

SCIENCE

FRIDAY, AUGUST 23, 1912

CONTENTS

<i>The Philosophy of a Scientist:</i> PROFESSOR VICTOR C. VAUGHAN	225
<i>Transcontinental Excursion of the American Geographical Society</i>	233
<i>Investigators at the Marine Biological Laboratory</i>	235
<i>The United States Public Health Service</i> ...	236
<i>Scientific Notes and News</i>	237
<i>University and Educational News</i>	239
<i>Discussion and Correspondence:—</i>	
<i>A Key to Basin-range Structure in the Cricket Range, Utah:</i> LANCASTER D. BURLING	240
<i>Scientific Books:—</i>	
<i>Martin's Triumphs and Wonders of Modern Chemistry:</i> J. L. H. MAYER <i>on the Ctenophores of the Atlantic Coast of North America:</i> HENRY B. BIGELOW. <i>Knipe's Evolution in the Past:</i> DR. W. J. HOLLAND	241
<i>Notes on Meteorology and Climatology:—</i>	
<i>A Rainless April in England; The Recording of Earthquakes; The Atmosphere at Great Heights; Free Air Data in Forecasting; Periodicity in Pressure Variations; The Need of a Meteorological Laboratory; New Books:</i> ANDREW H. PALMER	245
<i>Special Articles:—</i>	
<i>The Physiological Significance of the Segmented Structure of the Striated Muscle Fiber:</i> PROFESSOR RALPH S. LILLIE. <i>Fertilization of the Eggs of Various Invertebrates by Ox-serum:</i> PROFESSOR JACQUES LOEB, DR. HARDOLPH WASTENEYS	247

MSS. intended for publication and books, etc., intended for review should be sent to the Editor of SCIENCE, Garrison-on-Hudson, N. Y.

THE PHILOSOPHY OF A SCIENTIST¹

It may be asked what right has a scientist to have a philosophy? He spends his days in the study of gross, material things. The geologist busies himself with the earth, the composition and the structure of its crust, the nature of its rocks and other formations, the fossil remains of geologic ages, the elevation of its mountains, and the forces that tend to level the same. These and correlated subjects furnish the material with which his mentality employs itself and upon which it exhausts itself. The astronomer goes further afield and employs his time in the study of the moon, sun and the stars, but all his activities are materialistic. The biologist concerns himself with the development and modification of the various forms of life. His field is a wide and interesting one. The physicist is engaged in the observation of mass, and the effect of forces thereon. The chemist goes into the atomic structure and arrangement of matter. The physiologist is busy with function and the pathologist with abnormal structure and function. So we might go on enumerating the varied and multiple duties of the scientist, but, after all, his range of activity is confined to material things and what does he know of the higher life? What right has he to interest himself or to offer to speak with any authority on the great problems of life? What can the scientist know about idealism? Between materialism and idealism there is supposed to be a great chasm, which no man in his right senses would

¹ A popular lecture given in the summer school at the University of Michigan, July 2, 1912.

attempt to bridge. The scientist may be a silent follower of the idealist, but has no right to make even a suggestion, and to attempt to point out the way is the height of assumption on his part. The idealist is supposed to walk on a higher plane than the poor, materialistic scientist. The former dwells in the clouds. His food is the nectar of Olympus, and he spins his raiment from the philosophical theories evolved from his inner consciousness.

That I have not misstated the attitude of the modern idealistic philosopher toward modern science is shown by the following quotation from the work entitled "The Problem of Life," by Professor Eucken, of Jena. This book secured for its author the Nobel prize in 1908. In speaking of the theory of evolution Professor Eucken says:

We are not concerned with the theory in its scientific aspect, but merely as it affects the attitude toward life. From this point of view it is of paramount importance to keep the two stages of the doctrine clearly distinct. It is mainly the theory of natural selection that has ventured to come forward with a new and original view of life. By completely assimilating man to nature, it leaves the shaping of man's life with the forces which appear to control the formation of natural types. Life is thereby robbed of all that had given it inner worth, and dignity; the form which it takes is determined solely by circumstance, and is maintained only in so far as it proves serviceable in the struggle for existence. Advance is only made when properties which chance has brought together are maintained on account of their usefulness, inherited, and in the course of time wrought into the species. But since there can be no inward appropriation of this gain, there can also be no joy in the good and beautiful for their own sake. All we win is simply an added means of self-preservation. We have already seen in Adam Smith the effect of a doctrine of mere utility in lowering the status of the inward life, and here we see it in its extreme form. The inward life loses all independent value. The only right is the right of the stronger; all humanness, in particular, all care for the weak and suffering would simply take the heart out of the struggle, and therefore be a piece of pernicious

folly. If in this blind medley of conflicting forces there be anything at all left for us to do, it can only be to make the struggle for existence as hard, persistent and ruthless as we can, so that all the unfit may be weeded out, and the process of selection be made as speedy as possible.

This is the estimate placed upon the doctrine of evolution by one of the foremost of modern philosophers. Notice that he speaks of the scientist *venturing* to suggest something bearing on the problem of life. Rash and foolish scientist, what right has he to make a suggestion concerning the higher life? He should have known that the realm of philosophy is wholly beyond the domain of science, which concerns itself with only things material. The learned author objects to completely assimilating man with nature. This implies that he thinks man, in part at least, supernatural. If so, in what particular, may we inquire? If man is not shaped by the conditions under which he is born, his ancestry, and those under which he lives, his environment, pray tell what does shape him? Why the various races and varieties? If there be something supernatural in man, something that is not determined by natural conditions, why are there physical differences, intellectual inequalities and moral deviations among different peoples and among the same nations in successive generations? How many Pasteurs, Goethes or Shakespeares has the Ethiopian produced? This supernatural part of man in which the modern philosopher believes must be very capriciously distributed, and how is the distribution determined? Is blind chance the agent, or is the distribution made by some fickle God? Professor Eucken says that the assumption that types of men are determined by natural conditions robs life of all that gives it inner worth and dignity. Types of men exist. This can not be denied. If they do not result from natural

causes, what are the supernatural agencies that bring them into existence? There are good and bad types of men, then there must be good and bad genii. The truth is, the philosophy of Professor Eucken is a mental remnant of the primitive man who believed in a geocentric universe, peopled Olympus with gods, good and bad, and filled the woods with satyrs, nymphs and fairies. If the learned author knew something of science he would be more of a philosopher. He speaks of the inner life losing all independent value if man is affected by external conditions. I infer from this that he makes the inner life the supernatural part of man. It is impossible to tell what he means by the inner life. If he means man's mentality, we know that this is affected by natural conditions. Strike a man on the head and depress his skull and his mentality is disturbed. Under the influence of such a poison as alcohol he may become insane. If by inner life he means man's morality, there again are abundant evidences that man's morality is affected by external conditions. The insane are not criminally responsible, and a man with some foreign body driven into his brain may become a liar, a thief or a murderer.

The condemnation of science by Professor Eucken for its cruelty can be explained only on the assumption that he fails utterly to comprehend the doctrine of evolution. Is the science of eugenics, whose object is to secure healthier and better parents for the unborn, cruel? Are all our efforts toward securing wholesome water, unadulterated food, hygienic housing, and, in short, the betterment of life in every possible way, cruel? Do we improve our breeds of horses, cows, dogs, etc., by turning them out without shelter in the most rigorous weather, and who proposes to improve the types of man in that way?

No philosophy evolved from the inner consciousness of man has ever done man half the good that has been secured to him by the discovery of the agents of infection. In fact no important discovery in science has failed to better the lot of man. The printing press disseminated knowledge. The discovery of illuminating gas drove crime from the streets of large cities. The telegraph and telephone have hastened the detection of the criminal. Steam and electricity are driving the wheels of the manufacturing world and distributing the products of all climes. Improved machinery is shortening the hours of labor and lifting from man's shoulders his heaviest burdens. In short, I know of no scientific discovery which has not contributed to the physical, intellectual and moral betterment of the world, and certainly this can be said of nothing else.

The foundation stone of my philosophy is the doctrine of evolution, the truth of which has been so abundantly and positively demonstrated by geological, embryological and biological evidence. I shall not attempt to establish the soundness of the theory of evolution. I consider this already done.

Through countless ages this development has been going on. The time was in the history of this planet when the conditions of temperature, moisture, etc., were such that life as we know it could not have existed. But this does not mean that life in some form did not exist. By life we mean that combination of matter and energy by which the former is endowed with the capability of growth and reproduction. Such a combination of matter and energy might have existed when the earth was a molten mass, without water upon its surface and without the present atmospheric envelope, but the life of that time, if there were any, was quite different from any

form of life as we know it. All physiologists hold to the dictum: *Omne vivum ex vivo*, and some say: *Omne vivum ab eternitate ex vivo*. However this may be, the primordial forms of life have developed into the present forms. The simple in structure and function has become more complex in both these directions. The unicellular has evolved the multicellular. The undifferentiated protoplasm, under the stimulation and guidance of natural selection and environment, forces which we with all our studies only vaguely comprehend, has been differentiated into the tissues, systems and organs possessed by the world of life as it exists to-day. Soft tissues have protected themselves with cartilaginous and bony structures. From the invertebrate the vertebrate has developed. Organs especially devoted to digestion and assimilation have been evolved. Muscles for locomotion have come into existence. The vascular systems for the distribution of blood and lymph have been slowly and gradually elaborated, and every part of the complex and highly developed animal has been placed under the control and direction of the nervous system. The highest product of this wonderful and complicated development is man. Science has not only taught, but has demonstrated, all these things. Man, though far still from perfection, has reached a stage when he has become the most powerful and direct agent in evolution. He takes the grasses of the field, the flowers of the plains, the trees of the forest, the lower animals in their native states, and makes them almost anything he wishes. By breeding and selection, by altered and improved environment, and by modification and control of the conditions of life he is able to do these things. From prehistoric times he has been cultivating, developing and improving the grains which serve him and his dependent animals as

foods. With the dog, horse and cow he has developed special breeds to suit not only his needs, but even his whims. He has filled his gardens with a profusion and variety of flowers such as unaided nature has never produced. His orchards furnish his table with luscious fruits, so attractive in appearance, so great in size and so delicious in flavor that one can hardly realize that they have come from the wild varieties. Natural selection has been largely replaced by human selection, and who shall say that this is not natural? But best of all is the fact that man is himself an animal, yes, all animal, and therefore capable of being improved by breeding, selection and improved environment. Were man, even in part, other than animal or supernatural, and not influenced by natural and controllable conditions, the hope of his improvement would not be so great. A supernatural force, if there be such, is one which man can not know, can not study, can not modify, and if such a force controls the destiny of the race, man's attempts to improve his kind must be futile. A philosophy founded upon such a belief leads nowhere, stimulates to no good deed, and is barren and dead from the start. On the other hand, the belief that man himself is the most potent factor in evolution should call out the best effort in every one interested in the welfare of his kind. If my work can make two blades of grass where only one has grown, can so improve the native grain, which barely returns the seed sown, that it will produce a hundredfold; can convert the diminutive, sour, wild apple into the large, mellow, delicious pippin; can convert the native, scraggy pony, barely subsisting on the sparse growth of his native range, into the high-bred, well-developed, spirited, intelligent horse; can change the thieving, slinking wolf that once followed the nomadic man in order to feed upon the

sparse remnants of his scanty meal, into the noble, intelligent dog that has become man's companion; above all, if my work can aid ever so little in bettering the condition of my fellow man, either in the present or in future generations; if these things be true there is every incentive to do what I may in the accomplishment of these things. Who can say that the doctrine of the descent of man from the lower animals degrades him? On the contrary, it shows what man has done even with the slight enlightenment of the past, and it points to the heights to which he may reasonably hope to climb in the future.

I believe in heredity, that like breeds like, and the good or bad in the parent will pass on to the child. This belief in heredity does not lead me to spend my time in studying ancestral records. No, I let the past take care of itself. It is gone and can not be changed. I like to think that all my good impulses come from my ancestors, and that my bad ones are due to acquired sins. But for the great lesson taught by our knowledge of heredity we should look to the future. Generations to come may make inquiry as to their ancestors, and then they may mean you or me. The young man of to-day who gives himself to drink and venery is preparing himself to be the father of degenerates, imbeciles and insane. That degeneracy is inherited there can be no doubt. Statistics collected in widely separated parts of the world show this to be true. Fortunately, good qualities are equally inheritable. Could there be a higher incentive to any one to keep himself clean physically and morally than this? If so, I have failed to hear of it. Science teaches us that our actions and even our words are parts of the environment in which those about us live and may influence them for good or ill, and may live through their effects upon others, and

through them on generations yet unborn. Yea, more, our thoughts, even though unspoken, have their part in shaping ourselves. They constitute a part and an important part of our environment. Was there ever a higher incentive to righteousness in deed and purity in mind than this? Whether I shall do a certain thing or not should not be determined by hope of future reward or by fear of future punishment, but by its effects. Some of the most atrocious deeds recorded in history have been performed under the belief that religion and God were being thereby served. Such were the tortures of the Inquisition.

The doctrine of evolution teaches that environment is a powerful factor in the modification and improvement of species, and experiments upon plants and animals have confirmed these teachings so repeatedly and so positively that no sane man can question it. My philosophy, therefore, points out a way in which I can render a real and lasting service. I will therefore give my best endeavor to improve the conditions under which men live. This should be one of the strongest motives in the work of the scientist. Indeed, it should actuate the deeds of all intelligent men and women. The old Latin proverb: "*Salus populi suprema lex est*," which I should translate: "The welfare of the people should be our highest concern," is a good motto under which we should live and labor.

Ignorance is bad environment and therefore we should labor to dispel it. Ignorance should be replaced by knowledge, and this shall make us free and strong. That knowledge which we can use is the best. As one of England's historians has said:

The knowledge which we can use is the only real knowledge; all else hangs like dust about the brain or dries up like rain drops off the stones.

The scientist, even though he be a rank materialist without any belief in the supernatural, with no thought of any personal existence beyond the grave, has his dreams of the future. He dreams of the time when the engines of destruction will be so powerful and certain in action that war will be impossible, and the world shall become one great community of enlightened, intelligent human beings, dwelling in peace and unity. He is striving not to send souls to heaven, but to convert earth into heaven. He dreams of a time when agriculture shall have been so perfected that the harvests shall supply of fruits and grains, such as the world has not yet seen, an abundance for all. He dreams of a time when there shall be no suffering or want, when every man shall labor and every man shall possess in equal abundance. He dreams of a time when there shall be no premature death, when sickness and pain have been abolished through the wisdom of man. He dreams of these things, not with the hope that he individually may participate in them, but with the joy that he may aid in their coming to those who shall live after him. It is more blessed to sow than to reap.

Science teaches, more effectually than any religion has ever done, the necessity of lending a helping hand to those in distress. The spread of infection has been a powerful agent in demonstrating to man that the condition of his less fortunate fellow is a matter of real concern to himself. Disease in the slums may spread to the palatial residences, and has shown the owner of the latter that the dweller in the former is indeed his neighbor. The typhoid bacillus finds its way from the squalid hut up the river into the great city, and visits the rich as well as the poor. Infection is an intruder against which locks and bolts furnish but slight protection. It comes in water, in milk, in food, in dust. It is

brought by mosquito, fly or other insect. We meet infection in the street, we brush against it in the street car, and we sleep in it in the Pullman. It comes to our places of business, sits by us in the restaurant, or hotel, and travels with us by both rail and water. It demonstrates the close relationship of all classes and conditions of men, and proves that no man can live to himself alone. It compels the intelligent to instruct the ignorant, and the rich to help the poor. Our knowledge of the spread of infection is the strongest factor in the socialistic movement of the day.

There is another lesson which the well-to-do should learn from science. The man who employs labor should know that the efficiency of the laborer depends upon the conditions under which he lives. His wages should be sufficient to provide for himself and those dependent upon him enough wholesome food to eat, proper housing, proper clothing, means of education for his children and some rational recreation. Many of the captains of industry have amassed great fortunes by giving to their employees a minimum wage, compelling them to live in squalor and on a starvation diet. Some of these capitalists have distributed large sums thus secured in charities, and have hoped by these gifts to be known as great philanthropists. The time is fast coming when wealth thus accumulated will be regarded as unjustly secured. It is better to pay a living wage to every workman than to distribute money obtained through the necessities of the poor in charity. Were justice more evenly and honestly practised by employers in the business world there would be less need of charity. I feel very strongly on this point. No man would think of running a costly machine or expect to get the highest efficiency out of it except under the most favorable conditions. He knows that low-

grade fuel results in low-grade work, and he recognizes the fact that proper lubrication is essential. He knows these things and employs his knowledge in working his engines, and he too often apparently forgets that the human body is a machine, the most complicated, and under favorable conditions the most efficient one in the world.

I believe in the ascent of man from lower forms of animal life, and we need not look back very far to see the low level from which he has climbed. Indeed we need not look back at all. The mass of mankind even in the civilized world is diseased, ignorant and immoral. We say that this is an enlightened age, and that we live in a civilized land, all of which is true, but enlightenment and civilization are relative terms and cover widely different conditions. Physical health has been improved in the past century. Epidemics have been held in abeyance by scientific agencies. The average life has been prolonged, and the material conditions of life have been greatly advanced. Learning is gradually extending its boundaries, and productive scholarship is reaping rich harvests, to the great benefit of the race. Scholasticism no longer dominates our educational institutions, and research is busy clearing away the jungles and draining the swamps of ignorance and superstition. Man is appreciating his moral obligations more fully than he has ever done in the past. All these things are true, but disease still takes a heavy toll; ignorance still opposes advance, and moral tyrannies are still practised. When we look down into the depths from which man has climbed, even since historical records began, and where many of our kind still linger, we shudder, but when we look up to the heights to which he may still go we are filled with hope and joy. Then when we realize that each one may contribute to the progress of the race,

the problem of life impresses upon us a hopeful seriousness, and a buoyant determination that though the task be great it is one well worth the effort.

Men are mortal, but man is immortal. The individual has only an ephemeral existence, but the germinal cell continues through all generations. The somatic man constitutes the temporary environment of the germ cell, and it is fortunate that the former has only a slight influence on the latter, but it is this slight influence which, multiplied through many generations, becomes the great and central moving force of evolution. This individual influence on the race is not confined to the direct line, but a man through his words and deeds may give direction to the growth of his neighbor, and on those to come from that neighbor. With this understanding, life is ennobled and impregnated with a divinity of which no religion has dreamed. It shows the brotherhood and interdependence of all men. It makes of the individual a unit, and an important factor in the great drama of creation. It makes the individual conscious of his duties and arms him with the means to perform them. It gives to the individual worth and dignity far beyond that conferred upon him by those philosophies the central doctrine of which is the hope of future reward, or the fear of future punishment. It is a practical, working philosophy which, when thoroughly understood and practised, will bring peace, good will, and brotherly love to all peoples of the earth. It does not lead to an imaginary heaven with streets paved with gold and precious stones, but it will bring to the earth and all that dwell therein a life of joy and righteousness.

The philosophy of science concerns itself with this world and with this life. It reaches every condition of life. It should pervade all our notions and influence all

our actions. It should determine our rules of conduct. It should stimulate the individual in making the most possible out of himself. It teaches the necessity of keeping the body in the most perfect condition, and that a sound mind is found only in a sound body, because the former is only a product of the latter. Much has been said about the influence of mind on matter, while science demonstrates the influence of matter on mind, because the two are one and indivisible. The individual who abuses his body commits a sin not only against himself, but against the race of which he is an individual unit. The man who takes a material advantage over a fellow debases himself and sins against his kind. A government which fails to secure for its humblest citizens proper and sufficient food, sanitary shelter and means for intellectual growth can not properly claim to be for the benefit of the people, nor for the advancement of the race. The failure of our own government to do equal justice to all has given rise to the present widespread discontent. Law and justice are by no means synonymous. The time will come when the unlimited inheritance of property, like that of the inheritance of power, will be regarded as a relic of ignorance and barbarism. The acquisition of valuable, natural resources such as mineral deposits and forests by individuals and corporations should no longer be permitted, and those thus held should be subject to government control. No man accumulates great wealth by his own unaided effort. One buys a large tract of land which becomes highly valuable by the extension of a city, another is able to utilize a scientific discovery, in some industry, while a third finds opportunity to employ new machinery and by these and similar means great wealth is accumulated. This is not only legitimate, but when properly done is praiseworthy.

The man who adds to the world's wealth makes life less burdensome, improves the facilities of transportation, adds to commerce, opens up new and profitable industries, increases the wages of labor and does these things without oppressing those who serve him is a benefactor to his race. The time will come when great captains of industry will be counted among the heroes of the nation, but the unlimited inheritance of wealth will not be permitted. Men will build fortunes which will not be employed to debauch their children, but will go to improve the conditions of life among the people as a whole. Intelligent men among those who have amassed great fortunes are already seeing this matter in its proper light. Mr. Carnegie has announced his desire to wisely distribute his property before his death, and the late Dr. Pearsons succeeded in distributing his millions and dying poor.

The conditions of life are compelling men to be brothers and ultimately they must largely stifle out of existence the gross forms of selfishness which still are so plainly evident. The urban resident must depend upon the city for his water supply and even the courts, so slow to progress, are beginning to recognize that the citizen has a just cause for action against the city if he or a member of his family becomes infected through the water supply. The dependence of the individual upon the community and the duty of the community to the individual are being realized now as never in the past. The relation between ignorance, poverty and squalor on the one hand and knowledge, efficiency and proper living on the other is so plainly seen that it can no longer be disregarded by those who control our governmental affairs, both general and local. The morbidity and mortality rates in the slums of some of our great cities should shame us, and since dis-

ease is always spreading from these breeding places, a selfish motive, if there be no better impulse to direct, will force municipalities to tax the rich in order to better the condition of the poor.

Man's most distinguished virtues have grown out of his worst vices. At first the strong protected himself, his dependents and his property by brute force. As his intelligence developed he secured this protection by the enactment and enforcement of law, but now this fails and he is being driven by necessity to practise humanity toward his less favored friend. The material betterment of all classes and conditions of men is demanded by the philosophy of science, and it must and will come, if not through the agency of a wise evolution, it will be reached by more costly and less humane methods.

It will be seen that my philosophy is thoroughly materialistic. I believe that man has been evolved from lower forms of animal life, that he has advanced, slowly and laboriously, with many atavistic lapses, from the brute to a condition of comparative civilization, that he will continue along this road which he has traveled through countless generations, and that this will ultimately lead the race over the mountain tops and into the promised land of human perfection. I look for this not for the individual, but for the race, of which each is a small, but an important part. I conceive the highest duty of the individual to contribute his mite to the betterment of the whole. Science teaches that what the man thinks, says and does lives after him, and influences for good or ill future generations. To me this is a higher, nobler and greater incentive to righteousness than any hope of personal reward or fear of punishment in a future life. I believe that this is a glorious world, full of great opportunities to the individual, and of unlimited

promise of development in the race. Life carries in itself the highest duties, the performance of which should not be regarded as tasks to be shirked if possible, or to be done reluctantly, but to be carried on with a spirit of thankfulness that it has fallen to the lot of the individual to be a participant in the great and glorious work of contributing to the uplift of the race. To widen the domain of knowledge, be it ever so little, to abate disease, to lessen pain and suffering, to decrease the burden of poverty, to brighten and ennoble the lives of others, to harness the forces of nature and make them subservient to man's will and contributory to his happiness, to increase the productiveness of the soil, to make man more considerate of his fellow, to appreciate and perform his duties, these are some of the things that science has done and is doing. To be even an humble and unknown worker in the great army of men who are doing these things is a privilege which should make glad the heart of any man.

VICTOR C. VAUGHAN

*THE TRANSCONTINENTAL EXCURSION OF
THE AMERICAN GEOGRAPHICAL
SOCIETY OF NEW YORK*

To celebrate the sixtieth anniversary of its founding, and the occupation of the new building which has been presented to it, the American Geographical Society of New York has planned, as has already been mentioned in *SCIENCE*, a transcontinental excursion, which is to be conducted by Professor William Morris Davis, of Harvard University. The excursion started from New York on August 22, and will end at New York on October 17 and 18, 1912. Many of the geographical societies of Europe were invited to appoint delegates to take part in the excursion. The following have accepted:

AUSTRIA

Dr. Eduard Brückner, professor of geography at the University of Vienna.