THE Local Government Board is of opinion that the sewage difficulty at Brentford, Isleworth, &c., would be overcome if those places united in obtaining a general suburban plan by which the sewage would be discharged into the sea.

PROFESSOR MURIE has resigned the chair of Anatomy in the Edinburgh Veterinary College; and the trustees of the late Professor Dick, with whom the right of appointment lies, are taking steps to fill the vacancy.

THE Home Secretary has issued a circular condemnatory of the employment of policemen as inspectors of nuisances under the Public Health Act. Such duties must be discontinued by the officers from the 31st inst.

Correspondence.

"Audi alteram partem."

DR. BELL PETTIGREW ON VITALITY.

To the Editor of THE LANCET.

SIR,—I have read with equal surprise and regret two letters—the one by Dr. Beale, the other by Dr. Ross—which appeared under the above heading in THE LANCET of the 22nd and 29th November.

In the first letter Dr. Beale avers I have misrepresented him, and in the second Dr. Ross affirms I have misrepresented Huxley, Tyndall, and Haeckel.

As this is a subject concerning which there may be considerable diversity of opinion, I think it proper simply to restate the facts, in order that your readers may judge for themselves. In my lecture "On the Relations of Plants and Animals to Inorganic Matter and on the Interaction of the Vital and Physical Forces," published in THE LANCET of November 15th, I make the following statement:—"The vital forces transform matter, but do not destroy it. In like manner they modify but do not destroy the physical forces with which that matter is indissolubly associated." The part of the statement to which Dr. Beale objects is that given in italics.

In his letter to THE LANCET (Nov. 22nd), Dr. Beale observes that some of my remarks would certainly lead my readers to conclude that in his (Dr. Beale's) opinion vital force really did destroy the forces which actuate ordinary non-living matter. Now, such, I reiterate, is my reading of the following passages from Dr. Beale's work, entitled "Life Theories and Religious Thought."

"Force (i.e., physical force) is actually opposed to construction, and before anything is built up, the tendencies of force must be overcome by formative agency or power..... The vital power transcends altogether physical forces." (*Op. cit.*, pp. 6, 78.) "The living is altogether different from the non-living, and the former in no way involves the existence of the latter." (*Op. cit.*, p. 77.) "The conviction has been pressed on my mind [Dr. Beale's] that vital phenomena must be referred to the influence of an agency distinct from the physical forces of Nature..... This overcomes, and in a moment, all the ordinary attractions, affinities, and other properties of material molecules, and in a manner with which there is nothing comparable in the non-living world." (*Op. cit.*, p. 82.) "We may therefore still regard life as transcending mere matter and its forces." (*Op. cit.*, p. 39.) "Regarded from a merely physico-chemical or, as some would say, scientific standpoint, the production of every living thing is indeed preternatural, inasmuch as the process cannot be explained by any law of nature yet explained." (*Op. cit.*, p. 19.)

It may be that the above passages convey to my mind an impression different from that which Dr. Beale wishes them to convey, but from Dr. Beale's letter it appears that others beside myself have misinterpreted him, for he writes:—"I have been over and over again inferentially accused of believing and teaching absurdities, which have been neither believed nor taught by any person during the last fifty

years." I hope it is not with Dr. Beale as with the famous Talleyrand, who regarded language, not as the exponent of thought, but as the medium or vehicle by which thought was to be concealed.

One of the points which I endeavoured to establish in my lecture was that *the vital forces work upon and through the physical forces* in building up a plant or animal, in the same way that they work upon and through inorganic matter. In this respect, as the foregoing quotations will show, I differ from Dr. Beale. My words are:—"Life, energy, and matter are equally distinct. Matter may be inert, or it may move under the influence of force, physical or vital. The physical and vital forces, however, are not to be confounded. An automaton is not an animal. While the vital and physical forces are independent, they are nevertheless correlated—i.e., the vital forces work in the same direction, and through the physical ones. A living organism builds itself up in accordance with natural laws, and avails itself equally of inorganic matter and physical force. The life supplies only part of the matter and force employed in building up an organism. The life, for example, appropriates and assimilates matter, but in doing this it does not necessarily interfere with capillarity, chemical affinity, gravitation, osmosis, or any of those influences or forces which regulate the distribution of matter in time and space. On the contrary, these are the instruments by which it makes itself known and felt. While living matter may and must be contra-distinguished from dead matter, there is no antagonism between them. What lives now dies hereafter, and the dead particles of a disorganised animal and plant may be, and frequently are, resuscitated. This arrangement equally adapts the organic world for the inorganic, and the converse. A living organism is incessantly taking in new and giving off old particles; it is a mysterious highway along which innumerable organic and inorganic atoms pass in the economy of an individual and in the natural order of events."

The next point to which Dr. Beale addresses himself is as to the *non-identity* of protoplasm and bioplasm; yet in the third edition of his work on "Protoplasm" (p. 188) he states:—"The word *protoplasm* has by some writers been made to stand for *living matter* or *bioplasm* only. It is, I think, possible that, after some years have passed, *protoplasm* may be restricted to *living matter* only. The term will then become synonymous with *bioplasm* or *living matter*, in which case the latter words may be given up." In my lecture I characterise protoplasm and bioplasm as *elementary life-stuffs*, and in this connexion the following passage occurs:—"Analogous in many respects to the protoplasm of Huxley is the bioplasm of Beale." To this passage Dr. Beale takes exception; nevertheless in his letter he remarks, "Bioplasm is analogous to certain forms of protoplasm only." Surely this is not a contradiction of my statement, but a corroboration of it.

Dr. Beale adds that his bioplasm is in no sense identical with protoplasm; that protoplasm is by no means *always undifferentiated*, and that his bioplasm *cannot be otherwise*. I certainly state in my lecture that bioplasm, according to Beale, is *undifferentiated*, and in this sense identical with protoplasm as defined by Huxley. So far as the absence of differentiation is concerned, I think I am fairly entitled to make this statement.

To say that protoplasm is by no means *always undifferentiated* is a mere quibble, for this want of differentiation is the distinguishing feature of protoplasm in its ordinary acceptation.

Huxley, in his "Physical Basis of Life," when speaking of protoplasm, states "that there is some one kind of matter which is common to all living beings, and that their endless diversities are bound together by a physical as well as an ideal unity" (Lay Sermon, &c., p. 133). He adds (p. 134), that there is a single physical basis of life which pervades the whole living world, and that this basis, which is protoplasm, has a threefold unity—viz., a unity of power or faculty, a unity of form, and a unity of substantial composition. Now this threefold unity, if it means anything, means, I apprehend, as I stated in my lecture, absence of differentiation.

As regards the non-differentiation of protoplasm and bioplasm, it is to be remarked that this is a mere assertion. It does not follow that because ultimate chemical analysis and the microscope fail to reveal structure, that therefore pro-

toplasm and bioplasm are structureless. The fact that all the tissues are developed from protoplasm, bioplasm, or other analogous germinal life-stuff, is a strong presumptive proof that both are differentiated, and this is one of the points on which I insisted in my lecture. Indeed, Dr. Beale is aware of a certain degree of differentiation in his bioplasm; for if I remember rightly, he states that in well-fed bioplasm a nucleus appears. Several of his figures, moreover, (*vide* Bioplasm and Protoplasm) convey to my mind a distinct impression of differentiation. In like manner Huxley speaks of protoplasm as simple or *nucleated*.

Dr. Beale in his letter proceeds: "I do not affirm that bioplasm is a *product* of vital forces. Bioplasm is not, according to me, the *same always and everywhere*." If, however, as I have endeavoured to show from Dr. Beale's own writings, "force (i.e., physical force) is actually opposed to construction, and must be overcome by *formative agency*," then it follows that bioplasm is and can only be the product of the *vital forces*. If, furthermore, as Dr. Beale avers, bioplasm is absolutely structureless, what exception can be taken to the statement that *it is the same always and everywhere*? His words are: "Bioplasm or living matter is *always transparent, colourless, and, as far as can be ascertained by examination with the highest powers, perfectly structureless, and it exhibits these same characters in everything that lives and at every period of existence*." ("Protoplasm," 3rd edit., p. 199.) Dr. Beale would probably reply that bioplasm acts differently in different cases; but this, in my opinion, is rather to be regarded as a proof that his bioplasm is differentiated, although he fails to perceive the differentiation by the microscope, *unless in the case of well-fed bioplasm*.

Dr. Beale, as your readers are doubtless aware, divides animal bodies into *living* or forming, and *dead* or formed matter, the former being *structureless*, the latter *having a structure*. The living and dead matter, according to him, are separated by a sharp line, and can be detected microscopically both in health and disease. The *dead or formed matter* in adult animals and in man, in Dr. Beale's opinion, amounts to *more than four-fifths of the whole*. ("Protoplasm," 3rd edition, pp. 187, 198, 199.) I fail to perceive the sharp line which Dr. Beale seeks to establish between the *living* and *non-living*, and between the *structureless* and that *having a structure*. In either case it appears to me the one glides into the other, an opinion in part corroborated by Dr. Beale's own works. Thus, in Fig. 4, Plate vii. ("Protoplasm," 3rd edition, p. 224), the living matter is represented as passing into the non-living by a series of concentric rings, which indicate a gradual transition; and in Fig. 1, Plate v., of the same work, the living and dead matter (if the colour which is produced by artificial staining be eliminated) are delineated as structurally resembling each other. In fact, the living is the more differentiated of the two, from its possessing in some cases a nucleus and in others nucleoli. I especially dissent from Dr. Beale's doctrine, that a living adult animal is *more than four-fifths dead*. What power, one might reasonably inquire, would the living fifth have to drag about the dead four-fifths? Fancy a man, when he takes a walk, carrying four other men, equally heavy with himself, on his back!

Dr. Beale's final assertion runs as follows: "I do not claim for bioplasm similar properties to those claimed by Huxley for his protoplasm." I presume I am correct in stating that the bioplasm of Beale and the protoplasm of Huxley are germinal or elementary life-stuffs uniformly diffused in plants and animals, and that from these elementary life-stuffs, according to Beale and Huxley, all the tissues of plants and animals proceed. If so, then it appears to me that Beale does in reality claim for his bioplasm what Huxley claims for his protoplasm.

So much for Dr. Beale's letter. Permit me, in conclusion, to refer very briefly to that of Dr. Ross.

Dr. Ross voluntarily constitutes himself the champion of Huxley, Tyndall, and Haeckel. From his mode of procedure I gravely doubt whether those gentlemen would have commissioned him to undertake their defence if they had been apprised of his intention. Dr. Ross states that the *unity* for which Huxley contends is converted in my hands into *identity*; and that the unity of Huxley is *perfectly compatible with an infinite number of special modifications*. Now if, as Huxley states in his "Physical Basis of Life," protoplasm is characterised by a threefold unity—

namely, a unity of power or faculty, a unity of form, and a unity of substantial composition—then I maintain, notwithstanding Dr. Ross's assertion to the contrary, that there is a oneness or, what is the same thing, *identity* in protoplasm. If, on the other hand, protoplasm admits, as Dr. Ross states, of an indefinite number of special modifications, either as regards its substance, form, or faculty, then I humbly submit that *the unity of protoplasm is destroyed*; modification in this sense being neither more nor less than differentiation. In reality, and as stated in my lecture, there are good grounds for believing that both protoplasm and bioplasm are *differentiated*.

Dr. Ross's analogy regarding the unity of science and the identity of chemistry, physics, and biology, is simply unintelligible. Dr. Ross, with a lenience which I do not crave at his hands, attributes my misrepresentation of Professor Huxley's views to my receiving my impressions, not from Huxley's own writings, but from those writings as epitomised by Dr. Hutchison Stirling. I beg to state that I am perfectly familiar with Professor Huxley's "Physical Basis of Life," and that I adopted Dr. Stirling's epitome of Huxley's "Lay Sermon" in my lecture simply because the exposition there given is remarkable at once for its lucidity and its brevity. I desire, moreover, to state in this connexion that I entirely agree with Dr. Stirling in his estimate of protoplasm as set forth in his exhaustive work on that subject. Dr. Stirling has published a very able and in every sense satisfactory reply to Professor Huxley's essay "On Yeast"—a circumstance which precludes my saying more on this point.

Dr. Ross informs us that he has been reading Haeckel's "Generelle Morphologie," that Haeckel contends for the *unity of God in nature*, and that I have placed Haeckel's philosophy in a false light. Now, I wish to inform Dr. Ross that, whatever Haeckel contends for in his "Generelle Morphologie," in his "Natürliche Schöpfungsgeschichte" the following passage occurs, and that the passage in question not only separates God from his works, but virtually denies the existence of God altogether. The passage freely translated, and as given in my lecture, runs as follows:—"The homogeneous, viscid, plasma substance, which singly and alone formed the bodies of the first organisms, and even at this day quite alone forms them in the case of the *moneres*, or simplest amoebic forms, is analogous to the tenacious and viscid planetary substance which contains the elements and substance of the young earth, as well as of the other glowing world bodies. In both cases the *form of the creation happened, not through the capricious [literally fidgety] interference of a personal Creator, but through the original power of matter fashioning itself*. Attraction and repulsion, centripetal force and centrifugal force, condensation and rarefaction of the material particles, are the only creative powers, which at this point lay the foundations of the complicated structure of creation."

Closely analogous if not identical with the foregoing is the annexed passage from Tyndall. In the region beyond the microscope limit, observes Tyndall, "the poles of the atoms are arranged, that tendency is given to their powers, so that when these poles and powers have free action, and proper stimulus in a suitable environment, they determine first the germ, and afterwards the complete organism." ("Use and Limit of the Imagination in Science," p. 40.)

I trust, Sir, that Drs. Beale and Ross will consider themselves sufficiently answered in what I now write, as want of time will prevent my saying anything more on the subject.

I am, Sir, yours very truly,

J. BELL PETTIGREW.

Royal College of Surgeons of Edinburgh, Dec. 4th, 1873.

THE "VICTOR EMANUEL."

To the Editor of THE LANCET.

SIR,—Will you allow me to make a few comments on your very admirable Report on the above vessel?

While I cordially acknowledge the correctness of your Commissioner's criticism, I venture to think that if he will be good enough to regard the arrangements by the light of some information, of which he could not have been aware when he wrote the Report, he will perceive that the defects he has indicated are more apparent than real.