

circulation better than the best massages, and admirably restores the musculature. This restoration of the muscles is probably due to the continuous tonic action on the muscle fibre consequent upon the vibratory shock which the solar radiations determine in the close network of sensory nerve-endings of the skin.

By restoring to the muscles their original firmness and tone the sun-cure re-establishes or reinforces the action of the muscles on the bony levers, and favours, by an eminently physiological process, the return of articular function. The action of the sun is also felt on the ligaments, and manifestly stimulates the recalcification of the entire bony skeleton. This characteristic, when I had pointed out from the beginning of my work, not only for tuberculosis but also for rickets, has been brought to light again by the remarkable researches of Hess and his collaborators, Huldshinski, Lesné, etc.

#### The Tonic Action of the Sun.

The tonic action of the sun manifests itself also on the thoracic and abdominal organs. The air and sun-bath, particularly at an altitude, revives the appetite, stimulates the digestive functions and gives new life to the vital forces. Under its influence the number of red blood corpuscles increases, as well as the hæmoglobin content of the blood. The blood formula improves, and the metabolic exchanges become more active. The blood is transformed, in some way, by the light absorbed into a reservoir of radiant energy. Carried throughout the organism, it stimulates the intracellular mechanisms of oxidation and reduction, thereby modifying its general metabolism, increasing its power of resistance and making it, by a natural immunisation, a better instrument for the cure of tuberculosis. Finally, I would point out the favourable action of the sun on the internal secretions; the therapeutic power of the sun on affections of endocrine origin proves the stimulating and regulating action of the radiations on the hormones (internal secretions).

While, then, heliotherapy may be considered the best general treatment of surgical tuberculosis, it also constitutes, as I have already said, the perfect local treatment, thanks to the analgesic, bactericidal and sclerogenic action of the sun's rays. Combined with immobilisation and extension, it rapidly diminishes and finally banishes the pain in all forms of tuberculous osteo-arthritis. This is also true of peritonitis and cystitis, when sunlight is carefully dosed. Further, the solar radiations cicatrise chronic wounds resistant to other treatment and provides for them the ideal dressing, destroying, as it does, the infecting bacteria better than the best antiseptics, while leaving uninjured the cellular resistance. This powerful sclerosing action of the sun is not limited to superficial foci; bone and joint lesions, however deep, and at whatever stage of their evolution, react to heliotherapy.

Our radiographic controls covering about 50,000 plates prove that no bone lesion escapes its action. In Pott's disease, whatever may be its position, one sees the progressive sclerosis of extensive vertebral lesions, the disappearance of the accompanying cold abscesses or the calcification of their remains: solid blocks are building up, inter-vertebral bridges are formed, and these latter provide a more efficient aid to consolidation than the most perfect bone-graft. In hip disease, whether in adult or child, even when the acetabulum, the head and often the neck show signs of extensive destruction, shown on an X-ray plate by a cloud obscuring the outlines of the articulation, one sees the gradual re-appearance of order out of this chaos. A new joint cavity, a new head form by degress, and their outlines, at first confused, take on an ever-increasing precision. The zone of demarcation becomes increasingly clear, and the atrophied parts are the seat of an intense

recalcification. In other cases, in which the femur has perforated the caseous floor of the acetabulum, the X-ray plate marks the stages of reconstruction of a strong partition of trabecular structure, rough at first, but later compact and regular. A new articular cavity is formed, so perfectly sclerosed and delimited that the femoral head attains an unhoped-for functional adaptation. We have witnessed similar and equally unhoped-for transformations in the X-ray pictures of tuberculous osteo-arthritis of the knee, shoulder, elbow and wrist. In the knee, for instance, even when an osteo-arthritis has destroyed the cartilages and articular surfaces, the reconstruction of the eroded surfaces and cartilages is frequent, and we have seen it go as far as *restitutio ad integrum*.

In bad cases of spina ventosa, we have seen entirely destroyed phalanges show, after cure, a structure so dense and compact that one could not distinguish them from their normal fellows. We have also a series of plates showing the successive phases of the spontaneous elimination of sequestra, thus demonstrating the natural process of demarcation, which it is in the interests of the organism to establish between the healthy and the diseased parts.

#### Influence on the Patient's Morale.

The sun-cure at an altitude is not only the best treatment for surgical tuberculosis, but exercises also a valuable psychotherapeutic influence on the patient's morale. This is particularly the case when it is combined, as it is usually in the majority of our establishments, with regular and methodical manual occupation.

Guided by this principle, that in surgical tuberculosis absolutely rigid immobilisation is an error prejudicial to the organic defence, we first replaced, as we have already seen, the unwieldy plaster cast with simple apparatus, which immobilises the diseased articulation only, giving freedom to the other joints. Subsequently we endeavoured to develop the specific resistance of every patient, concomitantly with his general resistance, by encouraging the practice of manual work, progressively and carefully adapted to each individual. It soon became evident that this manual occupation was a real therapeutic factor in the cure of tuberculosis; and we were thus led to recommend the work-cure, strictly individualised, as a general measure capable of rendering valuable aid, and the results have been every year more convincing. The work-cure is, of course, carried on in the sun whenever possible, but is suitable for any weather. Further, it has a double advantage, moral and material. It is a powerful protection against boredom, that disease of the soul, as Dr. Vigné says "a serious disease, though it has no name in pathology." Besides its therapeutic and moral influence, the work-cure offers to our poor patients a by no means negligible financial aid. Carving, lace-making, basket work, ornamentation on tin and leather, typewriting, top-making, etc., such are the principal occupations of our surgical cases, according to their individual tastes and aptitudes. The financial result of their work is by no means negligible; a sale, organised in February, 1926, of the things made by our patients and convalescents, yielded the respectable total of 10,000 francs, of which every penny was divided among the workers. We prescribe also this work habit, manual and intellectual, for the children in our clinics. Lessons are given to all our children, whether bed-cases or not (except at the beginning of treatment, when such as are weak or feverish are excused) on the galleries open to the sun and air. This breaks the monotony of the cure, gives an aim to the long hours of leisure and an interest to life, and encourages in the children a healthy emulation.

The morale of our patients is wonderfully sustained by the regular use of the sun-bath. The cases of surgical tuberculosis that come to the mountain present for the

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