both natural and artificial sunlight for these cases, but the exposures must be short and as free from heat rays as possible. That is to say, the treatment by natural sunlight should be given in the early morning, and the mercury-vapour lamp used when artificial sunlight is administered. I have treated pulmonary cases for seven years on these principles, and in no case has the treatment brought on hæmoptysis or any uncontrollable reaction.

EXERCISE.

Let us now pass on to the important subject of the function of exercise in sanatorium routine. Dr. Walthers, at the Nordrach Sanatorium, in 1904, described the beneficial results obtained from walking exercises. These were prescribed up to twenty miles a day. Sir Almoth Wright accounted for these good results by his theory of auto-inoculation, and then Dr. Marcus Paterson carried the scheme further by introducing graduated labour into treatment. The objections to the treatment were :—

(1) That the work would cause hæmoptysis.

(2) That the exertion would stimulate the disease into an uncontrollable activity.

Experience has shown that these fears were unfounded, and considerable success was obtained.

Now let me try and explain briefly the underlying principle in this important treatment.

When a body, which we will call the host, becomes infected by any organism, it attempts to eliminate it and to render it harmless by producing a substance which is antagonistic to the invader. This antibody will neutralise the harmful effects of the bacteria, and if the resistance of the host is good, a little more antibody than is actually needed to balance the harmful poison of the invader will be formed. This may be stored up for a varying length of time, and will act as a reserve in case of emergency, or in case of another attack by a fresh dose of the infecting organism. It will, in other words, create some immunity towards the infection. Now, if the general condition of the host is below par and the resistance to infection is low, the amount of antibody formed will not be enough to neutralise the harmful effects of the bacteria, so that constitutional symptoms, such as fever, rapid pulse, etc., will arise from the neutralised toxins in the host and the disease will progress.

It is in this state that the patient suffering from active pulmonary tuberculosis generally comes for treatment, and it is obvious that the first thing we have to do is to raise his natural resistance so that he can manufacture sufficient antibody to neutralise the toxins being produced by the infecting tubercle bacilli. This is done by allowing his body to devote the whole of its energies to this important work. All unnecessary movement and all external excitement must be avoided, for these mean a waste of energy. The patient is therefore placed on what is known as *absolute rest.*

Under these conditions the body gradually recovers its powers of producing antibody until the time comes when the toxins of the disease are being neutralised. This is made evident by the temperature and pulse falling to normal.

A balance has now been effected, but it is obvious that the patient cannot remain on absolute rest all his life, but the process of taking him off absolute rest is most difficult and requires considerable care and attention. For what will happen if it is done too quickly? The sudden amount of exercise and movement will stimulate the tuberculous lesion to pour toxins into the host more rapidly and in greater quantity than it is possible for the slowly recovering body to produce antibodies, the balance will be upset, there will be a free amount of unneutralised toxin in the body, and the temperature and pulse will go up, and the symptoms of activity will recommence.

It is therefore necessary to take the patient off absolute rest by very gradual stages so that the toxins are not allowed to accumulate in excess of the antitoxins or antibodies.

If, on the other hand, we do not increase movements and exercise rapidly enough, treatment is unduly prolonged, and we run the risk of the patient becoming irritable and melancholy. But there is a far more important reason than this. When a slight increase in movement is allowed the tuberculous lesion is stimulated and a small quantity of toxin is poured out into the system. The patient often, being on absolute rest and reducing his temperature to normal, is able to deal with this toxin and neutralise it, and, even more than that, his body is stimulated to make a little excess of antibody which may be stored away as a deposit account.

The next slight increase in exercise comes along and a similar process occurs, so that not only is the balance between the toxins and antibodies kept, but also is, as it were, a deposit account formed which will form a foundation to protect the individual in the future.

So, little by little, the amount of exercise is increased, always being controlled by records of temperature and pulse: First through the stages by which the patient passes from absolute rest to getting up all day; then through the walks from half-mile to six miles a day; and finally from very light work, such as carrying a small basket with earth or picking up paper litter, to heavy work, such as wheeling a barrow, mowing and rolling lawns and digging.

Now, what happens if the patient is made to work too hard or put on too high a grade? The tuberculous lesion is stimulated and pours out toxins to a greater extent than can be controlled by the body, and there is an excess in the system and the temperature will rise.

In order to restore the balance, the patient must be placed back on absolute rest, and, as soon as equilibrium has been established and the temperature and pulse are normal, he is rather rapidly passed through the stages and grades as before.

You will see that by this treatment each increase of exercise causes the patient to auto-inoculate himself, and the body responds by building up a resistance to the disease.

Now how does this treatment work out in practice? One of the difficulties is the personality of the patients. So much depends on their co-operation and adherence to instructions.

Some will work too strenuously in spite of a carefully-thought-out system of grades, and the results will be as I have just described.

Others will slack and pretend that they have done the required amount of work, so that on reviewing the case one assumes that he can carry out that particular grade satisfactorily and therefore increases the amount of exercises. The patient will probably attempt this as he feels strong, but owing to the fact that he slacked at the lower grade, and has not received his dose of auto-inoculation which that grade would have given him, his body has not attained the amount of resistance to protect him from the strain of the higher grade. His balance will, therefore, be upset and toxins will become in excess with the usual train of symptoms.

There is also a certain element of monotony in graduated labour which it is difficult to avoid, as only a certain class of work can be given to patients on a particular grade.

It is essential to explain to the patients, as far as possible, the reason for these exercises, a task which is not easy, for some feel that they are being exploited for the benefit of the institution and cannot conceive that work is a beneficial form of treatment.

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