Vegetable Treatments, but merely in passing to consider (a) how far it can be regarded as a chemically sound proposition, to gradually build up a diseased body by assimilating in vegetable form the same elements as those which constitute the essential basis (b) and how far it is sound to attempt to build up the body by the absorption of metals which possess no known nutritive qualities—but which are charged with a force of electricity of such potency that the heat generated suffices to burn up and destroy matter, to disintegrate chemical combinations and coagulate the blood.

The ancient System was to rebuild by vegetable treatment. The modern notion has been to burn away the growth regardless of the fact of the terrible consequences, chemical and physical, which must and do inevitably follow.

The body is bombarded with electric forces of such penetration, that can pass easily through such obstructions as stone or wood. The blood stream is infected with metallic elements of such power that disintegration of essential substances result.

To future generations of Chemists this belief in the therapeutic value of metals will surely be regarded with incredulity.

* This has been referred to as the 'direst woe' but the fact that an acute and terrible malady invaded every civilised country and for which the combined resources of medicine have found no alleviation, justifies the phrase that "civilisation is threatened."

Metals are chemically incompatible with the healthy growth of living organisms. Life seems to be governed by a system based on the maintenance of a normal temperature and blood pressure.

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The Ancient and Modern Treatment of Cancer.

For many centuries Cancer has been known in Britain and if we may judge by the remedies which were in common use up to a very recent period, cancer was formerly regarded as a disease of the blood, which could be corrected by vegetable medicine, dieting and a careful regimen. Up to the close of the eighteenth century this treatment appears to have been commonly adopted and it may be inferred that it kept the disease to a certain extent in check since when, in 1792, the first Ward for the Medical Treatment of Cancer was opened at Middlesex Hospital, the accommodation comprised but four beds. The recent appeals for Radium have disclosed the extent to which cancer has increased in little more than one hundred years.

From a Medical text book, published in 1791, by J. Elliot, M.D., we find the following treatment laid down for cancer: "*Bleeding, cooling laxatives, fomentations, ablution with cold water, herbal infusions and medicines,*" together with "*calmness of mind on a proper regimen.*"

To-day such remedies are regarded as futile; vegetable and herbal remedies are practically unknown; indeed Medicine as far as cancer is concerned seems to be discarded. Yet we cannot blind ourselves to the fact that since these treatments were discontinued cancer has not decreased. On the contrary, in the last twenty-five years the increase in cancer is startling, and we are forced to ask whether those vegetable remedies, which were once so universally followed did indeed possess a particular efficiency in diseases of the blood. The ancient remedies which to the modern mind are almost childish in their simplicity were, it may be inferred, the remnant of a half-forgotten medical culture of great antiquity. The ancient knowledge of the curative properties of herbs must have been extensive.

The surviving fragments of an ancient medical lore seem to have flourished in Britain and at a very early age, if we may accept the evidence of Strabo and Pliny and other ancient writers.

Pliny refers to the plants most in repute in Britain, for their medicinal properties as defined by the Druids and we learn from the same MSS., that after the departure of the Romans, "*the Druids resumed their medical lore and once more medicine became a characteristic pursuit of the Cymri.*" It seems certain that the knowledge of medicine bequeathed by the Druids was handed down among the Celtic tribes of Ireland and Wales and that this knowledge is not entirely lost to-day.

From that ancient Treatise, "*The Physicians of the Muddvai,*"* we may learn something of the vegetable and herbal remedies in use in

* "*The Physicians of the Muddvai*"—Translated from the Thirteenth Century Celtic MSS., collected from earlier sources by John Pughe, Esq., M.D., F.R.C.S., Aberdovey, 1861.

Celtic Britain, "even before the age of Prydain (generally dated about "1000 B.C.) the art of healing was practised by the priests and ancient teachers of the Cymri, mainly if not wholly by means of Herbs. The nature and property of some 700 plants and herbs, with which the ancient Cymri appear to have been well acquainted are enumerated."

The remedies prescribed are mostly for common ailments, but the fact that no fewer than nineteen Prescriptions are for Cancer, including three for epithelial cancer of the mouth indicates that cancer was a very prevalent disease at that time and one which was regarded as curable by herbal medicines.

To-day, the notion that a disease that has resisted all modern methods, yields to such herbs as rue, sage, plantain, knapweed, ground ivy, reedock, onions, marsh mallow, cow parsley, and frankincense, appears little short of preposterous, but the meticulous care, devoted by these ancient writers to the drying and preparing of those herbs, according to Dr. Pughe's work, and the precise manner in which the directions are set forth, suggests a profound perception of the curative properties contained in plant life and the value of the correct drying and storing.*

Before we dismiss these ancient remedies as preposterous, we may do well to ask ourselves—

- (1) If cancer is a disease of the blood ; is the principle of taking remedies which will purify and nourish the blood, sound ?
- (2) Is it reasonable to assume that the body is restored to health by absorption of the fundamental elements of which it is primarily composed ?
- (3) Are these elements present in varying proportion in all plant life ?
- (4) Does the fact that all terrestrial animals are chiefly nourished on herbs and plants, point to vegetation as the natural form of diet ?
- (5) Is the immunity from cancer and other diseases in animals living in the free state due to the fact that herbs containing medicinal properties form a large part of their diet ? Is the immunity from cancer among uncivilized races in any degree attributable to the same cause and may the low cancer incidence which was, till recently, recorded among agricultural labourers in any degree attributable to this factor and the survival of vegetable remedies ?
- (6) In a World ruled by System, is it logical to infer that plant life fills a very definite place and purpose in the scheme of creation and that herbs are not only designed to clothe the ground and nourish the animal life—but that they fulfil the definite purpose of providing the curative and medicinal properties of every form of terrestrial life ?

The fact that we have overlooked and discarded the remedies that are at hand and have wandered off in pursuit of cures of our own invention, cannot lessen the efficacy of the remedies Nature offers. We may persuade ourselves that the ancients were wrong in supposing (to name but a few in alphabetical order) that medicinal properties lay in acanthus, aconite, anemone, arbutus, aquilgia, asphodel, angelica, balsam, buglos,

* Among the West African Secret Societies, we have on the authority of Captain Butt Thompson, that "their knowledge of medicine is profound. They link homeopathy to the nearest allopathy known to the European Schools."†
 † "West African Secret Societies" by Captain Butt Thompson, Published by Witherby.

borage, clematis, cyperus, calendula and the like, and that the real purpose of plants consists in decorating herbaceous borders, and meadow side, but the Celtic physicians who had tried those remedies and proved their efficacy, assert in plainest terms that in them lay certain hope of cure "of all diseases" says the ancient writer: "*Cancer is the worst, and by careful treatment only can be cured not otherwise.*"

Which treatment is founded on the most scientific principle, the old, which cures by rebuilding the body with simple elements and making good the chemical deficiencies the blood lacks; or the modern, which burns away the tissues, absorbs the moisture on which life is primarily dependent?

The simple elements contained in plants are the essential elements that build up all life; the metallic form Lead, Thorium, Uranium and Radium, neither feed the body or nourish the blood.

* * * * *

The Treatment of Cancer by Radium.

Of all the innovations that have taken place in the practice of Medicine, from the earliest days until now—none have been so startling as the treatment of disease by Radiotherapy.

So completely has this treatment taken hold, that although little more than twenty years has elapsed since the discovery of Radium and the further discovery by Becquerel (1901) of its power to inflict severe burns, Radium to-day now takes not only a foremost place in the treatment of malignant growth, but appears likely to supercede surgery as completely as surgery superceded the medicinal and dietic treatment of Cancer.

To-day, not only in Great Britain, America and the Colonies, but practically in every city in Europe the treatment of cancer by radium has become an accepted fact.

Some idea of the hold that radium has taken upon the public mind may be instanced by the immediate response that met the Minister of Health's announcement that the Government were prepared to add £1 for £1 up to £100,000 contributed for the purchase of Radium. In less than six months this was not merely subscribed, but over-subscribed with additional munificent gifts in sums of £50,000; £30,000; and £20,000 have swelled the smaller sums which have poured in from every quarter of the Empire, witnessing to a Nation's faith in the new treatment "*for who knows which of us will not presently require the treatment which is going to be made available by this substance (Radium); who of us would not be in that case prepared to find any sum within his means to escape the anguish, the torture and the possible death which might thereafter follow.*"*

The appeal found an echo in every heart and the funds of the British Empire Cancer Campaign; The Imperial Cancer Research Fund and kindred Research Associations bear eloquent testimony to the response the appeal for Radium treatment has made.

* Minister of Health, House of Commons, May 1st, 1929.

An important Commission supported by an influential Committee which includes some of the best known Medical experts in England and with Lord Lee of Fareham as Chairman, has put a crowning point in this great undertaking. The Medical Research Council has declared that "*Radium treatment must be put within easy reach of all whose lives depend upon it.*" before an unknown power, a scourge that makes the strongest tremble, it has accepted the New Treatment without question and yet a close perusal of the Daily Press, the Medical Journals and the Hospital Records indicates that there have been serious "*accidents*" while a close scrutiny of the Cancer Hospital Reports cannot fail to leave on the mind certain misgivings as to the efficiency of the new treatment.

It is impossible to disguise the fact that the treatment of Cancer by Radium not infrequently re-acts disastrously; the spread and recurrence of the disease and the rapid acceleration in the growth cannot fail to be disquieting features of radium treatment a fact that is none the less disquieting that up to the present no adequate explanation or interpretation has been advanced to explain this fact or to counteract its influence.

Expert opinion is now expressed with increasing frequency that Radium treatment should only be undertaken by those possessing a very expert knowledge of Radiotherapy, and increasing precautions are enjoined as to the dosage employed.

Yet research appears to have furnished no clue as to the particular nature of the danger which is encountered or to the means which may be employed to counteract them.

To those who have made a study of Chemistry and Physics it cannot fail to afford the profoundest astonishment that, notwithstanding the vast literature which has grown up around the treatment of Cancer by Radium, **the purely chemical and physical aspect of the problem, i.e., the precise influence that intrinsic heat is calculated to exercise on the chemical exchanges of the living laboratory does not appear to have been the subject of serious investigation.*** The effect of the bombardment of living tissue by a force of such power as Radium must inevitably procure chemical and physical conditions of monstrous gravity.

A close investigation of the chemical and physical effects of intensive heat on the processes of growth and the development of the body tissues, reveals the fact that the application of such heat procures conditions which are utterly opposed to the normal operation of the chemical and physical laws which control the body. Abnormal conditions and energies are induced of a disastrous nature, abnormal growth is accelerated, and the balance of chemical exchange is destroyed.

The bombardment of cells and tissues whether healthy or unhealthy, by a powerful electric force exceeding anything to

* An exception to this statement was made at the opening Meeting of the Winter Session, 1928, of the Middlesex Hospital Medical School when the announcement was made by Mr. A. E. Webb-Johnson that the Solution of the problem of Cancer would probably be found to be of chemical origin. This statement followed almost immediately after the writer had presented the Outline of this Paper to the British Empire Cancer Campaign for consideration at the International Cancer Conference.

which the body is adapted inevitably procures conditions which are chemically, physically and biologically destructive.

The more deeply we examine into the nature of the processes by which in living bodies normal healthy growth is attained, the more evident does it become that although the application of radium affords a temporary alleviation by the mere fact that it burns away the obstructive growth, the more evident does it become that its application must be regarded as a danger since it serves to accelerate and increase the adverse chemical conditions which form the very root and basis of malignant growth. More particularly is this danger apparent when intensive heat is applied to those regions of the body, where the most profound and complex chemical processes take place.

APPENDIX.

It may be stated, the writer submitted a Paper ("Cancer and the Electron System") embodying the principles here set out, to the President of the British Association at the Annual Meeting in September, 1927.

The writer realized the paper was inadequate.

On the advice of the President, however, it was submitted to the President of the British Medical Association, who, in a letter of October 3rd, 1927, acknowledged the Paper as "valuable" and as "a delicate and refined investigation" and suggested that it should be laid before the Councils qualified to examine such matters. Accordingly the Paper was laid before the Imperial Cancer Research Fund. The Director "was, however, unable to recommend it" to the Council and the matter dropped. Later, however, as a result of encouragement from qualified medical and scientific men, the attempt was made to arouse the attention of the Cancer Research Councils, through the International Cancer Conference and the present Paper was commenced, but before its completion the writer was disabled owing to a severe accident and thus prevented from further work. Consequently, a Paper embodying some of the Principles the writer here outlines was laid before "The Advisory Committee of the International Conference." This was duly acknowledged in July, 1928, and referred to as "a valuable contribution to Cancer Research." Regret was expressed that the Paper arrived too late to include in the Conference Proceedings.

A few months later the Secretary of the Conference made request for the return of the Paper that "it might be dealt with without delay." It was further stated that the Paper "had not been selected by the International Conference Committee," but "it had been intended to pass the document for submission to the Investigation Committee." The writer was not able to comply with this request as the Work was under revision.

It may be stated that the writer had received an invitation to read the Paper before the British Association at Bristol, 1930, but was prevented by the serious illness referred to.

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