Facts and Arguments

OPPOSED TO

DR. BENNETT'S THEORY OF ORGANISATION.

BY

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DR. BENNETT deprecates further discussion until the whole of his lectures are published; but as this theory is not a new one put forward for the first time by a young observer, as most of the statements have been repeatedly made, as the same facts and arguments have been advanced before, and many of the drawings now being published have been already used for illustrating similar observations, there seems to me no sufficient reason for postponing the discussion already commenced; and if the forthcoming lectures contain as many statements open to discussion as those which have already appeared, the task of criticism would be too great to attempt. Nor would it be just to the author to raise objections so long after the statements which called them forth had appeared.

Moreover, when a public teacher of deservedly high repute, and an examiner in one of our great universities, makes such vague statements as the following, "*the molecules of the ovary first coalesce to form the ovum*"—"after fecundation the *spermatozooids* and *germinal vesicle disintegrate* and form *histolytic molecules*,"—it seems only right to ask at once for further explanation, for it is doubtful if the author means literally what he says. What evidence has he in favour of the view he has expressed? I am not aware of any observations by Dr. Bennett, or by any other observer, which tend in any way to show that the ovum is formed by the *coalescence of the molecules of the ovary*, or that *spermatozooids* and *germinal vesicles disintegrate* to form *molecules*.

Again, under the head of "practical applications," Dr. Bennett says,—"*The molecular theory must ultimately constitute the basis for the arts of horticulture, agriculture, and medicine. Thus, vegetables and animals grow by the juxtaposition of molecules which are introduced into the economy in the fluid form. This fluid holds in solution the particles of which the different textures consist. These are deposited, and so increase of bulk takes place.*" It would seem that every sentence here requires further explanation; and I can see no logical connection between the first and those that succeed it.

Dr. Bennett, not content with publishing his own doctrine, asserts that by his view several conflicting theories are reconciled, and at once proceeds to combine ideas which are quite incompatible with each other. He accepts completely contradictory statements, and himself makes assertions so opposite to each other, that both cannot be correct.

If vegetables and animals, as Dr. Bennett asserts, grow by the juxtaposition of molecules, such molecules must exist as positive particles. If in solution, they are no longer molecules. Dr. Bennett must accept his own definition of a molecule as "*a minute body seen*," "*a visible molecule*;" or he must admit, with other observers in the present day, that living matter absorbs substances in solution, and converts these into matter of the same, or into matter of a different, kind. If the matter is in a state of *solution* when it comes into contact with the living mass there can be no *juxtaposition of molecules*, and Dr. Bennett agrees in this matter with other observers.

With regard to the formation of vibriones, Dr. Bennett says that his assertion that molecules united to form the minute filaments is an inference, like my statement that the particles divided. The latter is a fact generally admitted by observers here and on the continent, and to be *seen* in whole classes of organisms. The former is a statement, in making which, I believe, Dr. Bennett stands quite alone.

Dr. Bennett says living organisms may be formed in one way, and multiply in another;—"Having been produced by precipitation, they may increase by absorption or imbibition of nutritive fluids." Now there is, in such a number of cases, incontrovertible evidence that a living mass does increase in size by the absorption of nutritive fluid, and that it does multiply by a portion of the living matter becoming separated, or moving away from the general mass, or by the division of the mass into two parts, that we are quite justified in concluding that living matter *always* increases in the same manner, and living particles *always* multiply in the same way.

There is, therefore, no reason for assuming that molecules become aggregated together to produce nuclei and cells, for the observed facts can be accounted for in a much more simple manner. That living matter always increases by absorbing nutritive pabulum in a state of solution, and that every living particle springs from a preëxisting living particle, are generalisations justified by observation.

I shall conclude this paper by drawing attention to Dr. Bennett's observations upon the use of high powers. Since many of the drawings and observations now being published by Dr. Bennett were made, vast improvements have been carried out in microscopes and magnifying-glasses, and new methods of observation have been introduced. Dr. Bennett maintains that in rare cases only has he gained any advantage by using powers varying from 700 to 1200 linear. I would simply observe in answer to this—

1. That it has been proved that points can be seen by the use of high powers which are not visible by a power of 250 diameters, and I shall be happy to show specimens in proof of this assertion to any one.

2. It is a fact, that for purposes of class illustration a power of 700 linear can be used quite readily. Objects under such a magnifying power were seen by classes of upwards of one hundred persons in London nearly two years ago.

3. There is no difficulty in proving that, by the use of very high powers and special modes of preparation, facts bearing in a most important manner on the mode of growth and multiplication of living particles can be demonstrated which cannot be seen

with powers in ordinary use; and there is every reason to believe that by improved means of inquiry new and valuable facts will be elicited.

The difference in mere dimension may be illustrated by the following figures of the same circle variously magnified; from which it must be obvious that the higher degrees of enlargement must give a clearer insight into the most minute recesses of structure than the lower powers used by Dr. Bennett, it being understood that the loss in definition bears no proportion to the augmentation of area.

Molecules less than the 1-6000th and 1-20000th of an inch, magnified 250 linear.

Molecules of about 1-4000th and 1-20000th of an inch in diameter, magnified 700 linear.

Molecules of the 1-4000th and less than the 1-20000th of an inch, magnified 1800 linear.

Molecules of the same diameter, magnified 3000 linear. The engraver has made the smaller circle too wide by nearly one-third of its diameter.

Vibriones, magnified 1700 linear.

Vibriones and vegetable growths in epithelium of the mouth, magnified 3000 linear.

The one-thousandth of an English inch, magnified 250 linear.

The one-thousandth of an English inch, magnified 3000 linear.
This line should have been exactly three inches in length.

It is only just to Messrs. Powell and Lealand that I should state here most distinctly that the high powers made by them, and magnifying from 1700 to 1800 linear with the low eye-piece, are thoroughly practical working glasses. That extremely delicate instruments of any kind rather confuse and discourage than assist those who are just beginning to learn, is certain; but this is no argument against

their use by those who have been working for years. Better and higher powers and improved processes of preparation are clearly the means by which alone this branch of inquiry can be advanced.

Now, if molecules have united to form the vibriones represented in the last figure but one, the molecules were *certainly invisible* even to a power of 3000 diameters. The smallest of these organisms is less than the 1-100,000th of an inch in diameter. Particles considerably larger than this are quite invisible under a power magnifying 250 linear. It is certain, therefore, that if this particle were formed by the aggregation of smaller particles, these must have been quite invisible by the powers employed by Dr. Bennett; and since I can at least prove by direct observation that living particles of this size (1-100,000th of an inch in diameter) *do not coalesce or become aggregated* to form larger masses (*compound molecules*), I may affirm that this process cannot occur in the case of particles so large as those figured by Dr. Bennett.

TRANSFORMATION OF UREA INTO CYANIDE OF AMMONIUM. M. Fleury effected this change (*Comptes Rendus*, t. lv., p. 519) by heating urea with an excess of bisulphide of carbon. The products were carbonic acid and sulphocyanide of ammonium ($C^2H^4N^2O^2 + CS^2 = CO^2 + NH^4.C^2NS^2$). He has not perfectly succeeded in forming urea from sulphocyanide of ammonium.

ALUMINIUM BRONZE. In the supplementary number to vol. xxiv of the *Philosophical Magazine*, just published, is an article by Lieutenant-Colonel A. Strange, on the properties and present value of aluminium bronze, an alloy consisting of ten parts of aluminium and 90 of copper. Its tensile strength is stated at 73,185lbs. per square inch, being more than double the breaking-strain of gun-metal, and 1,185lbs. more than the average tenacity of cast steel. Its resistance to compression is 132,416lbs. to the square inch; that of cast iron being 115,542lbs. This alloy may be drawn out under the hammer almost to a needle-point at a red heat. Its rigidity is about three times that of gun-metal, and 44 times that of brass; it is less affected by change of temperature than either of the latter; it may be cast with extraordinary facility into any shape; it does not clog the file, and yields fine elastic shavings on the lathe. It tarnishes much less readily in the air than any other metal or alloy used for astronomical instruments, and will receive the finest graduation possible. It is extremely elastic, can be rolled into sheet metal, or also hammered and drawn, and seems admirably adapted for the tubular parts of astronomical instruments. Its specific gravity is 7.689, nearly the same as that of wrought iron. To make this alloy extremely pure, copper should be used; the best is copper deposited by electricity; but since that kind is very expensive, the next best is copper from Lake Superior, which makes an alloy of excellent quality. The ordinary coppers of commerce generally fail, owing, it is said, chiefly to the presence of iron, which appears to be specially prejudicial. Another precaution is to remelt the alloy two or three times. The first melting, in the proportions above stated, produces an alloy of extreme brittleness; but each successive melting, up to a certain point determined by the working, and particularly the forging properties of the metal, improves its tenacity and strength. The present price of English made 10 per cent. aluminium bronze is 6s. 6d. per lb., or four or five times the price of gun-metal; but as a much smaller quantity of the new alloy would give the same strength, the cost of ordinance made of it would not be very considerably increased. (*Galignani's Messenger*.)