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are the great crucial points on which we may take our stand. I thank the meeting very much for the kind attention it has given to my paper.

The meeting was then adjourned.

### PROFESSOR VIRCHOW ON EVOLUTION.

The following speech was made by Professor Virchow, during the Edinburgh University Tercentenary, 1884 :—

“I should have wished to speak to you in your own language, but as I only received the invitation to this meeting on arriving in London, it was impossible for me to prepare a good address ; therefore I beg to be excused if I make my speech in German. [Professor Virchow then proceeded with his speech in German, of which the following is a translation.] In considering what to say that might be of interest to a group of students, I remembered that I would be speaking not only to Scotland, but to the whole English-speaking world. I knew that great subjects were discussed in your university, in the wide range of which the teachings of this school were largely in accordance with my own. Among the matters which have a common interest for us, I am in such cordial sympathy with you that there is only one topic on which there may seem to have been some disturbance in the happy relations which subsist between us. You will allow me to speak to you on the position which I am supposed to have taken up towards the teachings of Darwin. The opinions which I expressed here, in some English publications, been much misunderstood. I never was hostile to Darwin, never have said that Darwinism was a scientific impossibility. But at that time, when I pronounced my opinion on Darwinism at the Association of German Naturalists at Munich, I was convinced, and still am, that the development which it had taken in Germany was extreme and arbitrary. Allow me to state to you the reasons on which I founded my opinions. Firstly, Darwinism was interpreted in Germany as including the question of the first origin in life, not merely its manner of propagation. Whoever investigates the subject of development, comes upon the question of the creation of life. This was not a new question. It is the old *generatio equivoca*, or *Epigenesis*. Does life arise from a peculiar arrangement of inorganic atoms under certain conditions ? We can imagine oxygen, hydrogen, carbon, and nitrogen coming together to form albumen, and that out of the albumen there was produced a living cell. All this is possible ; but the highest possibility is only a speculation, and cannot be admitted as the basis of a doctrine. In science it is not hypotheses that decide, but facts ; we arrive at truth only by investigation and experiment. I need not say that this demand of science for proof, instead of speculation, was long ago made in England. Ever since the time of Bacon it has had a home amongst you. We may concede that *generatio equivoca* is a logical possibility. But it is important for you students always to bear in mind the great distinctions between the construction of logical possibilities and their application in practical life. If you try to shape your conduct simply according to logical possibilities, you will often find yourself coming into violent conflict with the stern facts of existence. Let me give you an illustration. In recent times, the fact of the presence of minute organisms giving rise to important processes has been recognised, not only in medicine, but in connexion with agriculture, and various industries. It was of the utmost importance to determine whether these organisms were originated *de novo* in the decomposing bodies, or were produced by similar pre-existing organisms, and introduced from without. A century ago it was possible to admit the spontaneous generation of microbia. But here sits M. Pasteur, the man who has demonstrated by means of direct experiment that, in spite of all logical possibility, all known

microbia found in decaying matter are derived from similar ancestors. No man would now be justified in practical life in acting on the possibility of a *generati equivoca* of microbia. A physician who finds himself in presence of infectious disease among his patients, or an agriculturist whose crops are blighted, or a man engaged in the production of alcohol or sugar by fermentation, must set himself to discover what brings about the changes that he has to deal with; he must see that organisms are there which have been imported from without, and must then inquire whence they had been derived. The physician who has to combat an epidemic, dare not act if the germ were spontaneously produced in any patient. Such is the difference between logical possibilities and the practical work of daily life. Every teacher of science must lead his students to suppose that each living being that he meets must have had a father and a mother, or at least one or other of them; and every scientific conclusion maintains that one generation is legitimately descended from another precisely similar. That was one consideration that led me to warn my fellow-countrymen against developing a system out of logical possibilities. At the very time when we were getting free from the chains of former dogma, we seemed to be in danger of forging new ones for ourselves.

“The second question concerning Darwinism had regard to the descent of man, whether from apes or some other vertebrate animal. Was there anywhere a pro-anthropos? In regard to this question, I thought that the existence of such a precursor of man was a logical possibility, perhaps a probability. Only I found, to begin with, that it was a purely speculative question; not one raised by any observed phenomenon. No pro-anthropos had ever been discovered; not even a fragment of him. I had myself long been specially occupied in making pre-historic investigations to get near the primitive man. When I began these studies, twenty years ago, there was a general disposition to arrive at this discovery. Everybody who found a skull in a cave or a bone in the fissure of a rock, thought he had got a bit of him. I wish you specially to notice that the smaller the fragment of skull, the easier it was to make it out to be the skull of the pro-anthropos. It was never thought of where the entire skull was in hand. When the upper part of the cranium alone—the calvarium without the face and the base, as in the case of the Neanderthal skull,—was discovered, it was easy, by changing its horizontal position, by elevating either the anterior or posterior part, to give the impression that it had belonged either to a being of a superior or inferior race. You can make the experiment with any calvarium. If you make a series of diagrams of skulls, placing them over each other, you may make them appear similar or dissimilar, according as you choose one or another fixed point for bringing them into relation. I should like to impress upon you that every discovery of that kind should be received with caution and scrutiny. In my judgment no skull hitherto discovered can be regarded as that of a predecessor of man. In the course of the last fifteen years we have had opportunity to examine skulls of all the various races of mankind,—even of the most savage tribes—and among them all no group has been observed differing in its essential characters from the general human type. So that I must say that an anthropological teacher has not occasion to speak of a pro-anthropos except as a matter of speculation. But speculation in general is unprofitable. As Goethe says,—‘A speculating fellow is like a beast on a barren heath led about by the Evil Spirit.’ The day before I gave the address in Munich to which I have referred, Haeckel had gone so far as to propose to introduce into our schools a new system of religious instruction based upon the doctrine of the ‘Descent of Man’; and I still think it necessary to guard against the danger of constructing systems of doctrine out of possibilities, and making these the basis of general education.”