THE EVOLUTION OF IDEAS.

Science declares that ideas are the results of the same natural forces which act in organic nature; and mental phenomena are not different from other natural phenomena in kind, but only in greater complexity. Herbert Spencer says: "All impressions from moment to moment made on our organs of sense stand in direct correlation with physical forces existing externally." "But how," he continues, in another chapter of his "Principles of Philosophy," "can we interpret by the law of correlation the genesis of those thoughts and feelings, which, instead of following external stimuli, arise spontaneously? . . . The reply is, that the immediate correlates of these and other such modes of consciousness are not to be found in the agencies acting on us externally, but in certain internal agencies. The forces called vital, which we have seen to be correlates of the forces called physical, are the immediate sources of these thoughts and feelings; and are expended in producing them. . . . That no idea or feeling arises, save as a result of some physical force expended in producing it, is fast becoming a commonplace of science; and whoever duly weighs the evidence will see that nothing but an overwhelming bias in favor of preconceived theory, can explain its non-acceptance." These words of the renowned English philosopher express the opinion of all those men of science who approve the theory of "evolution," and the object of this paper is to show how the results of the scientific investigation of ideas support this theory.

Evolution in nature is always going on from the unconscious toward self-consciousness. The highest stage it has reached on our globe is man, and with him terrestrial development has arrived at a remarkable turning point. It seems not to proceed, at least for the present, in a further organic evolution, but only in a higher development of consciousness. Intellectual evolution has become predominant, and the unfolding of ideas has become more significant than the creation of new organs.

Instead of producing higher organisms, nature has given to the human species the faculty of invention. By means of this faculty man has transferred the form of the human organs, as well as their functionary and formal relations, to the instruments he invented, and the productiveness and receptiveness of the former have thereby been remarkably increased. The evolution of ideas has thus accomplished what the further development of organisms would have done.

When we study the construction of our most important instruments we discover to our astonishment that the latter are true copies of some parts of our body, and simply a further completion of them.

In the first stone hammer man has unknowingly imitated his forearm with closed fist; in the shovel and spoon we see the forearm and hollowed hand; in the saw we find a reproduction of a row of teeth; tongs represent the closing together of thumb and fingers; in the hook is a bent finger reproduced; the pencil is simply a prolongation of the forefinger; so, we see in all instruments, from the simplest to the most complicated, only an improvement and completion of the human organs; and thus we find that all the inventional thoughts of men are directed toward the same aim as that toward which organic development tends.

But here we have first to answer an objection. Some might say, that this imitation of organs was intentional, or that man may have found instruments which resembled those organs and recognized them as most useful for the purpose. Though this explanation may not seem to us satisfactory, let us take it for granted. There could yet have been no conscious imitation of *interior* organs, of which the following furnishes some beautiful examples: From the most simple magnifying glass to the compound microscope, we find nothing else but an imitation of the lens in the animal eye; and these instruments were invented long before anything was known of the anatomy of the eye; yes, even more; the invention of these instruments has helped to solve a physiological problem hitherto unexplained, and the construction of the camera obscura and the daguerreotype has taught us the composition of our own seeing apparatus. When the telescope was invented, the discovery was made that colored margins which surrounded the objects disturbed the clearness of the view. This inconvenience was overcome by constructing object lenses composed of two different kinds of glass (crown and flint glass), which rendered these instruments perfectly achromatic. What was the astonishment of scientific men, when the fact was revealed that in the human eye there are also two refractory substances, the crystalline body and the lens, which render the sight achromatic. The construction of the human ear gives us another interesting proof, and we were only able to understand it after the invention of the piano. Corti's strings are a regular graduated series of strings which correspond to the strings of the harp or the piano, and just as each of the strings of these instruments resound only when a corresponding sound strikes it, so do Corti's strings in the ear.

In the same manner the construction of the organ has given to physiology the explanation of the organ of speech, and partially explained the mechanism of the heart. The late Prof. Dove has summed up the result of these facts in the words: "We only understood the mechanism of our own organs when we had unconsciously reproduced them by the exercise of our inventional faculties."

After a careful consideration of the facts before us few will doubt that in the invention of instruments we have reproduced the human organs, though some one might suggest that this reproduction is not the result of the action of natural laws, but only the consequence of careful contemplation, and say that in nature, as well as in technics, there are mechanical problems to be solved, and as in the former success is granted by natural selection, so in the latter by industrial progress, that a reproduction of organs can scarcely be avoided, for, if in our instruments the power and usefulness of our organs are to be extended, it is only natural that we give them a corresponding form. The weakness of this reasoning will be apparent if we show that in those products of our thought, which are not the results of a mere practical tendency, and where a further completion of the human organs was out of question, in products where our intelligence had seemingly a perfectly free field for operation, we have been directed by the same laws and led by the same tendency, which is the basis of all organic development. We are speaking of the products of art. Shakespeare, in his "Winter's Tale," says "art is but nature," and Schopenhauer calls a work of art "an anticipation of that which nature intends." One of the most interesting proofs of this fact is to be found in A. Zeising's book,* in which he speaks of the "golden cut."

The "golden cut" is the name given by German mathematicians to that division of a whole into unequal parts, whereby the smaller part is related to the larger as the larger to the whole, or *vice versa*—the whole is related to the larger part as the larger to the smaller.

Zeising endeavors to show that in this law is embodied the ground principle of all formation in nature and art, where the tendency is toward the total and the beautiful. He calls this law the ideal type and normal measure of all things, and recognizes it in the morphology of animals, of plants, of crystals, in the proportions of sculpture and painting, and even in the musical proportions. It cannot be denied that this discovery is of the highest value for the study of æsthetics. Although this principle had been long recognized in nature, Zeising was the first to demonstrate that it was represented in works of art, and illustrates in a very clear manner that it forms the basis of beauty in the "Apollo of Belvedere," in the "Antinous," the "Venus of Medici," the "Venus of Praxiteles," the "Eva of Raphael," etc.

Those who accept the dogma of free will can never find a satisfactory explanation of this remarkable fact, but it is easily understood if we admit that our ideas and thoughts are produced by natural causation, and are the result of unchangeable laws.

In works of architecture the same principle is repeated, and this is an additional proof that the activity of genius and the conception of an artistic idea are only the result of natural laws pervading the artist. The measures and proportions of different Greek buildings harmonize in a remarkable manner with the law of the "golden cut." We mention only the Parthenon in Athens, the Propylæa of the Acropolis, the Erechtheum, the Theseus Temple, the Temple of Apollo Epikurios, the Temple of the Olympic Jupiter in Agrigentum, the Propylæa of Eleusis, the Temple of the Capitolinic Jupiter in Rome, the most ancient of the temples in Selinuntum, etc. We also find the law of the golden cut in Gothic architecture—in the dome of Cologne, the Cathedral of Elizabeth in Marburg, and with more or less precision it is represented in nearly all cathedrals of the world.

That the rule of the "golden cut" was not known as an æsthetical principle, but only felt instinctively, is evident from the fact that only in a few cases it has been strictly observed; in all the others it is simply approached.

And now, after having seen the invalidity of the argument of conscious imitation, let us return to the technical sciences. It cannot be denied that in these sciences consciousness plays a more important part than in merely artistic conceptions. Very often there is a prefixed tendency to be recognized in the construction of machines and instruments, which are invented to supply a deeply felt want, and most of them are the product of careful and conscious meditation. But we have already seen that *meditation* and not *consciousness* is the productive element.

The truth of this assertion can be found by a careful study of technical development, and has been perfectly well recognized by Prof. Reuleaux,† who is perhaps the most able connoisseur of machineries. Among other things he says:

"When one observes the development of the technical sciences one is tempted to believe in a perfect *self-acting* evolution of ideas. . . . Everywhere we see how one idea unfolds from the other, as the leaf from the bud or the fruit from the blossom, just as in nature everywhere each new development is the product of some previous forms."

The development of technical sciences is based upon a continuous increasing of relations between man and the external world, and is perfectly identical with organic evolution, which takes place under a further differentiation of organs with increasing adaptation.

But this is not only true of this single phase of culture. The same organic construction is to be found in the whole world of thought.

Ideas unfold and evolve one from the other, and differentiate strictly according to the law of evolution.

In the history of the human mind there is to be found a process of adaptation of conceptions to reality. In this process there is a competition, an elimination of the "unfit," that is, of the *error*; and here likewise, as in organic nature, the greater adaptation—that is, the higher truth—leads to victory. It is the old law of the "survival of the fittest." And to make this analogy more complete, and to give it the worth of a real analogy, our thoughts are not coming to appearance in an arbitrary manner, but in a consequent order. They come forth when the foundation of their existence is laid, and not singly but in groups, which bear the same general character. "Each age," says Goethe, "hovers in an atmosphere of familiar ideas, and it is quite natural that the same discoveries are made by different persons perfectly independent, yet nearly at the same time, just as in different gardens fruits of the same species fall from the trees at the same season."

When the world is ripe for certain ideas they are produced. Before each great discovery a kind of fermentation seizes the minds of humanity, and it is the task of the genius to concentrate the thoughts of his time and bring them to a conclusion.

G. G.

*A. Zeising: "Neue Lehre von den Proportionen des Menschlichen Koerpers." Leipzig, Weigel, 1854.

†Reuleaux: "Theoretische Kinematic," Braunschweig, 1875.

THE PREVENTION OF VIRULENT DISEASES.

One of the most promising discoveries, since Jenner's day, in connection with the nature and treatment of virulent disease, has recently been made by the eminent investigator of microscopic life, M. Pasteur. A full report of the investigations leading up to the discovery will be found in the SCIENTIFIC AMERICAN SUPPLEMENT. In studying the microscopic organism which is the cause of that malignant disease of poultry known as chicken cholera, M. Pasteur finds this disease to be a connecting link between those virulent diseases of man and animals known to be caused by living virus and other diseases in the virus of which life has never been demonstrated. He finds also that under suitable treatment the nature of the virus of chicken cholera may be so modified that it will no longer produce virulent disease, but only a mild disorder, which, however, protects the animal organization against the fatal disease just as cow-pox protects humanity against small pox.

In the study of the microscopic germs of chicken cholera, M. Pasteur employs a broth made of chicken flesh neutralized with potassa and sterilized by high temperature. In this liquid the organism multiplies with astonishing rapidity just as it does in the bodies of poultry. If a few drops of a cultivation of the organism be fed to chickens the disease is quickly propagated, and the infected chickens transmit the disease to others. Repeated cultivation, by sowing in fresh broth a minute quantity of infected broth, does not weaken the virulence of the germ. But by a modified cultivation, the nature of which is not disclosed, the virulence of the germ is diminished, so that when chickens are inoculated with it they are sickened but not killed. And it is found that chickens which have had the mild disease are practically incapable of taking the malignant disease. The analogy of the behavior of the mild, artificial chicken cholera, to that of cow-pox in preventing small pox, is quite complete. M. Pasteur finds further that the attenuated virus most probably keeps its character of mildness after passing through the animal organization.

The possible outcome of this discovery covers a far wider field of sanitation than at first sight appears. It gives a clew to the nature of many of the worst scourges of humanity, and holds out the promise that when the viruses of such diseases as measles, scarlet fever, typhus, plague, yellow fever, and others, have been similarly investigated, it may be possible to develop mild disorders, by means of which the more virulent forms may be greatly mitigated in severity, if not entirely stamped out.

Earthquakes and Volcanic Eruptions.

The month of July has been characterized by seismic disturbances of more or less severity over many and widely separated regions. In the fore part of the month an earthquake at the island of St. George, one of the Azores, resulted in the formation of a new island, 600 yards distant, and about 18,000 square yards in extent.

About the same time, Sunday, July 4, an unusually severe and widespread earthquake was experienced in Switzerland. Several meters of the summit of Schnebelberg, near Quarten, fell, overwhelming a large forest. Two persons were killed by falling structures.

On the 13th seismic disturbances began in the Philippine Islands, and continued for several days. On the 21st an earthquake unequaled in severity since 1824, destroyed a large part of the city of Manila and killed many of the inhabitants. All the volcanoes of the islands were in full activity.

On the 20th New Hampshire experienced an earthquake shock of considerable severity, but noticeable chiefly as a symptom of the prevailing uneasiness of Mother Earth. The same may be said of the slight volcanic outbreak at Vesuvius.

Dispatches from Panama, July 17, speak of the exceeding activity of the long silent volcano Fuego, near the city of Antigua. The heavens for miles around were filled with smoke and dust. The first outburst occurred on the night of June 29. As seen from the deck of the Pacific mail steamer Wilmington, at a distance of nearly 50 miles, the spectacle was magnificent. From the highest peak of the Fuego great columns of flame darted up into the air to a height of from 400 to 500 feet. The surrounding country to the east and south was illuminated by the tremendous glare of the flames, while to the northward and westward the clouds of dust and smoke obscured the whole country.