In whose heart do the consequences of this pericarditis most rapidly induce enlargement? Not in the well-fed and well-clothed; but at the same weakly time, in the same weakly sex, and under the same debilitating circumstances as the original lesion occurred.

Cancers and other tumours are found of quickest growth and most frequently in the least lively bodies, in the least lively parts, in the idle uterus, in the unused breast, in the cellular tissue, in scars, in parts half killed by wounds, injuries, or previous disease.

Take now the second question, and let us concede the possibility, that, while the general vitality of the individual is lessened, some part might exhibit an extra amount. But morbid processes are not evidences of it; they rather resemble developments of a lower form of life; their products, though abundant, are less vital than the normal growth whose place they take; their existence is temporary, and "they are not capable of becoming permanent constituents of the body, or of lasting as long as the individual." (Virchow's *Cellular Pathology*, p. 456.) Examine a patient with thickened heart during life, and the pulse does not strike your finger vigorously, the apex of the organ does not beat sharply against the ribs; indeed, the thicker it becomes, the less powerful is both pulse and beat, and the less actively does the blood course through the vessels. Examine it after death, and you will seldom fail to find a pale tissue with microscopical evidences of commencing fatty degeneration. Still more evident is the same degenerative tendency in cancer. The tissue of malignant tumours, directly it ceases to grow rapidly, begins to decay, to shrink, and be converted into fat. It is difficult to imagine local strength or local excess of life producing such a weakling crop.

In cancer, truly, there is a continuous reproduction of new foci of growth, a new progeny of prolific cells, which certainly does look like an extension of local life over a larger space, if not of the production of fresh local life. But when we should reflect that the highest and most vital function of nutritive growth is the retention of the form of the body or its separate parts; that in morbid augmentations of size this is lost; the regulating and forming power is absent, and the more so the more morbid and the larger the augmentation is.

The formlessness of cancers and of so-called hypertrophic tissues refers them to a lower grade of organic life than normal growth.

Size proves nothing; surely the professor would not maintain that there is more vitality in a jelly-fish than in a sprat, in a mushroom than in a flea.

This is not a mere question of verbal criticism or Sorbonnic controversy; it is a matter of life and death to our patients. If we treat cases of pneumonic consolidation by weakening life, by bleeding *coup sur coup*, by antimony, by starvation, we are doing our best to kill them; if we supply life by food, warmth, moisture, etc., we are doing our best to save them. If Dr. Beale tries to "weaken the life of a cancer" in the same way, it will grow all the quicker; if he will give the patient tonics, food, oil, and other restoratives, it is much more likely to become dormant.

Dr. Beale says that "few will agree" with me. He should not have used the future tense; for I fully

expect that soon not only all the class he was addressing, but the professor himself, will cordially agree with the theses he has made me responsible for. They must daily become more and more the guide to medical practice, and I should be glad to see them in the hands of teachers more influential than myself. In the meantime, I do not think he ought to have objected that they are "not supported by observations"; for I have done my best by illustrations from the patients at the time under the eyes of my pupils, and have appended twenty-seven lectures thus illustrated to the Introductory on which he comments.

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.

II.

ON THE VITAL CHANGES OCCURRING IN THE MUCUS-CORPUSCLE.

IN my last lecture, I was compelled to speak of living cells, changes occurring during *life*, *vital* phenomena, etc. It is right, therefore, that I should endeavour to explain what I mean by a *living* cell. I ought to tell you what goes on in a living cell, and how this living cell gives rise to other living cells. As long as our views upon these fundamental questions remain unsettled, we shall be unable to give an intelligible account of the simplest changes occurring in the very simplest structures in health or disease.

The words *life*, *vitality*, *vital* power, are used so vaguely and so carelessly in speaking of a patient's state, that it is my duty to attempt, at least, to describe to you what meaning I attach to them. Moreover, these terms have been used in very different senses. They have been applied to the organism as a whole, as well as to the separate elementary parts or cells of which the tissues are composed. Our life may be destroyed, but many of our tissues may exhibit vital actions for some time afterwards. Many of our tissues live longer than we ourselves live. In this lecture I restrict myself to the consideration of the *vital* changes which take place in individual "cells."

I have shown that a cell always consists of *living matter*, and matter that *has lived* (of germinal matter and formed matter), and that no structure exists *which is composed entirely of living matter*.

It is true that, in the present state of knowledge, we cannot explain how some of the simplest phy-

biological changes which occur in the body in health take place. Nor have we much positive knowledge even of the actual phenomena which occur in some of those states, which, though scarcely to be called morbid, nevertheless can be distinguished from those characteristic of health. For example, how ignorant are we of the precise order of the occurrence, and of the exact relation to each other, of the changes which take place in the course of a common cold. We do not know how the very unpleasant chilly sensation which marks its accession is produced; neither are we acquainted with the condition of the blood which precedes and is undoubtedly connected with the dry congested state of the mucous membrane; nor are the precise causes of the increased secretion which soon takes place from the nasal or bronchial mucous surface accurately determined.

If, however, the changes which occur upon the surface of the mucous membrane be carefully watched, many highly important facts which have no slight bearing upon the question of the nature of vital changes generally, will be revealed. And we can actually demonstrate the transition from normal structure of a very simple kind, to what is spoken of as a morbid product.

Every one knows that upon the surface of the mucous membrane of the air-passages, even in health, there is a small quantity of a soft viscid matter generally termed *mucus*. This mucus, said to be *secreted* by the mucous membrane, contains certain oval or spherical cells or corpuscles, which are transparent and granular. From the change of form which takes place in them, it is certain that the matter of which they are composed is almost diffuent. These corpuscles or cells are *mucous corpuscles*. They have no cell-wall. They are embedded in, and separated from each other by, a more or less transparent, viscid, tenacious substance termed *mucus*. This viscid mucus bears to the corpuscles the same relation that the matrix of cartilage bears to the so-called cells, or the fibrous tissue of tendon to its "nuclei," and it is considered by many to be an *intercellular substance*.

The specific character of the mucus depends upon the presence of a peculiar substance called *mucin*, which exhibits certain well-known chemical characters. Now, neither mucus nor mucin can be made from albumen or any other constituent of the blood, lymph, or chyle; nor does it exist ready-formed in those fluids; nor can it be prepared artificially. What is, then, the origin of this peculiar substance characteristic of mucus? Its elements must be, directly or indirectly, derived from the blood. It never exists without the corpuscles, and when it increases in quantity the corpuscles are found in increased number. There is, therefore, reason to infer that the formation of the mucus is in some way connected with the presence of the corpuscles. You may have masses of germinal matter without the tenacious mucus; but you cannot have mucus without the masses of germinal matter being present at the time of its formation. This fact has never yet been explained by those who still maintain that the so-called intercellular substance is formed by changes taking place in an exuded plasma independently of nuclei or cells (germinal matter).

Moreover, it is important to observe that the chemical characters and physical properties of the

mucus are not dependent upon the life of the corpuscles. The germinal matter of the mucus-corpuscles may be living and active, or dead and even disintegrated, without any observable immediate change upon the viscid mucus, so that it would appear that the mucus-corpuscles exert no direct influence upon the mucus *after its formation*.

Mucus, which is formed in health in very small quantity, is produced more rapidly and in larger amount in a slight cold or catarrh; but it still retains its transparency. If, however, the catarrhal state increase in severity, the mucus becomes more opaque. It is formed still faster, so that in the course of an hour more than a thousand times as much material, possessing definite chemical characters, may be produced upon the surface of the membrane, as is formed by it in the perfectly healthy state, which existed perhaps but two or three days previously. Examination will show that the opacity is due to the increased number of the granular corpuscles it contains, just as the creamlike appearance of laudable pus depends upon the multitude of corpuscles suspended in the fluid.

If you examine a little transparent mucus from the nose or windpipe upon a warm slide immediately after its removal, and under a very high power (not less than 1200 diameters), you will observe some very important facts which bear upon the general question of *life, growth, and formation*.

You see a great many of the corpuscles I have alluded to, which vary somewhat in shape and size; but their form is generally oval, their outline even, and most are about the one-thousandth of an inch in their longest diameter. I will not discuss whether they are cells, nuclei, or corpuscles; but will call them masses of living or germinal matter, because I shall show you that they are alive and that from them new corpuscles are formed. These bodies, like pus-corpuscles, the "nuclei" of epithelial cells, and fibrous tissues, etc., are coloured by carmine.

Let us watch very carefully one of the oval masses of germinal matter under a power of 3000 diameters. It seems to be composed of soft semitransparent matter, which exhibits delicate spherical particles varying in size in every part. These particles are in constant motion, and the movements are like those so well known in the salivary corpuscles. About the central part, two or more nuclei will be observed. These appear smoother than the rest of the mass; but even in them, indications of the existence of smaller spherical particles may be discerned with a power magnifying 3000 diameters when the light is well arranged.

In a few moments, an oscillation of the particles is observed at some portion of the circumference of the mass. Then one or many bulgings occur, and parts of the circumference become quite uneven by the formation of a number of little processes which move from the general mass, and often assume the form of little spherules which still remain attached by narrow pedicles to the general mass. Such changes occur at different points of the circumference, and from time to time some of the protrusions recede into the mass. Occasionally two or more processes coalesce, and a ring may be momentarily produced at some part of the circumference.

[To be continued.]