circumstances of the case, and the improved means at our disposal, we could calculate with certainty on avoidance of putrefaction. I venture to draw special attention to the use of the spray. In every wound treated antiseptically, two things are always to be attended to: first, to leave the wound free from living putrefactive organisms, and, second, to employ such an external dressing as shall securely prevent the entrance of such organisms at any subsequent period of the case. The latter point has, in most cases, been for a long time past satisfactorily accomplished; but the former, till we used the spray, was always a matter of more or less uncertainty. A floating germ might enter during the operation into some cellular interstice among the tissues, and, becoming surrounded with a clot of blood, might escape the action of the antiseptic lotion with which the wound was washed, and, retaining its vitality, might subsequently propagate its kind, and spread putrefactive fermentation through the wound. But by help of the spray we operate in an antiseptic atmosphere, and effectually prevent putrefactive organisms from ever entering the wound alive. We thus dispense with the necessity for washing the wound at all with an antiseptic lotion, and in the particular case above related, not even the vapour of carbolic acid penetrated into the deeper parts of the wounds, which were thus left as free from irritation as if they had been made subcutaneously.

The spray is also of the greatest value during the stitching of such wounds as require it, and rids us of the troublesome and uncertain process of distending the wound with lotion by means of a syringe, after the introduction of the last suture. In the changing of dressings, also, the spray is in some cases, and especially in stumps after amputation, a great element of security.

Revision of the proof (Jan. 11, 1871) affords me the opportunity of giving another report of the progress of the case. On dressing the limb yesterday, after an interval of five days, I found the ulnar wound entirely healed, while at the site of the radial incision two or three granulations about as large as pins' heads alone remained to cicatrize, and an odourless serous stain of about a minim upon the gauze was the only appearance of discharge. The ulna seemed already firmly united; and, after performing passive motion throughout the range of the natural movements of the joint, I directed him to try its powers. He could himself pronate and supinate the hand, could extend the arm completely, and readily put his fingers to his mouth; and he lifted a heavy pair of tongs, exhibiting already a strength very superior to that which he had before the operation.

Edinburgh, 31st December, 1870.

OBSERVATIONS ON THE TEMPERATURE OF THE BODY IN HEALTH AND DISEASE.

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NO. I.—NORMAL TEMPERATURES.

IN presenting to the profession, through the medium of our JOURNAL, a series of observations on the changes of temperature met with in disease, it may be useful to precede them with some comment upon what is known of the laws of the variations of temperature in health. Without this, not only would the significance of many of the facts bearing upon the natural history of disease lose their significance, but the therapeutic value of many of the practical deductions, always foremost in view during these investigations, would be unappreciable. The attainment of truth even in the simplest inquiries is so difficult that, in spite of the careful attention of most honest searchers after it to this particular question, some obscurity and uncertainty have collected round many of the elementary facts relating to the range of temperature in the human economy.

The limits within which the temperature of the human body may vary in disease is very generally found so closely to correspond with the observations of Andral,* that clinical thermometers are now conveniently constructed to register only from 95 to 110 deg.; and though recent Indian and Abyssinian experience shows that the higher range must be still further extended, conclusive instances are yet wanting of the temperature of the interior of the body having undergone a depression beyond the lower limit.

The normal temperature of man is but little influenced by climate. Observations reported by M. de Blainville show that both in the tropics and the polar regions it is equally maintained at, or near, 98½ degrees (*Comptes rendus de l'Académie des Sciences*, 1838, tome vi, p. 457). Climate does not modify greatly the diurnal variation of normal tem-

perature. Of this, scientific evidence is given in the careful record by Dr. John Davy, of the results obtained upon himself during a winter in England in 1844-45, for comparison with similar observations made in Barbadoes from July 1845 to November 1848; where, with a difference of from twenty to thirty degrees in the air of his dwelling, in both cases the average temperature of the body is 98.4 degrees; in Barbadoes the evening temperatures appear to be higher than those of the morning, a difference traceable to the morning and evening observations having been made at a later hour in the colder than in the warmer climate (*Physiological Researches*; London, 1863, pp. 14 and 44).

The daily range of temperature in the adult has hitherto been taken to be much less than in reality it is. Those observers who have made themselves subjects of experiment, either from having neglected the ordinary exercise of active life, or from some other oversight, have not reached a sufficiently high mean daily temperature, so that their results give a daily range of one degree only, instead of a range of two and a half or even three degrees, as may frequently be found in health.

A diurnal variation of temperature, sufficiently constant to cause a continuous elevation at and after mid-day, and a tendency to depression at and after midnight, undoubtedly exists. This has no direct or necessary relation to the hours of the day, but depends upon quite other causes indirectly related.

Rest lowers temperature; exertion raises it. Dr. Houghton has shown how every elevation of bodily temperature represents so much work done, so much force expended, so much waste; on the other hand, we may see how that every active employment in which we are engaged is accompanied by an elevation of temperature. Rise from a warm bed, dress in the cold air, or bathe in the coldest water, and half a degree Fahrenheit of temperature is gained; the day's duties will before long demand another half degree; out-door exercise still more. Thus it will rarely happen that a temperature of 99 degrees, even in the axilla, is not reached by noon.

Strong out-door exercise will cause an elevation of from one and a half to two degrees of temperature—a fact of which any one may convince himself by placing a self-registering thermometer under his arm during half-an-hour's brisk walk; in this way a temperature of 100 degrees will generally be obtained: this has hitherto been overlooked. Numerous observations, taken both in warm and in cold weather, not only show this, but that an internal temperature of 100 degrees is frequently, if not usually, attained, and is, therefore, within the limits of normal temperature.

The condition on which this high temperature is to be considered normal, is that it should not be long maintained. Age, constitution, health, and training, as well as outward circumstances, influence both the readiness with which this degree of organic heat is reached, and the readiness with which it subsides. Heat from exercise, when rapidly induced, will rapidly subside, rest following after short exertion. A fall of one degree of heat in half-an-hour, or of two degrees in one hour of rest, in this case, will readily follow. During more prolonged exercise or exposure, some moderation of temperature may be observed: perhaps the want of food begins to tell, though a good meal helps to lower the temperature-disturbance, and so favours the coming on of sleep. After this elevation of temperature, there is generally a greater tendency to subsidence. Sometimes the disturbance occasioned may be so great or so prolonged that neither the food nor the rest needful to repair the waste occasioned will at once exert their powerful aid in lowering temperature; and, consequently, one is either too tired to sleep, or has to pay a heavier penalty for over-exertion.

Exercise and activity raise temperature; rest and repose are the most effective agents in lowering it. Rest is most perfect during sleep, and then the greatest subsidence of temperature is found. Fatigue, if not extreme, conduces to rest; hence, probably, the reason why the evening temperature of the body is generally lower than the morning. It has been said that sleep does not lower the temperature. Rest at any part of the day, mere rest of body, will allow a subsidence of temperature almost to the degree found at night or after sleep, and this even while active mental processes are being conducted in quiet: nor does the occurrence of a short sleep in the course of an afternoon's rest seem to make much difference in the degree to which the temperature is lowered; so that though the lowest temperature is usually found at night and during sleep, the one may have but an indirect dependence upon the other. It is to be remembered that while during bodily exertion the respiratory function is very active, during sleep it is reduced far below the ordinary rate, and that mental preoccupation will often interfere with full and complete respiratory efforts. The relation between sleep and a lowering of temperature is certainly a close one; they have this mutual reaction—sleep favours the subsidence of temperature, and a certain subsidence of temperature seems to be a necessary preliminary to good sleep.

* *Cours de la Faculté*. Paris: 1841. Andral gives the lower limit as 35° centigrade = 95° Fahrenheit; the higher as 42° centigrade = 108° Fahrenheit nearly.