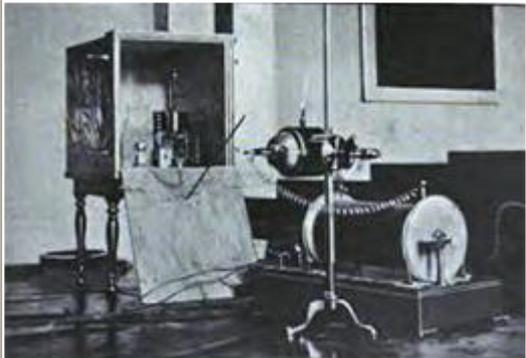


The Evolution of Matter' and 'The Evolution of Forces' on CD

Years ago, I had been told by several people, that the US government frequently removes books they deem dangerous or 'sensitive' from libraries. Some are replaced with sections removed or rewritten so as to 'contain' information that should not be available to the public despite the authors intent. A key example was during the Manhattan Project when the US was trying to finalize research into atomic bombs. They removed any books that dealt with the subject and two of them were by Dr. Gustave Le Bon since they dealt with both energy and matter including radioactivity. I had been looking for these two books for many years and fortunately stumbled across two copies for which I paid about \$40.00 each. I couldn't put down the books once I started reading them. Such a wealth of original discoveries, many not known or remembered today. / Page 88 - Without the ether there could be neither gravity, nor light, nor electricity, nor heat, nor anything, in a word, of which we have knowledge. The universe would be silent and dead, or would reveal itself in a form which we cannot even foresee. If one could construct a glass chamber from which the ether were to be entirely eliminated, heat and light could not pass through it. It would be absolutely dark, and probably gravitation would no longer act on the bodies within it. They would then have lost their weight. / Page 96-97 - A material vortex may be formed by any fluid, liquid or gaseous, turning round an axis, and by the fact of its rotation it describes spirals. The study of these vortices has been the object of important researches by different scholars, notably by Bjerkness and Weyher. They have shown that by them can be produced all the attractions and repulsions recognized in electricity, the deviations of the magnetic needle by currents, etc. These vortices are produced by the rapid rotation of a central rod furnished with pallets, or, more simply, of a sphere. Round this sphere gaseous currents are established, dissymetrical with regard to its equatorial plane, and the result is the attraction or repulsion of bodies brought near to it, according to the position given to them. It is even possible, as Weyher has proved, to compel these bodies to turn round the sphere as do the satellites of a planet without touching it. / Page 149 - "The problem of sending a pencil of parallel Hertzian waves to a distance possesses more than a theoretical interest. It is allowable to say that its solution would change the course of our civilization by rendering war impossible. The first physicist who realizes this discovery will be able to avail himself of the presence of an enemy's ironclads gathered together in a harbour to blow them up in a few minutes, from a distance of several kilometres, simply by directing on them a sheaf of electric radiations. On reaching the metal wires with which these vessels are nowadays honeycombed, this will excite an atmosphere of sparks which will at once explode the shells and torpedoes stored in their holds. With the same reflector, giving a pencil of parallel

radiations, it would not be much more difficult to cause the explosion of the stores of powder and shells contained in a fortress, or in the artillery sparks of an army corps, and finally the metal cartridges of the soldiers. Science, which at first rendered wars so deadly, would then at length have rendered them impossible, and the relations between nations would have to be established on new bases." - [Full Article Source](http://www.vanguardsciences.biz/morelebon.htm)
<http://www.vanguardsciences.biz/morelebon.htm>

'The Evolution of Matter' (462 pages)
'The Evolution of Forces' (416 pages)
by Professor Gustave Le Bon

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Years ago, I had been told by several people, that the US government frequently removes books from libraries which they deem dangerous. Some are replaced with sections removed or rewritten so as to be safe for the public.

A key example was during the Manhattan Project when the US was trying to finalize research into atomic bombs. They removed any books that dealt with the subject and two of them were by Dr. Gustave Le Bon since they dealt with both energy and matter including radiation.

I had been looking for these two books for many years and fortunately stumbled across two copies for which I paid about

\$40.00 each. I couldn't put down the books once I started reading them. Such a wealth of original discoveries, many not known or remembered today.

First, I want to associate some of the work of Le Bon with transmutation and cold fusion.

"Cold fusion (sometimes referred to as low energy nuclear reaction (LENR) studies or condensed matter nuclear science, refers to a postulated nuclear fusion process of unknown mechanism offered to explain a group of disputed experimental results first reported by electrochemists Martin Fleischmann and Stanley Pons."

"For most of the time, the power input to the cell was equal to the calculated power leaving the cell within measurement accuracy, and the cell temperature was stable at around 30 °C. But then, at some point (and in some of the experiments), the temperature rose suddenly to about 50 °C without changes in the input power. These high temperature phases would last for two days or more and would repeat several times in any given experiment once they had occurred. The calculated power leaving the cell was significantly higher than the input power during these high temperature phases. Eventually the high temperature phases would no longer occur within a particular cell."

Professor JOM Bockris invited me to attend his yearly Low Energy Nuclear Reactions Conference which hosted many top cold fusion scientists as speakers. These were invitation only for 30 presenters and guests. I was treated like a red headed stepchild since I didn't have a Phd nor was I employed by or associated with any university or government agency, but I did participate in the discussions. During one about the origins of cold fusion I commented that Le Bon was the first to do it back around 1898. Of course, they all laughed, not having heard of Le Bon or any such thing, then I explained who he was, what he did and why his material wasn't easily available. Then I described his experiment where he had a beaker of mercury which he rinsed out with distilled water. Some of the water landed on an aluminum plate which reacted violently. That could well have been, in my opinion, the first recorded case of cold fusion where such a reaction might have also produced heat from contact with the mercury residue.

[New process generates hydrogen from aluminum alloy to run engines, fuel cells](#) - Hydrogen is generated spontaneously when water is added to pellets of the alloy, which is made of aluminum and a metal called gallium. The researchers have shown how hydrogen is produced when water is added to a small tank containing the pellets. Hydrogen produced in such a system could be fed directly to an engine, such as those on lawn mowers.

"When water is added to the pellets, the aluminum in the solid alloy reacts because it has a strong attraction to the oxygen in the

water," Woodall said. This reaction splits the oxygen and hydrogen contained in water, releasing hydrogen in the process.

The gallium is critical to the process because it hinders the formation of a skin normally created on aluminum's surface after oxidation. This skin usually prevents oxygen from reacting with aluminum, acting as a barrier. Preventing the skin's formation allows the reaction to continue until all of the aluminum is used...

"I was cleaning a crucible containing liquid alloys of gallium and aluminum," Woodall said. "When I added water to this alloy - talk about a discovery - there was a violent poof. I went to my office and worked out the reaction in a couple of hours to figure out what had happened. When aluminum atoms in the liquid alloy come into contact with water, they react, splitting the water and producing hydrogen and aluminum oxide..."

"Most people don't realize how energy intensive aluminum is," Woodall said. "For every pound of aluminum you get more than two kilowatt hours of energy in the form of hydrogen combustion and more than two kilowatt hours of heat from the reaction of aluminum with water. A midsize car with a full tank of aluminum-gallium pellets, which amounts to about 350 pounds of aluminum, could take a 350-mile trip and it would cost \$60, assuming the alumina is converted back to aluminum on-site at a nuclear power plant..."

Comments - Old news kids -- I did some work on Al-air batteries for Alcan back in '87 the 'secret' sauce in their alloy was Gallium. BTW Mercury will do the same thing, but it makes folks all upset. And the reaction of aluminum to mercury;

The Amazing Rusting Aluminum - By rusting, aluminum is forming a protective coating that's chemically identical to sapphire—transparent, impervious to air and many chemicals, and able to protect the surface from further rusting: As soon as a microscopically thin layer has formed, the rusting stops.

("Anodized" aluminum has been treated with acid and electricity to force it to grow an extra-thick layer of rust, because the more you have on the surface, the stronger and more scratch-resistant it is.)

This invisible barrier forms so quickly that aluminum seems, even in molten form, to be an inert metal. But this illusion can be shattered with aluminum's archenemy, mercury.

Applied to aluminum's surface, mercury will infiltrate the metal and disrupt its protective coating, allowing it to "rust" (in the more destructive sense) continuously by preventing a new layer of oxide from forming. The aluminum I-beam below rusted half away in a few hours, something that would have taken an iron beam years.

I've heard that during World War II, commandos were sent deep into German territory to smear mercury paste on aircraft to make them inexplicably fall apart. Whether the story is true or not, the

sabotage would have worked. The few-micron-thick layer of aluminum oxide is the only thing holding an airplane together. All of them doubted what I said since they'd never heard of it in their studies but later, each of them cornered me privately, presented me with their business card and asked me to send them the information I was telling them all earlier.

One of them told me since most are tenured professors, they cannot be seen consorting or consulting with anyone who studies or researches non mainstream topics for fear word would get back and they might lose their tenure or jobs.

Such was almost the case with Professor Bockris when he dared to investigate the transmutation of mercury into gold using low level nuclear reactions. He was close to retirement so had nothing to lose, so why not step outside the borders of orthodoxy?

From the Wall Street Journal - "ALCHEMY AT TEXAS A&M UNIVERSITY" - Many faculty members say John O'M Bockris, a distinguished professor of chemistry, should be demoted for embarrassing the university with his effort to turn mercury into gold. John Bockris, formerly a distinguished professor in physical chemistry at Texas A&M University and a cofounder of the International Society for Electrochemistry: "Nuclear reactions can occur without high temperatures. Low-energy nuclear transformations can - and do - exist."

John Bockris sighs as he remembers the impact on his own career. He was investigated by his university, which found no evidence of incompetence or fraud. He was investigated again in 1992, and exonerated again; but his ordeal still wasn't over. As he recalls: "The people in the chemistry department created their own ad hoc committee for the investigation of professor Bockris. For 11 months I was under investigation by them, without ever knowing what the investigation was." He had to appeal to the American Association of University Professors before the harassment stopped.

According to Bockris, "A postdoctoral student named Kainthla, and a technician named Velez, both detected tritium and heat after we took Packham off the work because of the controversy. Since then, numerous people have obtained comparable results. In 1994, I counted 140 papers reporting tritium in low-temperature fusion experiments. One of them was by Fritz Will, the president of The Electrochemical Society, who has an impeccable reputation."

Let's be clear, the purpose of 'cold fusion' as promoted is to create a self-running process that will produce energy in the form of heat, hopefully in sufficient quantities and over a long enough time period as to pay for the cell in the first place.

The tiny amounts of transmuted elements produced in the operation are 'artefacts' of no consequence at this point.

I attended Dr. John Bockris' low level energy conferences at his invitation and have known (the late) Gene Mallove (an

excellent writer and public speaker) for a few years now. Besides having the honor of knowing Dr. Bockris and Gene, I also know Ken Shoulders (discoverer of 'charge clusters' where electrons are bound together in grapelike clumps to be ejected and exploded to produce all kinds of phenomena, INCLUDING cold fusion like 'dirt'/contaminants) and have met a few of the other cold fusion proponents, though Ken is definitely not one of them.

I think Ken has the best explanation of what is occurring with the transmutation effects noted in cold fusion experiments, however, the academics don't think much of my opinions because I don't have a Ph.D and am not affiliated with any academic institutions. Gene used to get upset with me for saying cold fusion is just a novel battery effect, but he was a fair guy and although he thinks I am off base on my view of cold fusion, the problem remains as transmutation which contaminates the purity of the components in cold fusion experiments.

Now cold fusion has grown into a church, much like the Church of Tesla or should I say cult...

John Bockris told me that he could not understand the interest in the anomalous heat production, that if he had the funding, he would devote the remainder of his life to the phenomena of transmutation. A process that clearly occurs in cold fusion cells and acts to contaminate and inevitably kill the heat production process.

To my view, cold fusion is a novel battery that produces 'anomalous' heat as a byproduct. I say this because a battery loses its ability to hold a useful charge over a period of 3 to 5 years, though some last longer.

In the case of a lead acid battery, we have plates which must be kept clean since the more surface area we have available, the more charge can be stored. As the battery is used, heat causes the sulphuric acid to precipitate as sulphate onto the plates, thus reducing the surface area and causing the battery to lose the ability to hold the charge.

How to restore the charge capacity of a lead acid battery? There are chemicals which supposedly dissolve the sulphate. Battery rebuild businesses gut the case and refinish or replace the plates and sell them as reconditioned.

Much like retreaded tires, they can be recycled, but at what cost for the cold fusion components compared to the amount of heat produced before they 'die'?

Take the cold fusion cells, using very pure components, in the purported 'cold fusion reaction' that takes place inside the cell, transmutation occurs which produces the heat. The more transmutation, the less heat. Eventually, the heat production reduces to levels of no practical use.

How to restore the cell? Clean it out thoroughly and replace the components.

And these components aren't cheap nor is it my opinion that the heat released FROM THE DECAY of the components is of sufficient intensity or duration to warrant chasing this phantom that has now gone commercial with nothing practical to sell.

I understand that some in the cold fusion circles think there might be a way for the contaminants to also produce a lesser heat level but I think it is a waste of time and technical skill of which there is an abundance being devoted to the quest for cold fusion.

In closing, I respect my late friend Gene Mallove and admire his tenacity in promoting cold fusion, however, in my opinion, it is misguided and diverting resources. I have to agree with Dr.

Bockris, these efforts would be better devoted to the phenomena of transmutation and quit worrying about the heat.

Professor Bockris often said if transmutation that could produce tritium at 3/4 of a million bucks per ounce it would definitely find a market and make a fortune but it's not free energy,

Le Bon wrote two amazing books, one on matter and the other on forces. His experiments covered radioactivity and both of his books, like many others in the libraries at the time, were removed from all public libraries while the Manhattan project was underway because it had so many clues and discoveries regarding atomic processes.

I think the focus of energy researchers should be on tapping into the forces that cause the planets to orbit on a macro scale and electrons to orbit on a micro scale.

This would be an energy source available anywhere, inexhaustible and would not consume mass, therefore not pollute our world.

That is one of the primacy foci of KeelyNet.

I have long urged Infinite Energy, the magazine that Gene created and produced, to not focus so much on cold fusion but to include other promising energy related technologies that are of equal or superior interest.

Yes, cold fusion is definitely of interest and of value, however in my opinion based on what I've read and heard, cold fusion IS a novel heat battery and in my considered opinion has no practical future as a practical and affordable energy producing method at it's current stage. There is always room for new discoveries that might make a long lasting cold fusion heat generator, but at this time, I don't know what it would be.

While Le Bon made contributions to theories of social evolution and political revolution, probably his most widely known work concerned the psychology of crowd behavior. He stated that crowds maintained a collective mind and that the group mind was not simply a summary of the individual persons. Instead, a new distillation of traits emerged, primarily unconscious in nature, which reflected racially inherited characteristics.

Le Bon also contributed to on-going debates in physics about the nature of matter and energy. His book *The Evolution of Matter* was very popular in France (going through twelve editions), and although some of its ideas—notably that all matter was inherently unstable and was constantly and slowly transforming into luminiferous ether—were taken up favorably by physicists of the day (including Henri Poincaré), his specific formulations were not given much consideration. In 1896, he reported observing a new kind of radiation, which he termed "black light" (not the same thing as a black light today), although it was later discovered not to exist.

In re-studying these two incredible books, I have been taking notes of a very tiny number of interesting observations from both for your perusal.

'The Evolution of Matter' (462 pages)

Notes from the 1st book, *The Evolution of Matter* here are just a few quotes of interest;

Preface - About ten years ago, Dr. Gustave Le Bon began to turn his attention to physical science, with the result that he entered upon the long course of experimental research which is summarized in the following pages. This led him to the conclusion—to put the affair in its simplest form—that all matter is radio-active in the same manner as uranium, radium, and the other so-called radio-active metals, and that this radio-activity is but a step in the process by which it gradually sinks back into the ether from which it was originally formed. To this he has lately added the corollary that, in the course of this disintegration, energies of an intensity transcending anything of the kind previously observed are very slowly and gradually liberated.

Introduction - According to a doctrine which seemed settled forever, and the building up of which has required a century of persistent labour, while all things in the universe are condemned to perish, two elements alone, Matter and Force, escape this fatal law. They undergo transformations without ceasing, but remain indestructible and consequently immortal.

Page 7 - What becomes of matter when it dissociates? Can it be supposed that when atoms disaggregate they only divide into smaller parts, and thus form a simple dust of atoms? We shall see that nothing of the sort takes place, and that matter which dissociates dematerializes itself by passing through successive phases which gradually deprive it of its material qualities until it finally returns to the imponderable ether whence it seems to have issued.

Page 9 - 5. Force and matter are two different forms of one and the same thing. Matter represents a stable form of intra-atomic energy; heat, light, electricity, etc. represent instable forms of it.

Page 24 - This general law, which I have not ceased to study, is as follows:-Under divers influences, light, chemical reaction, electric action, and often even, spontaneously, the atoms of simple bodies, as well as those of compound bodies, dissociate and emit effluves of the same family as the cathode rays.

Page 70 - M. Armand Gautier, Member of the Institut and Professor of Chemistry at the Faculty de Medicine of paris, has also taken up the question of intra-atomic energy in an article published by him on the subject of my researchers. He recognizes that intra-atomic energy may exist. I have not wished to enter into too many details on this point here, because it is evidently only hypothetical, and have confined myself to comparing the atoms to a solar system, a comparison which several physicists have arrived at by different roads. Without such movements of gyration it would be impossible to concieve a condensation of energy within the atom. With these movements it becomes easy to explain. Find the means, as I have pointed out above, to give to a body of any size whatever, were it even less than that of a pin's head, a sufficient speed of rotation, and you will communicate to it as considerable a provision of energy as you can desire. This is the precise condition which is realized by particles of atoms during their dissociation.

Page 88 - Without the ether there could be neither gravity, nor light, nor electricity, nor heat, nor anything, in a word, of which we have knowledge. The universe would be silent and dead, or would reveal itself in a form which we cannot even foresee. If one could construct a glass chamber from which the ether were to be entirely eliminated, heat and light could not pass through it. It would be absolutely dark, and probably gravitation would no longer act on the bodies within it. They would then have lost their weight.

Page 96 - Larmor and other physicists consider that electrons, the supposed elements of the electric fluid-and, according to some scholars, of material atoms-are vortices or gyrostats formed within the ether. Professor de Heen compaires them to a rigid wire twisted into a helix, the direction of their rotations determining the attractions and repulsions. Sutherland seeks in the direction of the movements of these gyrostats the explanation of the electrical and thermal phenomena of conduction. "Electric conduction," he says, "is due to the vibration of the gyrostats in the direction of the electric force, and thermal conduction to the vibration of vortices in all directions."

Page 96-97 - A material vortex may be formed by any fluid, liquid or gaseous, turning round an axis, and by the fact of its rotation it describes spirals. The study of these vortices has been the object of important researches by different scholars, notably by Bjerkness and Weyher. They have shown that by them can be produced all the attractions and repulsions recognized in

electricity, the deviations of the magnetic needle by currents, etc. These vortices are produced by the rapid rotation of a central rod furnished with pallets, or, more simply, of a sphere. Round this sphere gaseous currents are established, dissymmetrical with regard to its equatorial plane, and the result is the attraction or repulsion of bodies brought near to it, according to the position given to them. It is even possible, as Weyher has proved, to compel these bodies to turn round the sphere as do the satellites of a planet without touching it. (Orbit)

Page 121 - Electrons in motion behave like an electric current, since they are deviated by a magnetic field, and their structure is much more complex, in reality, than the above summary would seem to indicate. Without going into details, I shall confine myself to saying that they are supposed to be constituted by vortices of ether analogous to gyroscopes. In repose, they are surrounded by rectilinear rays of lines of force. In motion, they surround themselves with other lines of force-circular, not rectilinear-from which result their magnetic properties. If they are slowed down or stopped in their course they radiate Hertzian waves, light, etc. I shall recur to these properties in summing up in another chapter the current ideas on electricity.

Page 139 - Radium, when heated, loses the greater part of its activity by reason of the quantity of emanation it gives off, but it regains it entirely in twenty days or so. The same loss occurs when a solution of this salt is heated to boiling.

Page 161 - This dissociation, which has gone on since the beginning of the ages, must have played a great part in natural phenomena. It is probably the origin of atmospheric electricity, and no doubt that of the clouds, and consequently of the rainfall which exercises so great an influence on climate. One of the characteristic properties of radio-active emissions is that of condensing the vapour of water, a property which also belongs to all kinds of dust, and is demonstrated by an experiment of long standing. A globe full of water in ebullition is placed in communication with two other globes, one filled with ordinary air cleared of dust by simple filtration through cotton-wool. It can then be seen that the steam coming into the globe containing the unfiltered air immediately condenses into a thick fog, while that in the globe containing pure air does not condense.

Page 168 - I have therefore tried to obtain this globular electricity with a single pole, and I have succeeded in doing so by a very simple process. A rod, about half a centimetre in diameter, terminated by a needle of which the point is placed on a plate covered with gelatino-bromide of silver, is connected with the negative pole of a Wimshurst machine, and the other pole is earthed. When the machine is in motion, one sees issue from the point of the needle one or several luminous globes which advance slowly and disappear abruptly after a few centimeters, leaving on

the plate the trace of their trajectory. If, instead of employing a thick rod terminated by a needle, a thin rod were used, the formation of luminous spheres would not take place... The luminous spheres formed by one of the processes just indicated, possess very singular properties, notably a considerable stability. They can be touched and displaced with a strip of metal without being discharged. Page 178 - Two bodies not radioactive sometimes become so when combined. Mercury and tin may be placed among bodies of which the dissociation, under the action of light, is the weakest: I have shown, however, that mercury became extraordinarily radioactive under this same influence, so soon as traces of tin are added to it.

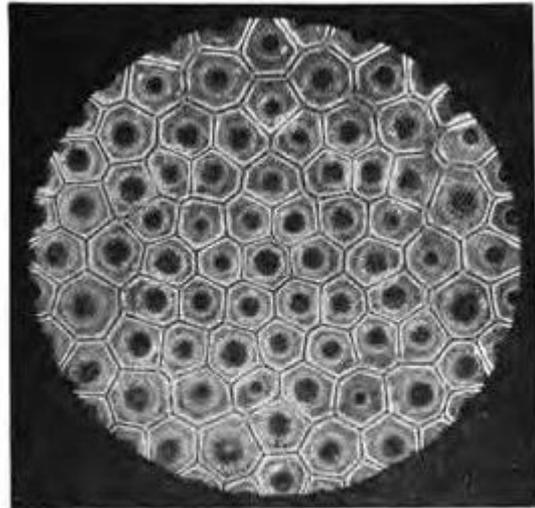


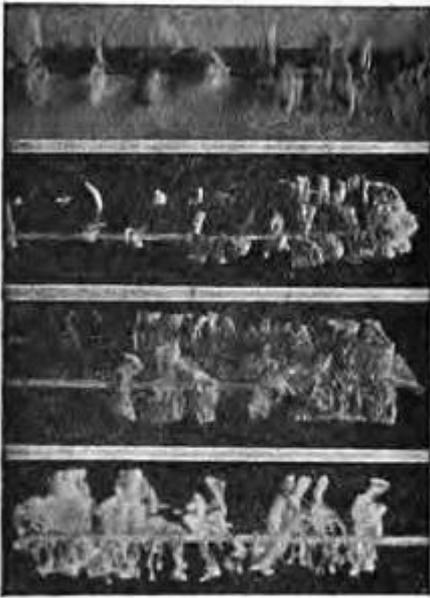
FIG. 32.—Photograph of artificial cells obtained by diffusion.

Page 200-201 - In no case, I repeat, are ions and electrons formed in the vacuum tube; they are brought there from outside. They are elements produced by the generator of electricity. It is not in a Crookes' tube that matter is dissociated; it is taken there already dissociated. If this be actually so, we ought to be able to meet, in the electric discharges produced in the air by an electric machine, with the various elements-ions and electrons- of which we have noted the existence in the Crookes' tube, and which we know to be likewise generated by radioactive bodies.

Page 245-246 - In osmotic phenomena there are always produced two currents in a converse direction, called exosmose and endosmose, of which one may overcome the other. These simple molecular attractions and repulsions acting in the bosom of liquids govern a great number of vital phenomena, and are, perhaps, one of the most important causes of the formation of living things. "Osmotic pressure," says Van't Hoff, "is a fundamental factor in the various vital functions of animals and vegetables. According to Vries, it is this which regulates the growth of plants; and, accordint to Massart, it governs the life of pathogenic germs." - By utilizing the attractions and repulsions of the free molecules in a liquid, M. Leduc has succeeded in creating the geometric cells of living beings. According to the mixtures employed, he has been able to bring before us particles which attract and repel each other, like electric atoms.

Page 251 - The study of mere matter yields ever-increasing proofs that it has properties which were formerly deemed the exclusive appanage of living beings. By taking as a basis this fact "that the

most general and most delicate sign in life is the electric



FIGS. 57 to 60.—Formation of tufts of alumina on strips of aluminium covered with invisible traces of mercury. (Instantaneous photograph.)

response," Mr. Bose has proved that this electric response "considered generally as the effect of an unknown vital force" exists in matter. And he shows by ingenious experiments "the fatigue" of metals and its disappearance after rest, and the action on these same metals of excitants, of depressants, and of poisons.

Page 252 - Matter, as we know it, only represents, as I have before said, a state of equilibrium, a relation between the internal forces it contains and the external forces which act upon them.

Page 277 - Thus, the property possessed by aluminum of not decomposing water when cold and of not being oxidized at the ordinary temperature constitutes one of the fundamental characteristics of this metal. If it can be compelled to oxidize when cold and to decompose

water by simply adding to it traces of certain bodies, we shall evidently have the right to say that its fundamental properties have been modified.

Page 277 - I have only brought them to bear on three metals—namely, aluminum, magnesium, and mercury... It will there be seen that by putting the first two of these metals in the presence of various substances—for example, distilled water which has served to wash out an empty flask previously containing mercury—it becomes possible so to modify their characteristics that, if classified according to their new properties, their places in the list of elements would have to be altered. Thereafter, these metals, decompose it violently, the aluminum instantly becomes oxidized in air, becoming covered with thick tufts which grow under one's eyes, and which give to a plate of polished aluminum the look of a jungle.

Page 299 - It is to their presence in various mineral waters that Professor Garrigou attributes several properties of these waters—that of abolishing the phenomena of intoxication, for example. M. Robin has employed colloid metals as a remedy for sundry affections, notably typhoid fever and pneumonia, by injecting from 5 to 10 cubic milligrammes of metal per litre. The result was a considerable increase of the organic exchanges, and of the oxidation of the elimination products as revealed by an over-production of urea and uric acid. These solutions being, unfortunately, very rapidly alterable, their practical use is very difficult.

Notes from 'The Evolution of Forces' (416 pages)

From the 2nd book, 'The Evolution of Forces' here are just a few quotes of interest;

Preface - As in Dr. Gustave Le Bon's 'The Evolution of Matter', he enunciated the doctrine, which he was the first to deduce, that all matter is continually in a state of dissociation and decay, so in this he goes in detail into the corollary, there only briefly stated, that the atom is a great reservoir of energy, and itself the source of most of the forces of the universe. In support of this position, he calls in the aid of his earlier reseraches into the nature of invisible radiations, phosphorescence, and the Hertzian waves, all which, with several related phenomena, he declares to be explicable by the hypothesis that the atom, on dissociating, sets free, either wholly or in part, the energy stored up within it on its formation.

Page 13 - "It now seems, however, that physicists should have seen a long time ago-that is, long before the recent discoveries-that matter and the ether are intimately connected, that they are unceasingly inter-changing energies, and are in no way two separate worlds. Matter continuously emits luminous or calorific radiations, and can absorb them. Down to the absolute zero it radiates continuously-that is to say, emits ethereal vibrations. The agitations of matter propageat themselves in the ether, and those of the ether in matter, and without this propagation there would be neither light nor heat. The ether and matter are one thing under different forms, and we cannot put them asunder. If we had not taken as a starting point the narrow view that light and heat are imponderable agents because they appear to add nothing to the weight of bodies, the distinction between the ponderable and the imponderable, to which scholars attach so much importance, would long ago have vanished."

Page 15 - "Intra-atomic energy, scientifically brought into play," recently wrote M. Ferrand, "will creat the totally new science of modern Energetics; it will give us the formula of the thermodynamic potential of energy freed from matter. Turned commercially to account, it is capable of turning upside down the productive activity of our old world."

Page 16 - "3. Matter, formerly regarded as inert and only able to give back the energy originally supplied to it, is, on the other hand, a colossal reservoir of energy-intra-atomic energy-which it can expend without borrowing anything from without. 4. It is from the intra-atomic energy liberated during the dissociation of matter that most of the forces in the universe are derived, and notably electricity and solar heat."

Page 19 - "To immobilize the world and the beings which inhabit it would be to immobilize time-that is to say, to cause it to vanish. If this fixedness were absolute, life would be impossible, since life implies change; but neither could anything grow old. The immortal gods who, according to the legends, never undergo change, cannot know time. For them the clock of heaven marks always the same hour. Change is therefore the true generator of time."

Page 33 - "All living things on the surface of our globe are carried along with it in its movement, and possess in consequence a considerable kinetic energy. This would appear if they were suddenly transported from one point on the globe's surface to another endowed with different velocity; for instance, from the pole to the equator. On arriving at the equator they would be hurled into space with a speed more than six times that of a railway train."

Page 40 - "The critical mind is so rare a gift that the most profound ideas and the most convincing experiments exercise no influence so long as they are not adopted by scholars enjoying the prestige of official authority."

Page 43 - "The second principle of thermodynamics, or principle of Carnot, although it has become very complicated from the introduction into it of very different things in a purely mathematical form, is nevertheless completely contained in the following enunciation given by Clausius: Heat cannot pass from a cold body to a hot without work. This is now generalizd thus: The transport of energy can only be effected by a fall in tension. This signifies that energy always goes from the point where the tension is highest to that where it is lowest. The importance of the princple of Carnot dwells in this generalization. It is applicable not only to heat but to all knoww modes of energy-calorific, thermal, electrical, or otherwise."

Page 52 - "The transformation of quantity into tension results simply from the mode of distribution of the same energy. We realize the transformation by concentrating the energy with a very small space, which amounts to raising its level above that of the zero of energy. The converse operation will transorm, on the contrary, tension into quantity. A coulomb spread over a sphere of 10,000 kilometres radius will give only a pressure of one volt. Let us spread the same quantity of electricity over a sphere of a diameter 100,000 times less-that is to say, of 100 metres, and this same quantity of electricity will produce a potential a hundred thousand times higher-that is to say, a pressure of 100,000 volts. It would be the same for any other form of energy-for instance, light."

Page 68 - "The reader who bears in my my theory of intra-atomic energy, according to which all atoms are a colossal reservoir of energy, will no doubt object that, apart from any combinattion, any body whatever is thus a reservoir of forces. But these forces

have not been utilized up to the present. Only molecular and not intra-atomic reactions are recognized by chemistry and commerce."

Pages 73-74 - "Equalities of velocity render manifestations of kinetic energy impossible. If the hunter's bullet kills the animal flying before him, it is because the velocities of the two are different. If these were equal, the bullet would evidently have no effect. The locomotive, notwithstanding its mass, can do nothing to the fly which hovers in front of it at the same rate of speed. The effects of masses, endowed with kinetic energy, on the bodies they meet, result solely from the inertia of matter, which prevents its instantaneously adopting the velocity of the elements which act upon it. If bodies were not possessed of inertia-that is to say, of resistance to movement-they would simply take the velocity of the masses striking them, and would not be destroyed by them. Kinetic energy therefore, on final analysis, represents movement which passes or tends to pass from one body to another. It is the same, moreover, with thermal energy. It manifests itself by molecular movements from a heated body to the elements of a cold body, the movements of which have less velocity. It is always movement which is transmitted in order to make itself equal with another movement, and to be in equilibrium with it."

Page 75 - "Let us suppose a universe with an invariable temperature where the sole source or energy known is that of the waterfalls coming from immense lakes situated on mountain-tops, such as one sometimes meets with in different regions of the earth. the leaned men of such a world would no doubt have discovered pretty quickly the possibility of converting into heat, light, and electricity the energy of these waterfalls, but they would also have established by experiment that they could not, without enormous leakage restore the water to its original level with the forces produced by its own flow. They would thus be led to believe that energy is a thing which is used up and lost, and that the energy of their world would be exhausted when all the water of the lakes should have descended to the plains."

Page 79 - "Experiments made in hydro-electric factories have shown that a liquid column only 2 centimetres in diameter, falling through a tube of the height of 500 metres, cannot be broken into by a violent blow from a sabre. The arm is stopped as if by a wall when it arrives at the surface of the liquid. Professor Bernard Brunhes, who witnessed this experiment, is persuaded that if the velocity of the liquid column were sufficient a cannon ball would not go through it. A layer of water a few centimetres thick, animabe by a sufficient velocity, would be as impenetrable to shells as the steel plates of an ironclad. Let us give to the above column of water the form of a vortex-ring, and we shall get an image of the particles of matter and the explanation of its ridigity. This enables us to understand how the immaterial ether, when

transformed into small vortex-rings animated by sufficient velocity, may become very material. It will be also understood that, if these whirling movements were stopped, matter would instantaneously vanish by return to the ether. Matter, which seems to give us the image of stability and repose, only exists, then, by reason of the rapidity of the rotary movement of its particles. Matter is velocity, and, as a substance animated by velocity is also energy, matter may be considered a particular form of energy. Velocity being the fundamental condition of the existence of matter, we may say that this last is born so soon as the vortex-rings of the ether have acquired, by reason of their increasing condensation, a rapidity sufficient to give them rigidity. Matter grows old when the speed of its elements slackens. It will cease to exist so soon as its particles lose their movement."

Page 86 - "Intra-atomic energy is, moreover, very stable or the world would long ago have vanished. It is even so stable that chemists considered the aggregation of energy called matter to be absolutely indestructible. We have now learnt to dissociate matter, but only in extremely feeble quantities."

Page 92 - "Bodies such as radium, thorium, etc., represent no doubt a state of old age at which all bodies must some day arrive, and which they already begin to manifest in our universe, since all matter is slightly radio-active. It would suffice for the dissociation to be fairly general and fairly rapid for an explosion to occur in the world where it was manifested."

Page 115-119 - "How can we explain the fact that from an isolated fragment of metal we can extract an apparently infinite quantity of electricity."

Page 127 - "Since the electricity generated by chemical decomposition as in batteries, and that produced by simple friction in machines, do not differ, why has the electricity of a battery produced by chemical decompositions only a tension of one or two volts, while that obtained by simple friction attains a tension twenty or thirty thousand times as much? The text-books are silent on this question."

Page 133-134 - Magnets as infinite generators.

Page 149 - "The problem of sending a pencil of parallel Hertzian waves to a distance possesses more than a theoretical interest. It is allowable to say that its solution would change the course of our civilization by rendering war impossible. The first physicist who realizes this discovery will be able to avail himself of the presence of an enemy's ironclads gathered together in a harbour to blow them up in a few minutes, from a distance of several kilometres, simply by directing on them a sheaf of electric radiations. On reaching the metal wires with which these vessels are nowadays honeycombed, this will excite an atmosphere of sparks which will at once explode the shells and torpedoes stored in their holds. With the same reflector, giving a pencil of parallel radiations, it

would not be much more difficult to cause the explosion of the stores of powder and shells contained in a fortress, or in the artillery sparks of an army corps, and finally the metal cartridges of the soldiers. Science, which at first rendered wars so deadly, would then at length have rendered them impossible, and the relations between nations would have to be established on new bases."

Page 166 - "Since I have shown that, contrary to the old belief, matter constitutes a colossal reservoir of a special energy-intra-atomic energy-it has become easy to explain how it is possible, at the expense of this energy, to obtain heat, electricity, or any other force. Without invoking any unknown phenomena, I have shown how a tiny atom contains an immense quantity of energy. By calculations needless to reproduce, I have shown that a sphere the size of a pin's head, revolving on its own axis with the speed of projection of the cathode particles, represents an amount of kinetic energy equal to that produced in an hour by fifteen hundred steam-engines of 500 horse-power each. The rotary movements attributed to the elements of matter alone explain how the particles of radio-active bodies are projected into space with a velocity of the same order as that of light."

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