from increased warmth, the vessels on the surface were relaxed. A comparison of the pulsations of each trace points to the greater rapidity of the circulation under influences which facilitate the passage of the blood.

The force of the pulse is indicated by the height of the pulsations. The greater the elevation of the lever, the greater the energy of the pulse-beat; and we may say that, in many cases, the strength of the ventricular contraction is expressed by the force of the pulse. This law, however, has many exceptions; and we find that the altitude of the pulse-trace depends on several other conditions.

i. The volume of the artery influences much the amplitude of the trace. This can be well seen in traces collected from old persons. In senile changes, the volume of the vessels is increased considerably, and the trace betrays great fullness. Marey believes this to be due, not solely to the hypertrophy of the ventricle which exists in the old, but also to the dilatation of the artery. (*Vide* trace, Fig. 5.)

ii. The state of arterial tension modifies greatly the force of the pulse; and, as the tension is dependent on the state of the capillary circulation, it may be said that in most cases "the force of the pulse is not in relation with the energy of the ventricular systole, but that it is regulated by the state of the circulation in the ultimate ramifications of the vascular system." (Marey, *op. cit.*, p. 235.) By means of the manometer, in a great number of experiments, this law has been found to hold good; a feeble state of arterial tension giving to the finger and the instrument the sensation of increased amplitude. Marey, by means of the following diagrams (Figs. 10 and 11), illustrates this very well.

Fig. 10.

The first shows the form of pulsation in a state of feeble tension; the second, under a state of strong tension. The difference in the amplitude of the traces is very distinct. In the state of feeble tension, or easy passage of the blood onwards, the lever falls quickly to the point of least tension, and is ele-

Fig. 11.

vated considerably at each pulsation. In the case of difficult passage of the blood through the capillaries, and consequently of great arterial tension, the lever descends slowly by a line convex upwards; and, long before it has reached a minimum tension equal to that in the former case, the lever is raised slightly by the next pulsation. While the lines of the maxima of arterial tension are the same in both cases, the lines of the minima are very different. On this depends the amplitude of the pulse-trace.

iii. The duration of the interval which separates the pulsations has also a distinct influence on the amplitude of the trace. This is due to the fact that, during a long interval, the blood flowing continually onward lessens the pressure in the ves-

sels, and thus favours the greater amplitude of the next pulsation. This is well seen in a trace (Fig. 12) taken from a patient of mine in the Queen's Hospital.

Fig. 12.

The condition of the vessel itself, as to permeability below the point observed, influences the force of the pulsation by altering the pressure within the artery. Marey has also pointed out that in some cases, where the pulse-beat is almost imperceptible to the finger, the sphygmograph records a considerable amplitude of trace; and *vice versa*. I have been struck with this peculiarity in several instances; and the explanation appears to be, that we perceive changes in the artery more distinctly in proportion as they occur more suddenly. The cases in which the pulse has been almost imperceptible to the touch, but has nevertheless yielded a distinct trace, have been associated with a very slow distension of the vessels.

The foregoing remarks, based upon the work of the French author, will, I trust, by pointing out the meaning of the many forms of pulse-trace, and by setting before us the causes to which they are due, enable us to understand more clearly the changes exhibited by the arterial pulse-form in disease. The remainder of the paper I shall, with the permission of the Society, devote to a consideration of some few of the many pathological conditions in the detection of which the use of the sphygmograph renders us invaluable aid.

[To be continued.]

ON THE USE OF THE THERMOMETER AS A GUIDE IN THE DIAGNOSIS OF PYREXIAL DISEASES.

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[Concluded from page 251.]

Typical Range of Temperature in different Diseases.

A knowledge of the range of temperature peculiar to each disease enables the observer, when he perceives any marked departure from the type, to pronounce either that his diagnosis is wrong, and that the disease is not what it appeared to be, or that some secondary lesion has supervened.

For example, the typical range or temperature in typhoid (Peyerian) fever, as established by Wunderlich, is as follows.

	Morning.	Evening.
First day	98.5 deg.	100.5 deg.
Second day	99.5	101.5
Third day	100.5	102.5
Fourth day	101.5	104
Second half of week	102	104

At the commencement of the second week, in mild cases, the temperature begins to decrease; for, although the evening temperature may be 104 deg., the morning is only 102 deg. In severe cases, on the other hand, the morning temperature is above 103 deg.; the evening above 104.5 deg., and may reach 106 deg. In the third week, remarkable vacillations of four to six degrees between the morning and evening temperature occur. The fever terminates

by a gradual defervescence (*lysis*), not by a sudden crisis, as in typhus. In mild cases, the fever lasts from three to four weeks; in severe, from four and a half to ten weeks.

Typhoid fever is not present, if, on the evening of the first or second day of the disease, the temperature be 104 deg.; if the evening temperature do not rise to 103.3 deg. between the fourth and sixth days; if, in the second half of the first week, the evening temperature decrease considerably; lastly, if, between the eighth and eleventh days, the temperature be below 103 deg.

As an illustration of the truth of the first proposition, I cite the succeeding case. A woman, in a ward of the hospital in which there were two or three cases of typhoid fever, had one evening an attack of rigors. Her temperature was 102 deg.; on the morning of the next day, 103 deg.; in the evening, 105 deg. The symptoms in all other respects resembled those of incipient typhoid. The woman was much alarmed, for a patient had just died of typhoid fever. The existence of a temperature of 105 deg. in the evening of the second day enabled her to be assured that she was not threatened with that disease. This prognosis was proved to be correct by the symptoms developing shortly into those of erysipelas.

The next case is an example of the value of the second and third propositions. A girl, aged 21, was admitted on January 15th, 1866, with symptoms of impending typhoid. The attack began with rigors on the evening of the 11th. She had great abdominal tenderness, a hot dry skin, pains in the limbs, muscular tremors, and one or two suspicious specks on the skin of the chest. Nevertheless, because the temperature did not on any evening rise to 103 deg., and a marked decrease of temperature occurred on the evening of the 18th, the disease was pronounced not to be typhoid. On the 20th, she was quite well.

The next case illustrates the last proposition. A man, aged 40, living in a locality in which typhoid had lately been rife, who had had rigors, followed by diarrhoea and pains in the limbs, a week previous to his admission, was found to have a typhoid tongue, frontal headache, diarrhoea, and numerous specks on his abdomen and chest, very closely resembling the eruption peculiar to typhoid fever. On the tenth evening of the disease, his temperature was 101.8 deg. This temperature forbade the diagnosis of typhoid. In three days after, the man was well.

The effect of hæmorrhage in reducing the temperature was seen in the case of a woman with typhoid fever, whose temperature fell suddenly from a high degree to 98 deg. This led to an inquiry after intestinal hæmorrhage; and it was discovered that she had lost a considerable quantity of blood from the intestines, which accident the nurse omitted to mention until she was questioned.

Range of Temperature in Traumatic Erysipelas. In all of the cases of traumatic erysipelas which I have observed thermometrically, the attack began with a fit of rigors more or less severe. The *fastigium*, or highest point of the temperature, was attained in a short time. The fall, or defervescence of temperature, nearly coincident with the decline of the eruption, and accompanied in the majority of the cases by sweating, was rapid. In some of the cases, relapse occurred.

If the temperature remain high for any considerable number of hours after the disappearance of the eruption, some secondary complication—abscess, pneumonia, pleurisy, pericarditis, or pyæmia—has undoubtedly supervened.

CASE I. On February 8th, 1866, the operation for ectropium was performed on a man aged 33. At 3.30

p.m. on Feb. 9th, he had an attack of rigors. At 4.10 p.m., his temperature was 103.6 deg.; pulse 120; respirations 20. There was slight redness round the wound. At 6 p.m., the temperature was 104 deg.; pulse 100; respirations 24. He was then sweating. Feb. 10th, 9 a.m. Temperature 100.8 deg.; pulse 84; respirations 20. The erysipelas was much less. At 6 p.m., the temperature was 102 deg.; pulse 100. Feb. 11th, 9 a.m. Temperature 100.8 deg.; pulse 84; respirations 24. The erysipelas was gone. 6 p.m. Temperature 101 deg.; pulse 84; respirations 24. Feb. 12th, a.m. Temperature 99.8 deg.; pulse 72; respirations 20. There was no relapse.

CASE II. This case was one of erysipelas of the leg in a man aged 40. On Feb. 16th, 1866, he had rigors at 1 p.m. At 5.50 p.m., the temperature was 103.8 deg.; pulse 68; respirations 20. There was a slight erysipelatous blush on the leg, and angina faucium. 8.46 p.m. Temperature 102.6 deg.; pulse 90; respirations 20. He was then sweating. Feb. 17th, 12.30 a.m. Temperature 101.2 deg.; pulse 64; respirations 20. 6 a.m. Temperature 99.6 deg.; pulse 48; respirations 20. 9.30 a.m. Temperature 99 deg.; pulse 64; respirations 24. The erysipelas had nearly disappeared. 6 p.m. Temperature 99 deg.; pulse 68; respirations 24. Feb. 18th, 6 p.m. Temperature 99.8 deg.; pulse 58; respirations 24. Feb. 19th. The patient had a fit of rigors at 12 a.m., denoting another attack of erysipelas. At 6 p.m., the temperature was 103.4 deg.; pulse 80; respirations 24.

The usefulness of the thermometer in the diagnosis of pyrexia is well shown in this case; for, although the temperature on February 19th, p.m., was 103.4 deg., yet the pulse was only 80, the respirations but 24, and the skin was objectively cool.

CASE III. A woman, aged 49, was operated on for cancer of the breast on January 22nd, 1866. The wound being nearly healed, she had, at 4 a.m. on February 12th, an attack of rigors. At 9 a.m., the temperature was 103 deg.; pulse 120; and there was an erysipelatous blush around the wound. At 10.30 a.m., she had another attack of rigors. 11.35 a.m. Temperature 105.4 deg.; pulse 120; respirations 24. 6 p.m. Temperature 105 deg.; pulse 108; respirations 24. Feb. 13th, 9 a.m. Temperature 105 deg.; pulse 120; respirations 20. The erysipelas was extending. 6 p.m. Temperature 104.6 deg.; pulse 108; respirations 24. Feb. 14th, 6 p.m. Temperature 104 deg.; pulse 120; respirations 24. The erysipelas was subsiding. Feb. 16th, 6 p.m. Temperature 104 deg.; pulse 120; respirations 24. The erysipelas was nearly gone. She had no cough; no pain in the chest. There was dullness at the base of the left lung; no crepitation. The respiration-sound was rather feeble. Feb. 17th, 9 a.m. Temperature 103 deg.; pulse 120; respirations 28. There was dullness over the left lung as high as the inferior angle of the scapula; no crepitation.

In this case, the fact that the temperature remained, on February 16th, at so high a degree after the subsidence of the erysipelatous eruption, led to the diagnosis of the secondary complication; for no other signs of the lung-disease save the continuance of the high temperature existed. There was no cough; no pain in the chest; the respirations were not accelerated; the pulse was feeble, so that its rapidity might have been due to weakness; and, lastly, the skin felt abnormally cool.

ERRATUM. In Dr. Gibson's paper published in last week's JOURNAL, page 249, column 2, line 28 from bottom, for "covered near the bulb", read "curved near the bulb".