by Dr. Beale and myself. He says the molecules increase by absorption till they arrive at a certain size, and then divide. How he explains the formation of the filaments I do not know. But the molecules are formed first, and the filaments last; hence the latter must be produced from the former, in some way. To render my views intelligible, I have numbered what I conceive to be the different stages of growth; and I would ask Dr. Beale if, when the development has reached No. 2, the molecules divide, how it is the filaments can form at all. Surely a constant division of molecules at that period would be opposed to the formation of Nos. 4, 5, and 6. But it may frequently be seen that No. 3 is composed of molecules of exactly the same size as those of No. 2, which are floating loose—a fact in favour of the molecules coalescing, rather than dividing, as then they would be half their original size. My view, therefore, is, that the smaller molecules, although they may increase by imbibition of fluids, have yet a constant tendency to aggregate together and melt into one another. No. 3 is not a proof of No. 2 dividing, but of two molecules coalescing; and when they unite, they form No. 4. Two or more of these uniting form Nos. 5 and 6. When a similar process to this goes on in mineral bodies, as shown by Mr. Rainey, it cannot suggest division, but union; and this for the obvious reason, that the former would lead to disintegration; whereas it can be seen in one case, as in the other, that development is the result. In short, in the same manner as a tube is formed by a coalescence of cells, so is this minute vibratile filament formed by the coalescence of molecules. It may be argued, however, that each molecule elongates itself; that is, No. 2 is converted into No. 4; this into Nos. 5 and 6; and that No. 3 are spores or ova, caused by the disintegration of No. 6. This view, however, is opposed by the fact that Nos. 1, 2, and 3 can be seen *before* Nos. 4, 5, and 6 are produced. Of this I have satisfied myself by frequent examinations of animal and vegetable infusions; and cannot, therefore, resist the conclusion that the development is such as I have described.

If, as Dr. Beale alleges, every one of my future lectures is likely to contain as many statements open to discussion as those which have appeared, it strengthens my conviction in the propriety of delaying further controversy until all are published. For although the task of criticism, as he thinks, would then be too great, I cannot help thinking that the labour of reply would be much diminished. Unless Dr. Beale, therefore, abandons generalities and assertions, and becomes more particular in his "facts and arguments", I cannot promise to continue the explanations to which he invites me.

DISCOVERY OF SKELETONS. A sensation has been created at Guildford, and for several miles round, in consequence of the discovery of five skeletons on a piece of land about a mile from Guildford. The skeletons were discovered by a man who has been trenching the ground and getting flints. They were each lying in a hole, or sort of rough vault, dug out of the chalk. On the breast of one was a dagger or knife. The bones were much decayed, but one of the skulls was in a remarkable state of preservation, as were the whole of the teeth. The skeletons have been examined by Mr. Ross, surgeon, of Guildford, who has given it as his opinion that two were old men, two middle-aged, and one a young man. The bodies were all lying east and west.

Short Clinical Lectures

ON

THE FIRST PRINCIPLES OF MEDICINE.

Delivered at King's College Hospital.

BY

LIONEL S. BEALE, M.B., F.R.S.,

FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS; PROFESSOR OF PHYSIOLOGY AND OF GENERAL AND MORBID ANATOMY IN KING'S COLLEGE, LONDON; PHYSICIAN TO KING'S COLLEGE HOSPITAL; HONORARY FELLOW OF KING'S COLLEGE; ETC.

I.—SOME OBSERVATIONS ON THE NATURE OF CERTAIN HEALTHY AND MORBID CHANGES, AND ON COUNTERIRRITATION.

[Concluded from page 184.]

COUNTERIRRITATION has nothing whatever to do with allopathy, or any other special system. It rests upon a principle which, I shall now endeavour to show, is thoroughly sound, and confirmed by some of the most recent and most exact observations.

Let us, then, consider how a blister applied to the skin can produce any beneficial effect in a case where a quantity of pus, mucus, and fluid, are being formed upon the surface of the mucous membrane of the bronchial tubes—in a case of chronic catarrh. I shall not discuss the effects of moxa, the actual cautery, and the more violent forms of counter-irritation, in this lecture.

As to the above morbid condition, we know—

1. That the vessels generally of the mucous membrane are congested; that it contains more blood than in the healthy state. The muscular walls of the small arteries are relaxed; the elastic capillaries distended with blood. Their thin, transparent, permeable walls, being stretched, are necessarily thinner, and more permeable to certain fluid parts of the blood. A greater quantity of soluble matters, therefore, escapes through the vascular walls than in a normal state.

2. Much of this increased quantity of fluid is taken up by the epithelial cells. The young cells especially, being supplied with a greater quantity of nutrient matter, grow faster. The masses of germinal matter (nuclei) increase, divide, and subdivide; and the process proceeds so rapidly, that there is no time for the conversion of the oldest outer portion into the formed matter corresponding to the wall of the cell, as always occurs in normal nutrition. A vast number of imperfectly formed epithelial cells and pus-cuscles result. The more or less viscid material which surrounds these is all that represents the more hardened substance which forms the walls of epithelial cells generally, and gives to the healthy structure its characteristic properties and regularity of arrangement.

With regard to the influence of counterirritation, we must bear in mind—

1. That, generally, the afferent nerves distributed to the skin may influence, through the centre into which they are implanted, the efferent fibres distributed to the vessels of an organ lying beneath and perhaps at a considerable distance. It is possible, therefore, that the calibre of the small arteries dis-

tributed to the mucous membrane of the bronchial tubes may be diminished in consequence of the terminal network of afferent fibres distributed to the skin being influenced by the counterirritation.*

2. In consequence of this contraction of the arteries, the walls of the capillaries would be relieved from the pressure of the blood; and, provided their elasticity was not permanently destroyed, they would recoil, and the blood they contained would be driven on to the veins. The effusion of fluid would be diminished. The cells would increase more slowly, and time would be allowed for the production of formed material (cell-wall) around each.

3. Crude matters in the blood may be taken up by cells which are multiplying with abnormal rapidity in any part of the body. Hence, when the cuticular cells are placed under conditions which facilitate their multiplication—that is, when they are supplied with an increased supply of pabulum—they grow very fast, and may separate from the blood materials which would otherwise form the pabulum of pus-cells that were multiplying upon the surface of the mucous membrane of the bronchial tubes. Thus, the increased nutrition in the latter situation would diminish while this state would be established in the skin.

Hence, counterirritation employed in such a case may act beneficially in two ways. First, by exciting through the afferent nerves in the skin an impression by which the efferent nerves distributed to the vessels of the mucous membrane are caused to contract, and thus a diminution in the supply of blood results; the direct consequence of this diminished supply of pabulum being a slower multiplication of the pus and imperfectly formed epithelial cells. In consequence of the increased flow of blood to the skin, the young cells of the cuticle grow and multiply at the expense of the pabulum, which would otherwise have gone to feed the structures formed on the surface of the mucous membrane. Secondly, such an increased action being established in the deep layers of the epidermis, crude materials in the blood, which would otherwise have been taken up by the pus on the mucous membrane, are appropriated here.

By giving diuretics and sudorifics in such a case, you promote increased action of the kidneys and skin, and the cells of these organs take up the crude pabulum, which has been accumulating in the blood; and thus, in another way, it is diverted from the mucous membrane of the bronchial tubes, and removed from the organism in the most rapid possible manner.

In this way the beneficial action of counterirritation may be explained.

But, if you have not permitted yourselves to be too much influenced by theoretical considerations, you will have felt inclined to say, ere this, "but counterirritation, applied directly to the skin or indirectly to the kidneys and other emunctories, is not the only thing to be thought of in the treatment of

an ordinary case of chronic bronchitis, where a quantity of secretion is being formed upon the mucous membrane of the larger and smaller bronchial tubes."

Nor will counterirritation always relieve permanently; for it not unfrequently happens that the discharge of sputum increases in spite of the application of a blister; and, as the blister, if kept open, often exhausts a patient, you know we have recourse to turpentine stupes (turpentine sprinkled on flannel which has been soaked in hot water and wrung out nearly dry), because we can apply them every day, and twice a day if we desire it, with much of the benefit and with none of the exhausting effects of a large blister.

There is then another point which, although not connected with the subject of counterirritation, is so important that it must never be lost sight of in the treatment of such cases. Just at this time of year, we have many cases of chronic winter cough in the wards, and of these the great majority would remain in the hospital for months, if we only acted upon the principle of counterirritation, and some of the patients would die. In these cases, we have to administer support, and frequently to give alcohol; but I shall postpone the consideration of this part of the treatment until I have discussed some points of interest in connection with pneumonia, as the principles upon which the beneficial effects of alcohol may be accounted for, and the principles which guide us in administering it in both these affections of the respiratory apparatus, are precisely the same.

BEES. The *Agriculteur* contains the following remarks on these singular insects:—Bees do not pass the winter in a state of stupefaction, nor do they sleep much longer during that season than in any other; all that depends on the work they have to do. There are at all seasons some working bees alive and active in a hive, and at the time when provisions are being got in there are many at work day and night without taking any sleep at all. Their slumbers is very light at all times, for they sleep with their eyes open; the slightest noise, a vivid light, or a current of air, is enough to awaken them; but the warmer the hive is the easier it is for them to sleep. Hence they consume much less honey in a hive situated in a quiet place, little exposed to light and air, than in one more exposed. But if the outer temperature rises very high, this favours the laying of their eggs, and then a large quantity of honey is consumed. It is, therefore, easy to explain why in beehives placed close to each other the consumption of honey is different during winter, and this is a circumstance not to be neglected, because colonies which before winter seemed to have provisions enough to last them all through the month of March may be reduced to extremities before the end of January, in which case the agriculturist must come to their assistance. If the bees have been able to enjoy an excursion or two since Christmas they will easily partake of the liquid food, which may be offered them in a cup placed inside the hive, but if not, the food so administered may cause dysentery. To avoid this, honey-combs full of honey should be cut out of other hives where the supply is plentiful and transplanted into needy ones. This delicate operation is performed in a cellar, by the light of a lantern, and with the aid of smoke. The colonies thus assisted must be left in the cellar, if it be not too damp, until a fine day comes to allow of their flying out a little. The hives from which the honey-combs have been taken must also be left in the cellar for twenty-four hours at least, during which the bees feed on the honey that has exuded during the operation.

* Even in the substance of fibrous and other tissues I have demonstrated numerous very fine nerve-fibres, which are independent of the dark-bordered fibres. The fine fibres above referred to are numerous in the fibrous tissues, even of the frog; and in tissues which contain truly sensitive fibres, they are also to be demonstrated. I believe them to be the afferent fibres of the sympathetic ganglia; the vaso-motor nerves distributed to the muscular coat of the small arteries being the efferent fibres of the same ganglia. (See papers on the "Ultimate Distribution of Nerve-Fibres," in course of publication in my *Archives*.)