

Citation:

Wiersma, E.D., On the value of the simultaneous registration of the plethysmogram and the psychogalvanic reaction, in:

KNAW, Proceedings, 18 II, 1916, Amsterdam, 1916, pp. 1154-1158

Physiology. — *“On the value of the simultaneous registration of the plethysmogram and the psychogalvanic reaction.* By Prof. E. D. WIERSMA.

(Communicated in the meeting of December 18, 1915).

The respiration causes distinct fluctuations in the length and height of the pulse, in the blood-supply of the hand and in the position of the diacrotism. These fluctuations disappear under all influences which impel the heart to more labour, that is to say they disappear owing to bodily influences, but also in consequence of psychical agents such as emotions.

These emotions likewise bring about important modifications in the so-called cutaneous currents. If a zinc plate is taken in one hand, which is connected by a conducting-wire with a stick of carbon held in the other, an inserted galvanometer will deflect. This electric current which is pretty stable at a quiet attitude of the subject is called the “rest-current”. This investigation was first carried out by FÉRÉ in 1888, and subsequently repeated by TARCHANOFF in 1890. I shall pass by the many researches made afterwards. An important question was where the potential differences arise. They may originate in the body, and then we speak of endosomatic electromotive force. If they arise outside the body by the action of perspiration on the zinc, the electromotive force is exosomatic.

Where the potential difference takes its origin, may be determined in the following manner. If it takes place outside the body, an exchange of the hands will not affect the galvanometric deflection. Only by changing the conducting wires we can reverse the current. If the potential difference is found in the skin, the galvanometer will deflect as much in the opposite direction¹⁾. It appears that in the method I denoted above, the exosomatic electromotive force preponderates to such an extent that in these experiments it is the only factor we need take into account.

The above-mentioned rest-current is considerably strengthened by every sensory stimulus and by every psychical labour. Now it is of importance to determine what causes this increase. When namely a current in the opposite direction is made to counterbalance all electromotive forces, so that the galvanometer points to zero, not a single stimulus will produce a deflection of the galvanometer. It follows that such a stimulus produces no electromotive force, but

¹⁾ A. GREGOR and S. LÖWE. Zeitschrift für die Ges. Neurol. u. Psychiatrie p. 411.

that only an existing current can be strengthened by it, in other words that the resistance to that current has decreased, or that the polarisation-current in the skin grows weaker, as appears from the latest investigations of GILDEMEKSTER ¹⁾).

Now if the respiration, the plethysmogram and the galvanic reaction are simultaneously registered photographically, the effects of bodily stimuli and of psychical labour on these curves may be compared. In the first place it appears then that the modifications caused by them are chiefly dependent on emotions acting simultaneously. This appears from the weakened reactions of the plethysmogram and of the galvanometric deflection in consequence of the stimulus being repeated.

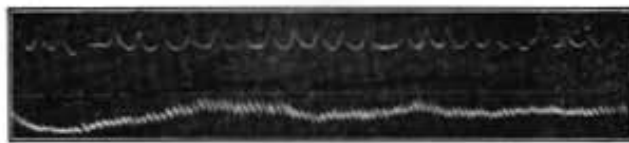


Fig. 1.

This reaction on emotions supplies us with a very reliable means of distinguishing organic anaesthesiae of the senses from functional anaesthesiae and from simulation. Every sensory stimulus and every psychic labour effects considerable modifications in the plethysmogram and in the psychogalvanic curve. This investigation enabled me

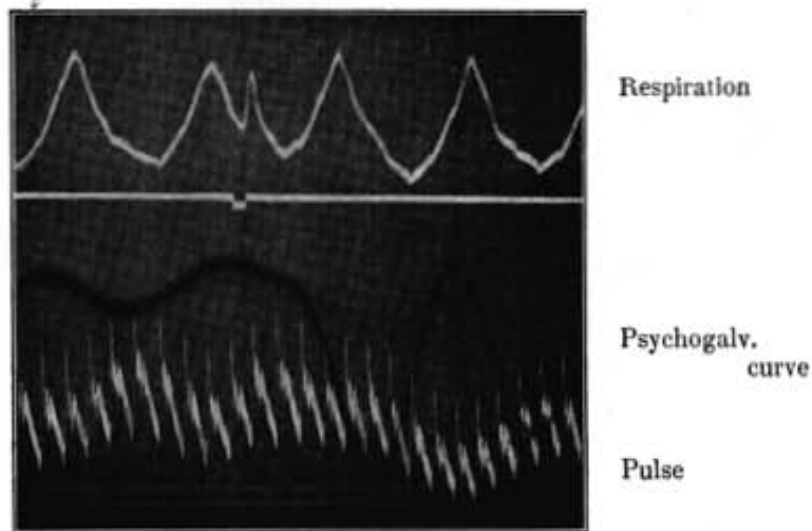


Fig. 2.

¹⁾ PFLÜGERS. Archiv. Bd. 162, p. 489.

repeatedly to identify organic deafness, and to demonstrate functional or organic deafness where it would have been very difficult or impossible to arrive at results by other methods.

After the stimulus the pulse (Fig. II) grows regular, its height decreases, the diastole is lower and the blood-supply of the hand diminishes. Sometimes, however, these modifications in the plethysmogram do not occur. In cases of hysteria, for instance, the plethysmogram often does not undergo the slightest change, while the psychogalvanic reaction clearly manifests itself. (See Fig. III).

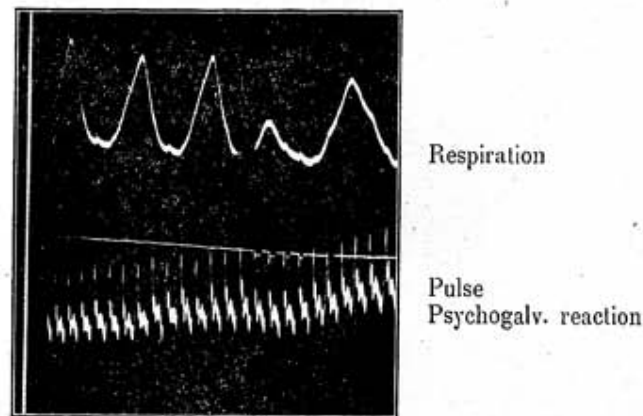


Fig. 3.

The insensibility to stimuli, of the plethysmogram finds its explanation in the fact that all changes otherwise effected by the stimulus have already taken place. The heightened emotionality of the hysteria has caused them. The lines of the plethysmogram enable us, therefore, to form an opinion on the existence of more permanent mental states. Wherever there is preoccupation, with normal persons as well as in pathological conditions, the respiration oscillations of the plethysmogram have diminished or disappeared. The above curve originates from a patient who had suddenly become deaf. This investigation, at which the stimulus consisted in the ticking of an electric bell, proves distinctly that organic deafness was out of the question. The patient showed, moreover, a number of hysteric stigmata. After a treatment of some weeks the deafness had entirely disappeared. An organic deafness, which is sometimes very difficult to identify, can easily be discovered by this method.

The absence of the respiratory oscillations in the plethysmogram is pretty regularly to be seen in the curves of melancholic or catatonic stupor-patients. This suggests, therefore, that here we have not

to deal with a suspension of consciousness, of which the patients often show the outward signs, but with preoccupation.

Preoccupation.

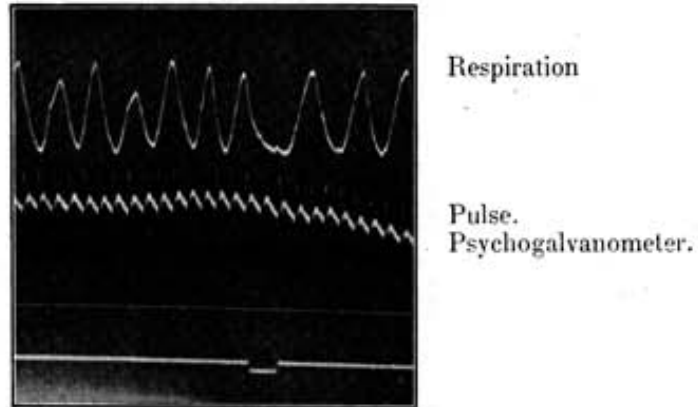


Fig. 4.

With these stupor-patients (see fig. 4) the psychogalvanometer mostly does not respond to stimuli, which must be attributed to the fact that they are so entirely occupied with their own emotions, that the additional emotion leaves no result.

Opposed to these states of preoccupation are psychic suspensions, as they normally occur in dozing, sleeping, and in coma. These suspensions can immediately be recognized by the extremely great

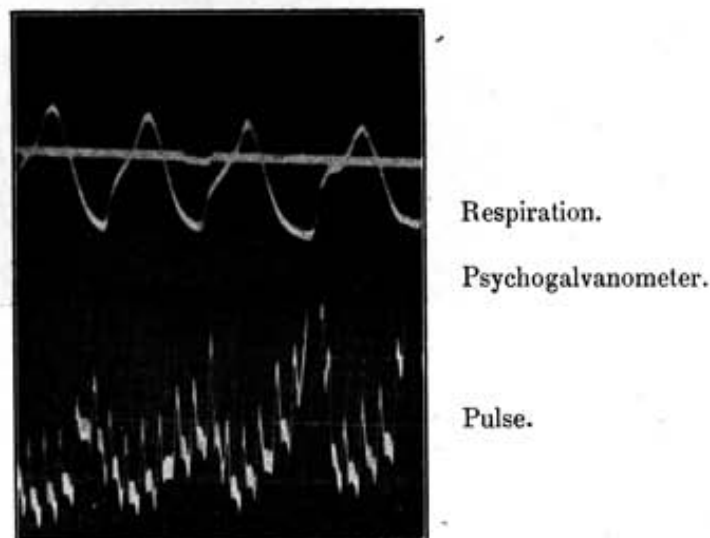


Fig. 5.

respiratory oscillations in the plethysmogram. The coma-patients I examined did not respond to sensory stimuli, neither in the plethysmogram nor in the psychogalvanic curve (see fig. 5).

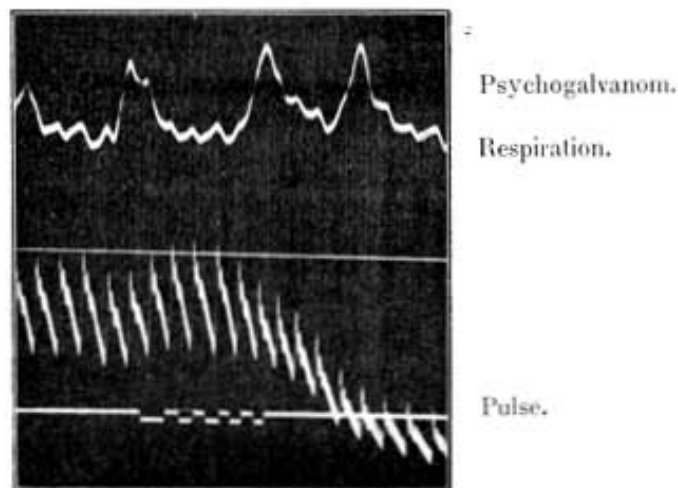


Fig. 6.

In sleep the reaction is different. In a light sleep the pulse still responds when the psychogalvanic reaction has ceased (see fig. 6).

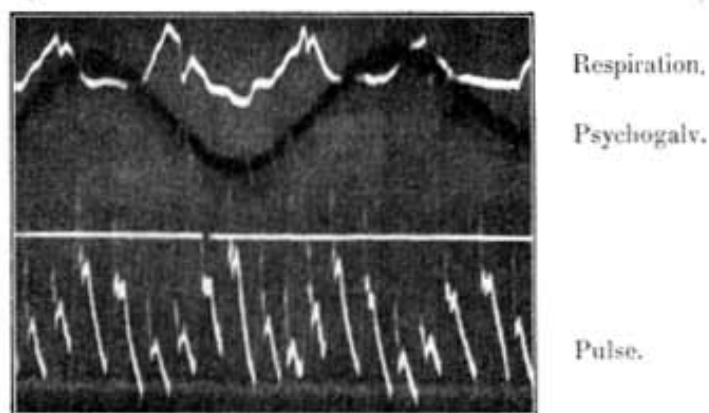


Fig. 7.

In a profound sleep, however, as in coma, no reaction manifests itself (see fig. 7).

This investigation establishes, therefore, the relationship existing between preoccupation and stupor on the one hand, and between sleep and coma on the other.