Extracts from an Address delivered April 12th, 1916, before the Zoological Department of the University of Chicago. By CASPER L. REDFIELD.

THE first thing I wish to call to your attention is the distinction between the foot-pound and the cubic foot. The foot-pound is used to measure work, and when work is stored it is called energy. The cubic foot is used to measure material substances, or the space in which bodies are contained. What I have to say relates to things measured by the foot-pound or corresponding unit, and not to things measured by the cubic foot.

If a man is sick he does not hire his doctor by the cubic foot. He hires him for the foot-pounds of intelligence he has. Not that we are in the habit of measuring intelligence by the foot-pound, but what I wish to direct your attention to is the fact that intelligence belongs in that class of things measured by the foot-pound and not in that class of things measured by the cubic foot.

The verb *to acquire* means to obtain by effort, by the performance of work, and work is measured in foot-pounds. If a man goes into a gymnasium he acquires strength by the exercise he takes, and the amount he acquires is measured by the foot-pounds of work he does. He will acquire more strength (muscular energy) by doing a million foot-pounds of work than by doing a thousand foot-pounds. Acquirements are also measured by time. A man who exercises regularly will acquire more dynamic development in a month than in a week, more in a year than in a month, and so on.

If an offspring is to inherit an acquirement made by the parent, the parent must make the acquirement first and get the offspring afterwards, not get the offspring first and make the acquirement afterwards. Among animals which work regularly the greatest acquirement exists in later life, hence, if acquirements are inherited, the better progeny should come from the older parents. On the other hand, if the better offspring do come from the older parents, that fact would mean the inheritance of acquirements, and mean nothing else. The reason is that age of parents represents time, and time is a factor in the measurement of work performed, and not a factor in the measurement of anything else.

It is commonly said that Weismann knocked out the doctrine of inheritance of acquirements and Lamarck's theory at the same time. Weismann did nothing of the kind, either directly or indirectly. He attacked Lamarck on the inheritance of mutilations, but if he had known anything whatever of the subject about which he pretended to give information he would have known that the assumed inheritance of mutilations had nothing to do with Lamarck's theory. He also would have known that Lamarck had distinctly stated that mutilations were not inherited.

We are told that Lamarck's theory is that the offspring inherit the effects of the action of the environment upon the parent. It is nothing of the kind. Lamarck took particular pains to caution his readers against putting such an interpretation upon anything he said.

Your text-books tell you that Lamarck's theory is "a species-forming theory." It is nothing of the kind. Lamarck says species are an artificial classification by man for convenience, but that they have no existence in nature, and have nothing to do with his theory. Lamarck's theory is a theory of the evolution of structural types by the action of habits formed in the struggle for existence, the kind of struggle being determined by the environment. Thus, animals living in water will struggle in certain ways; animals living in trees will struggle in other ways; animals living in the ground will struggle in still other ways; and so on. (See Packard's Translations.)

I am telling you these things for the purpose of pointing out to you that the doctrine which denies the inheritance of acquirements is based on an amazing amount of misinformation. It is also based on a total lack of scientific investigation of the subject. Acquirements are obtained by work, and work is measured in foot-pounds or some unit convertible into foot-pounds. No investigation of this subject can have scientific merit unless it makes some attempt to measure acquirements quantitatively, and compare such measurements with subsequently produced offspring.

A parent cannot transmit what he does not have. If he can transmit no more than he inherited, how can there be an evolution of animal powers, either mental or physical? Perhaps you think that such an increase might come by muta-

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tion or advantageous variation. But stop a moment to think what that means. A child is born with something it did not inherit from its parents! That would mean that special creation had taken place somewhere in connection with the reproductive process.

But some persons say that there has been no evolution of mental power, and they point to the men of ancient Greece as being equal to anything which has since existed. I might dispute that claim, but there is a better answer. We are not descended from Aristotle, Plato, Socrates, *et al.* Our ancestors were savages two or three thousand years ago. The fact that there were great men in ancient Greece is not evidence that we are no improvement over the savages from whom we are descended.

But it is even said that we are not inherently superior to those savages, and that the apparent superiority comes from education and accumulated information sometimes designated as social heredity. But how about another three thousand years, ten thousand years, a hundred thousand years, and so on back? If you deny all evolution of mental and physical powers, then you return immediately to the Garden of Eden story, with each kind of animal originally created equal to anything which has since existed. If you attempt to dodge the Garden of Eden story, then you admit that a parent may transmit more than he inherited. That "more" must be something acquired, or it must be some special creation associated with reproduction. Something from nothing is just as wonderful at one place as another. The issue is not dodged by removing special creation from the Garden of Eden to the germ and dividing it into small fractions so as to spread it over many generations.

If you wind up a spring you store work in it. You can get out as much work as you put in, and that work may be used to drive a clock, pump water, compress air, or do any one of many other things. If used to pump water the energy (stored work) is taken out of the spring and stored in the water. It may then be taken out of the water and stored in some other place, and so on in endless succession. There are laws relating to energy, which laws govern it in all of its transformations. But the energy which went into that spring came out of your muscles, and you may be certain that those laws

governed that energy while it was in your muscles, and on its way to and from that place.

You may concede that fact, yet think that human intelligence stands on a different footing. A mathematical calculation performed by either the human intelligence or a calculating machine is the same thing, and things which are equal to the same things are equal to each other. The energy employed to drive the calculating machine is measured in foot-pounds, and the difference between the energy going through the machine and that going through the brain is a difference in the efficiency of the apparatus, and not a difference in the essence of the energy involved.

Energy is transformable into many forms, yet it is always the same energy, and is always measurable in foot-pounds or some unit which may be transformed into foot-pounds. Heat, light, electricity, physical strength, and human intelligence are different species of the genus energy. There are specific laws for each species, and generic laws for the genus. What I am driving at is to point out to you that the evolution of physical strength and human intelligence is and must be in accordance with certain generic laws which are definite and precise things in science.

The first of these laws is to the effect that you cannot get something out of nothing. If, in the process of evolution from monad to man, we get successive generations of animals having greater and greater physical and mental power, the energy involved must necessarily have a source. That source can only be some existing form of energy. One trouble with the biological teaching of the present day is that it assumes conditions which involve a contradiction of this fundamental law known to science as the Conservation of Energy.

The second law relates to the behaviour of energy, and the only possible conditions under which it may be conveyed from its source to an available condition in man or mechanics. This law says that energy left to itself always dissipates, and can be raised to an available condition only by the performance of work. This means that if there has been an evolution of mental and physical powers at any time in the past, that evolution was necessarily the product of work performed. Unless you are prepared to denounce as unsound the fundamental laws of another science, this is a conclusion you must

accept. This second law is known to science as the Dissipation of Energy, and a large amount of the scientific progress during the past half century is based on a recognition of the soundness of this law.

The eugenists are telling us that the superior part of the population is producing an average of about a child and a half to the family, while the inferior part is producing some six or eight children to the family. That is a partial truth which may be a new discovery to the eugenists, but it is not a new phenomenon in the history of man. The same thing existed fifty and a hundred years ago; five hundred and a thousand years ago. It existed in ancient Greece, and there are indications that it existed in China at the time of Confucius.

The eugenists tell us that from the feeble-minded we get only feeble-minded, but if we are not all descended from feeble-minded ancestors, then evolution is false. Evolution tells us that we are descended from a common ancestor with the ape, and we cannot assume that common ancestor to have been mentally superior to those members of our community which we now designate as feeble-minded. Go back only twenty generations (about 600 years), and each one of us has more than a million ancestors taken from the common stock. In a population of a million there are many feeble-minded persons. But, on the test of family size, we can find them much nearer. None of us can go back far in our pedigrees without coming to large families. Under the Binet test, our eugenists would condemn their own ancestors as unfit to reproduce, and they would find those "unfit" ancestors much nearer than most of us suppose.

There is, and always has been, improvement in power capabilities from generation to generation. The most clearly defined and best recorded case is the American trotter which was developed from the three-minute trotter to the two-minute trotter in a hundred years. I have published full details of the process by which this improvement has been brought about, yet those who deny the inheritance of acquirements have deliberately shut their eyes to this definite and positive evidence, and have gone on repeating their unfounded statements.

But you need not take the evidence I have collected. You can see the same thing from the animals with which you deal.

Acquirements are obtained by the performance of work. With that in mind it can be seen that the amount of work performed per generation before reproducing by the different kinds of animals, is an accurate representation of their advancement in power capabilities. This is true for all kinds of animals, but is most easily seen in the higher animals. Man is intellectually superior to other animals simply and solely because he is mentally active more hours a day for more years before reproducing than any other animal. Increase the amount of work per generation and the race will advance. Decrease it and the race will degenerate.

Presidential Address (1): *Our Work as Psychiatrists, and its Opportunities.* By EDWARD N. BRUSH, M.D., Physician-in-Chief and Superintendent, Sheppard and Enoch Pratt Hospital; Professor of Psychiatry, University of Maryland, Baltimore, Md.; President of the American Medico-Psychological Association.

[We have received the following Address from Dr. Brush, who, knowing that we have had some difficulty in obtaining sufficient material for the Journal since the war began, kindly offered it for publication in our pages, while it will appear simultaneously in the July issue of the *American Journal of Insanity*, of which Dr. Brush is the Managing Editor. He is also the President of the *American Medico-Psychological Association* for the current year, and his views will no doubt be full of interest for his colleagues in the specialty on this side of the Atlantic.—EDITOR, *Journal of Mental Science.*]

FELLOW-MEMBERS OF THE AMERICAN MEDICO-PSYCHOLOGICAL ASSOCIATION, LADIES AND GENTLEMEN,—The Constitution of the Association requires that the President shall prepare an inaugural address, which he shall deliver at the opening session of the meeting. Beyond that requirement it does not go. It gives to the anxious President during the term of his office no hint either as to subject, matter, or manner of that address. The necessity of its preparation haunts his waking hours and troubles his sleep—and there are betwixt his