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SCIENTIFIC AMERICAN SUPPLEMENT

No. 958.

For the Week Ending May 12, 1894.

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THE RICH AND THE POOR.

During the last few weeks our country has been the scene of a series of pilgrimages, all directed to the shrine of the Federal capitol, and having for their object some mysterious alleviation by governmental methods of the hardships of the poor man's life. The central idea underlying these organizations seems to be that as money is the embodiment of man's possessions and opens up to him the road to happiness on earth, and as the government possesses the right to coin money in its mints and print bills in its printing offices, that it also can be for the nonce the creator of money. The members of these pilgrimages, termed Coxey's Army, Kelly's Army and the like, propose to go to Washington, and by their presence to give so imposing a demonstration as to influence legislation in the desired direction. One scheme is to have the government issue bonds, bearing no interest and payable in installments.

Whatever one's opinion may be of the right of a man to be rich, it is far from clear how the proposed issue of bonds could be conducted so as to produce any good effect. As the world is organized and as humanity is constituted, there will always be rich and poor. The distribution of wealth may seem unjust. The deserving inventor who has worn his life out in devising improvements in mechanical things, the scientist who has worked for hours evolving in the laboratory new chemical products, the bacteriologist who finds a panacea for the most dreaded diseases, certainly rank as the benefactors of humanity; but the history of the world shows that it is precisely these classes who receive the benefit least commensurate with the value of their work, when its importance to the rest of humanity is considered. The inventor invents and patents and the capitalist makes the fortune from the invention. This is the story repeated over and over again. Yet unjust and severe as it seems, this is the definite lot of humanity, and there is no probability that the cure of inequality of fortune will ever be discovered.

The typical inventor invents because he has to, and he may hope to reap a modest reward from his work. Whether he does or does not, his very genius will not allow him to be idle. The apparent injustice has to be endured. But in spite of the communistic tendencies of the age on one side, and of the undue accumulation of wealth by the few on the other side, examples sometimes appear where the benefactor of humanity from the standpoint of scientific or mechanical advancement meets with an adequate reward. In a recent address before the old New York society, the General Society of Mechanics and Tradesmen, Mr. Abram S. Hewitt, well known from his prominence in the iron industry, as well as from his political record, gave a most graphic presentation of the results of the work of one of the world's greatest benefactors, Bessemer. We quote from the concluding portions of his address:

"You all know about the Bessemer invention of steel. It was made in 1855 by a student in his laboratory. He propounded his idea to the world, but it took fifteen years before it was successfully put in operation. I know Mr Bessemer very well. He is a modest man who never sought to make a fortune, but he has taken the rewards of his great invention, and he told me the last time I saw him in London that he had got out of his invention £2,000,000—nearly $10,000,000. The contribution which he made to the world by that invention in the saving it has effected in the ordinary operations of society is simply incalculable. If I were to say we were saving $1,000,000,000 a year in this country alone as the result of that invention applied to every branch of industry, particularly in the transportation of the goods and the products of the country, I should certainly underestimate the amount. And now I am going to say something even more surprising. Taking the world together, the saving effected by that invention is greater than the total value of all the movable capital of the world one hundred years ago.

"One man, by a single invention, has contributed to the aggregate wealth of the world more value than existed fifty years before his birth. Now he has got ten millions of dollars. It is a great sum. He will leave it to his children, who have done nothing, have contributed nothing to the acquisition of this money. Whom has he robbed? Whom will his children rob? Who would be the gainer if he had never received one penny for his great discovery? How much would the distribution of his $10,000 000 over the face of society add to the fortune of any single individual, and how much has his invention added to the fortunes of all mankind?"

Waterproofing Fabrics.

According to Holfert's process for waterproofing fabrics, the materials are first passed through a bath of gelatine, then exposed to the action of formaldehyde in a gaseous state. The gelatine is thus rendered insoluble and imparts water-resisting properties to the fabrics.

Pipe Lifting by Expansion.

An interesting illustration, to be commended to the notice of popular lecturers, of the old aphorism that "knowledge is power," as well as of the more modern definition of science as "organized common sense in regard to things," is supplied by some recent proceedings of Mr. Howe, the engineer of the Clay Cross Collieries. It is reported that some weeks ago the second pipe from the bottom of a 6½ inch rising pump main, 140 yards long and 30 tons in weight, in one of the Clay Cross pit shafts, broke off at the branch connecting it with the underground pumping engine. The whole weight of the line of piping rested upon itself, so that it was a question of how to get the broken member out and replace it. Mr. Howe decided, with the concurrence of Mr. Jackson, the manager, to lift the pipe column by the force of expansion due to steam heat. Accordingly, a cross beam was inserted in the shaft at a height of 60 yards from the bottom, bearing close against the defective main, and not far under one of the flange joints. The pipe being then empty, steam was turned into it at the bottom through a ½ inch pipe and regulating cock; and in the course of an hour the main had moved up 2½ inches at the point where the cross beam was fixed. The main was then secured to the beam by strong clamps, and as soon as the weight had been taken in this way, steam was shut off; and the pipes, contracting, began to lift the broken end from the pit bottom. The broken pipe was changed for a sound one, and steam again turned on until the clamps could be taken off. The time occupied in the operation, from first turning on the steam to restarting the pumps, was only four hours; and the operation was effected without a hitch.

Dr. Brown-Sequard's Orchitic Fluid.

The death of Dr. Brown-Sequard has served to revive in some minds an interest in his orchitic fluid, in which the great physician had himself much hope.

The *Lancet* in a recent number publishes some significant notes upon experiments with the fluid made by Dr. Guy M. Wood and Dr. A. J. Whiting, both physicians to the Hospital for the Paralyzed and Epileptic, Queen's Square, London.

The fluid used was obtained directly from Paris, through Dr. Brown-Sequard's personal kindness. The injections were hypodermic, made with a Koch's syringe, kept aseptic in absolute alcohol. The dose was from one gramme of the fluid to six grammes, and in all but three cases, diluted with an equal quantity of water. Except when the doses were large, no immediate effects were perceptible. In those cases some pain was felt at the point of injection.

Twenty-three patients were treated. In eighteen cases there was no change from the treatment; three patients were slightly better; two were worse.

At the beginning of the observations several patients said they felt better after the injections. At the suggestion of Dr. Buzzard, two women were given daily injections of two grammes of *distilled water only*, for three weeks. Both the patients declared that they *felt* decidedly better after each treatment, though of course there was no change in the physical condition.

The physicians, therefore, conclude that in all the cases treated, the sensation of being better was due to the mental effect of the injection and not to the orchitic fluid, and they do not think that the results obtained warrant any further trial of the remedy.

J. O. Davidson.

In the death of Julian Oliver Davidson, the art and publishing world has sustained a severe loss. Born in Cumberland, Maryland, in 1853, he early exhibited a talent for drawing, especially of marine and battle scenes. His pictures were characterized by life and spirit, and as an artist he soon rose into prominence. As an illustrator he was well known; he worked for the leading magazines and weekly papers. For many years Mr. Davidson designed marine views for the SCIENTIFIC AMERICAN, the last occasion being views of the Vigilant and Valkyrie, published in the issue of October 14, 1893. Mr. Davidson died at his Nyack (N. Y.) home on April 30, after an illness of several months.

Peroxide Bleaching.

This is the invention of Konigswarter & Ebell, who recommended the process for the bleaching of straw, wood, and similar fibers. To 100 liters of soft, cold water, 1,600 grammes of pure crystallized oxalic acid are added, and then 1,000 grammes of peroxide of sodium are slowly stirred in. The liquor, when this is done, will still be acid, and must be made feebly alkaline with silicate of soda or with more peroxide. The stuff to be bleached must be clean and free from grease, and is put into the alkaline bath of the mixture and kept in it until bleached at a temperature of from 90 deg. to 100 deg. F. It is then rinsed and freed from any traces of yellow in a weak acid bath, tartaric, for instance, or by slow drying in the open air. The above bath can be used over and over again, and to save time may be made stronger. An economy may also be effected by substituting sulphuric for oxalic acid.

The Role of Microbes in Society.

The *Revue Scientifique* publishes an address upon this subject, before the Society of Anthropology, in Paris, by M. L. Capitan.

Quoting from an address before the same society by the distinguished scientist Broca, he speaks of the gradual overcrowding of our planet, and of death as necessary to make room for coming generations. After showing that the decomposition of dead matter is also necessary to this preparation for new life, and that the process is the work of microbes, M. Capitan thus continues: "Microbes have an important rôle in digestion. Ordinary digestion takes place in the stomach and intestines by means of soluble ferments secreted by organic cells, which attack the foods, separate them, and make them fit to be assimilated; it is work similar to that of microbes. But the digestive tract contains great quantities of microbes constantly brought in by food. They multiply indefinitely, and play most complex roles. They necessarily take part in the digestive phenomena, as aids in the breaking up of organic compounds, and, again, they are the *only* effective agents to that end. M. Duclaux, insisting upon this point, says that certain kinds of cellulose can be attacked by microbes only; no organic juices have that power. M. Pasteur cannot conceive of the possibility of digestion where microbes do not exist.

The purely chemical work of the microbe is enormous. What we know about it is nothing in comparison with what it must be. Every kind of microbe, every race, every variety, is charged with a special function; the division of labor is pushed to the extreme limits, so that for any chemical reaction whatever to be realized, the microbe makes several attacks. Each variety takes part in the work, beginning a partial separation of the matter, which is completed by another kind, and this goes on until the organic matter is reduced to its elementary constituents, or to a state of sufficient simplicity for the plant to assimilate it. . . .

Further, as old as the world, contemporary with the first generations of vegetables, the microbes have contributed materially to the constitution and formation of the geological strata. Microbes made the peat which later became coal; they had their part in the complex work of precipitation which made the great beds of calcareous deposits; they played their part in the complex reactions which resulted in the deposits of sulphur, iron and many of the other metals. . . .

Industrially, the chemical work of microbes is often utilized by man. Two typical examples may be given. First in the preparation of indigo. It is obtained from a wood cultivated in India, Japan and Central America. This plant contains a sugar, *indiglucine*, which is removed by washing with warm water; this *indiglucine* is then submitted to special fermentation. The microbe separates it into indigotine and sucrose. The indigotine, which is white, is oxidized by the reaction due to the microbe, and is changed into indigo, with its blue color. And this preparation would be impossible without these peculiar reactions produced by microbes.

Again, the chemical action of microbes is illustrated in the preparation of opium to smoke. . . . But it is especially in the preparation of many of the most indispensable foods that certain *micro-organisms*, thus domesticated (*i. e.*, in the preparation. Tran.), show themselves incomparable chemists. Without them these different preparations would be impossible. Such is the case with bread, alcohol, wine, beer, the different milk ferments (koumiss, kephyr), cheese, sour-krout, etc.

I cannot show you in detail the part which the *micro-organisms* have in the elaboration of each of these products. Besides, you all know what characterizes bread. Yeast is the principal agent in the fermentation. There are milk ferments, and many other kinds of microbes. For alcohol, wine, and beer there are the different kinds of yeast, with the addition of various microbes and their numerous diastases, which, as the case may be, separate the molecules of starch and change them progressively, by successive separations, into dextrine, glucose and finally into alcohol; or again, change sugar into alcohol, or even, separating from the malt, make alcohol, and finally make the complex products, wine, brandy, and beer. . . . I have spoken thus at length about microbes and I have not yet presented them to you. They are, as you know, very inferior *algæ* formed of one cell, generally with an envelope. They live almost everywhere upon and in living creatures, in the soil, water, upon solids, etc., multiplying with extreme rapidity. They have very varied actions, often useful, as you have seen, or, on the contrary, hurtful, as you will soon see.

Sometimes they take a rounded form, are little spheres with a diameter of about a half thousandth of a millimeter. Sometimes they are isolated, and, again, they are in strings composed of a more or less considerable number of grains. They may present themselves in the form of little sticks from a half to one or two thousandths of a millimeter in diameter with a very variable length, thus forming, sometimes, short sticks (tuberculose), sometimes long threads (charcoal *en culture*). The little sticks are immovable, or, on the contrary, movable, rigid or curved. They may take the form of a half circle, as in the cholera microbe, or they may present themselves in a spiral form, as the microbes of intermittent fever.

They generally color easily with the aniline colors. Finally, when they are placed in a medium suitable for their culture, such as bouillon, peptonized gelatine or solidified blood serum, they multiply in great abundance. These elementary facts give you a general idea of the morphology and biology of microbes. You know them now. I have shown you how they may be useful in society. Now let us see how they are harmful.

If microbes decompose dead matter, they may also decompose living matter! Certain kinds especially have the power which is called *virulence*. They are called *pathogenes*, that is to say, they may determine the diseases. Every kind of microbe, moreover, produces a special kind of disease and has a power which varies much, according to a number of circumstances.

But the microbe cannot *alone* make the disease; the intervention of the organism of the subject in whom the disease is to develop is necessary. If you please, following the forcible comparison of Professor Bouchard, the organism is a stronghold, the microbe is the assailant, the struggle between the two is the infectious disease.

Thus the condition of the organic domain, which the microbe seeks to invade, is important. In fact, if the person is very well, he offers a great resistance to microbes. If, on the contrary, his health is not perfect, it is a stronghold poorly defended, and the danger is great for him. For, as M. Bouchard has said for a long time, a person does not become ill, except when he is already not in very good health. But there are many means for getting into bad health. One may change his health by a number of processes, which may be summed up, essentially, in two grand classes: Troubles of organic functions and disorders of tissues. Many of the processes leading to the production and development of disease are directly dependent upon various social influences. Do you wish some examples?

Wealth, like poverty, is a powerful agent in disease. The rich man, from his frequent overeating, his want of exercise, his excess of comfort, easily acquires obesity, the gout or diabetes; his kidneys, his heart, are frequently affected. The poor man, on the other hand, from want in its different forms, from overwork, exposure to inclement weather, or want of cleanliness, may suffer from various derangements of the internal organs, the lungs, the liver, the kidneys, the bowels, etc. He has, like the rich man, a special pathology in certain points and very different from the last; a pathology, moreover, due absolutely to his social condition.

The occupations create also special diseases. They may poison those who engage in them. Lead produces chronic poisoning among those who handle it (painters, printers, manufacturers of white lead); it is the same with mercury (silverers of looking glasses, gilders, hatters). Every poison produces its special effect upon the system: lead upon the kidneys, the intestines, the brain, and mercury upon the brain and the nerves. These examples might be multiplied; they show the occupation may affect the organs, create actual diseases, or induce such a state of health as to facilitate the invasion of the microbe. Is it necessary to mention that dreadful form of poisoning, alcoholism, which produces its effect upon kidneys, heart, liver, brain; alters all the internal organs and thus prepares the way for disease-producing microbes? . . .

All the natural cavities of the body opening exteriorly (the nose, mouth, alimentary canal) are filled with microbes that come from without, borne by the air or foods, and subsequently multiplying. There are even some for the skin. In the midst of these, there are others which are the remains of previous infectious diseases which have attacked the subject actually cured.

All microbes, in a normal state, live a latent life, often useful as we have seen for digestion, most often inoffensive, thanks to the resistance of the cellular lining of the organic cavities, thanks to the activity of the white globules, zealous defenders of the organism, thanks to the chemical action of organic liquids. But when various circumstances, external conditions, or internal ones, modify these elements of defense, alter the texture of linings (as in the case of poisoning from the occupation), or when one or more of the microbes take a sudden virulence, then the barriers of protection are broken, the microbe enters into the interior of the tissues, and may determine the greatest variety of diseases, from pneumonia to erysipelas, meningitis or an abscess in the liver.

The microbes which live outside the organism have equally diverse origin. We have spoken already of the innumerable varieties living in the soil, the water, and on plants which play such numerous and important roles. Certain ones may, under the right conditions, take on a disease-producing power, and determine a disease, but there are others which, disease-producing by profession, have been eliminated from diseased organisms, and instead of having succumbed have fallen into the outer world, have adapted themselves to new places and live another life, it may be in the earth or in water. They are all ready, when introduced by food, or by respiration, to penetrate anew, into a living organism, to develop there, if the circumstances are favorable, the disease which they characterize, such as is the case with the *vibrion* of cholera or the bacillus of lockjaw. . . .

To these innumerable special causes of infectious diseases, the invasion of microbes and their development in the organism, hygiene may oppose numerous means of protection or of defense. This is the role of prophylactics. On the other hand, medicine may aid the system in struggling victoriously against the microbe: this is the role of therapeutics. But upon these two points the social influences have an important bearing: the place in society of the patient may modify profoundly these preventive measures and make them effective or insufficient, according to circumstances. . . . You see, then, though I have given only a simple outline of it, that the role of microbes in society is immense.

Bad or good, hurtful or useful, all have a role which is, on the whole, indispensable to the regular evolution of society. And, however paradoxical that assertion may at first have seemed, I believe I have given you a clear demonstration, and in closing, I may formulate it thus: Society could not exist, it could not live or subsist, except by the constant intervention of microbes, the great carriers of death, but also distributers of matter, and thus the all-powerful carriers of life.

Miscellaneous Notes.

Nature reports that the Czar has authorized the trial of tea culture on the eastern borders of the Caucasus, where the temperature is about the same as that of the parts of China where the plant thrives.

Les Annalen de Physikalischen Central Observatoriums, of M. Wilds, reports that a temperature of —69·8° C. (157·64° below zero, Fah.) was registered at Werckojansk, Eastern Siberia, in February, 1892. This is the lowest temperature which has ever been registered on the surface of the earth.

The Hungarian government has established an Institute of Bacteriology at Budapest, intended to facilitate the scientific study of infectious diseases.

Natural Science deplores the fact that there is no laboratory for psychological experiments in England, and speaks of institutions of this kind which exist on the Continent. *Revue Scientifique* (Paris), commenting upon this, says "there is only one such laboratory worthy the name in France," and adds, "It is in Germany, but especially in America that these institutions are well established, and any one in England who wishes to start one must look to these two countries for his inspiration."

The University of Edinburgh has taken steps toward some notable improvements. It is to have two new halls for public ceremonials; a third one is to be built as a dormitory for the women students; a chair of public health has been endowed; and, finally, a field for athletic sports has been bought at a cost of $45,000.

The Canary Islands possess not only the most wonderful climate, but an extremely fertile soil. The only difficulty in agriculture is the want of water. It has lately been found that there are great quantities of water in cavities of the mountains of Teneriffe. An English company has undertaken to get it out. They find that boring to a depth of a hundred feet is enough to procure a large supply of water. If they succeed in getting an unlimited supply in this way, the islands, which have declined in prosperity in recent years, will probably develop greater productivity than hitherto.

Russian industries are developing with great rapidity. In the construction of the new railway train for the Czar and his suite, Russian materials were used, with the exception of axles and wheels, which were furnished by the Krupp works, at Essen. This train consisted of eleven carriages, made after American models. Unusually strong brakes were attached, enabling the train to be brought to a standstill very suddenly.

Norwegian Cooking Stove.

During the last maneuvers in Russia experiments were made with the Norwegian cooking stove, the object being to provide the troops on the march, within the least possible space of time, with warm food. The apparatus used was the ordinary camp kettle fitted into a thick felt covering. The soup or stew being placed in the kettle is raised to the boiling point, and then removed from the fire, the lid clamped down, the kettle inserted in the sheath, and the whole slung in the usual manner below the wagon. The process of stewing continues automatically, thanks to the heat retained, and even after several hours' marching the temperature does not fall below 100° Fah.—*Journal R. U. S. I.*