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Personal Identification by Electrocardiography

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PERSONAL IDENTIFICATION BY ELECTROCARDIOGRAPHY

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The exclusively medical methods of personal identification have not been successful. In general, not one of them has advanced beyond its initial exposition. The ophthalmologic method of Capdevielle; the ophthalmoscopic as well as radiographic of Levinshon; those of Tamassia and Ameuille employing the disposition of the veins of the dorsal part of the hand and those of the face; the umbilical method of A. Bert and Ch. Vianny, in short all that have called for special apparatus such as the purely descriptive ones, have remained only as subjects of reference in the history of identification, none leaving the hands of its author to enter the field of practical use.

After our experience with these methods proposing to identify subjects through their eyes, the bones of the hand, the disposition of their veins, and the shape of their navels, we now hear more and more about the possibility of identifying the individual by means of electrocardiography. We find ourselves, therefore, in the presence of another medical method for personal identification.

We shall not go into the technique of the procedure, as we wish to discuss it only critically. It is our intention to furnish the expert with a concrete judgment upon electrocardiography as a method of personal identification. We shall employ only the most necessary medical terms, and hope to reach our end without using unnecessarily technical expressions.

Electrocardiography is a method which, according to J. Yacoël, undertakes to present graphically the variations of the electrical phenomena of the heart during its activity. The electrocardiograph is the apparatus employed for recording graphically the electric currents emanating from the heart of the living subject. The electrocardiogram is the chart representing the curve of electric variations during the different phases of a heart beat. One might say that it is the electric picture of the heart.

After these definitions, we can say that the heart, by contracting and dilating, develops, like other muscular tissues, electric energy the variations of which are recorded by a special apparatus (electrocardiograph), in the form of an electrocardiogram. These are, in

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simple words, the physiologic foundations of the method (electrocardiography).

We see, therefore, that the heart beats are accompanied by the production of definite electric currents. Physiologists discovered this phenomenon in the heart of the frog (Kölliker and Müller, 1855); later on, Ludwig and Waller, in 1887, applied the findings to the human heart. The method born in the physiological laboratory, became, through subsequent scientific contributions, the field of activity of the practitioner in hospital and clinic.

The electrocardiographic method has made such progress that its use in cardiologic research has become generalized. Its medical value has been increasing day by day. The photographic tracings of the electric current radiating from the heart, that is to say the cardiogram, was originally thought of only as a medical chart—a document for the exclusive use of the hospital or clinic. But more and more it is urged that the electrocardiographic method is fit not only for diagnosing disease, but for identifying individuals as well. This means, that its proponents hold that the electrocardiograph has just claim for a place in a well-equipped and modern Bureau of Identification.

As far as we know, Thomas Lewis and M. D. D. Gilder[2] were the first who attributed some identifying value to electrocardiography. Indeed, speaking of the constancy of the electrocardiogram in an individual, they say:

"The similarity between the electrocardiograms taken from the same subject on different days is so close, and the variations from subject to subject are so numerous (for it may be said that no two series of curves are ever identical), that a series of three leads from any subject would be sufficient to identify the subject in question among a considerable number of his fellows."

At the end of their work, Lewis and Gilder write:

"In normal subjects, standardized curves from the same subject show little or no variation in respect of the amplitude of the summits and depressions, from day to day, from month to month, and from year to year. Yet each subject gives electrocardiograms of distinct forms, and so great is the detailed variation from subject to subject that the recognition of any individual amongst a large number is a matter of no great difficulty from the curves he yields."

[2]The Human Electrocardiogram: a Preliminary Investigation of Young Male Adults, to form a Basis for Pathological Study, in *Philosophical Transactions of the Royal Society of London,* Series B., containing papers of a biological character, Vol. 202, London, July, 1912, p. 351-376.

In their description, plates Nos. 1 and 2 are offered with the following explanation:

"Two electrocardiograms from lead I, taken with an interval of more than two years between them. Each has been standardized in the same manner. The first was taken by Prof. Einthoven in his laboratory at Leyden; the time-marker in this curve is constituted by the vertical lines, which are separated by time intervals of 0.04 sec.

The two curves resemble each other very closely. The chief difference between them is that, in Fig. 1, T is of somewhat greater amplitude. So far as the remaining summits and depressions are concerned, little difference can be found between them; perhaps R is somewhat larger in Fig. 1. Both curves show the same exceptional features, namely, a considerable variation in the heights of R and S from beat to beat. The variation is of similar degree in both curves."

Eight years after them, Thomas Lewis, in his famous work "The Mechanism and Graphic Registration of the Heart Beat" (London, 1920, p. 44), when treating on the physiologic type of the human electrocardiogram, says:

"As a whole the electrocardiogram exhibits considerable variations; thus, electrocardiograms might be successfully adopted as a means of identification."

And, afterwards, he refers, in his bibliography, to the above mentioned study.

In 1917, S. Neuhof, in his "Criminal Cardiology" (New York, 1917, p. 25), advanced his opinion:

"While the electrocardiograms of no two persons are exactly alike—they may indeed be quite dissimilar—and while physiological differences vary within wide limits, there is a general conformity to a normal type."

Actually, as experience teaches us, the authors maintain that there is no unique type of the normal electrocardiogram, and that each individual offers characteristics of his own, within the limits of normality. This individualization of the electrocardiogram, this differentiation in the normal state, shown by Lewis and his followers, supports the idea of personal identification through electrocardiography.

If the electrocardiogram obtained in the same conditions does not change in the sane, normal subject, if it offers over longer or shorter periods particular variations in every individual, as has been proved by Lewis, it would be logical to acknowledge that it presents a prac-

tical means of human identification. This and other arguments adduced by authors of scientific renown, justify, in a measure, the value of electrocardiography as a method of identification.

Furthermore, the apparent difficulty in identifying the new-born by their ridge patterns (fingerprints) and the use of the ultraviolet ray in order to avoid their confusion in Maternity Hospitals, has rather favored electrocardiography as an identifying method. However, having studied this problem both from the viewpoint of physician and that of the director of the National Bureau of Identification (Havana, Cuba) we do not hesitate to state that electrocardiography has but little value as a means of identification.

This method would be ideal for the identification of the newborn; but it appears that it is not easy to obtain the leads of an infant; in some cases we are obliged to administer hypnotics, as has been done by Heubner, of Berlin; or to give them the nipple and wait until they fall asleep, as Padilla, of Buenos Aires, recommends. Besides, Hecht says that the P wave is larger the younger the infant. Padilla, in his remarkable work "Electrocardiography" (Electrocardiografia, Buenos Aires, 1924, p. 277) holds that "the amplitude of the deviations is greater in infancy than in the adult age." Therefore, its efficiency in the new-born is rather problematical.

Electrocardiography can be applied only to the living subject; for only the heart beats producing electric energy can produce the tracings. It is necessary to remember that the writers speak of "normal electrocardiograms," that is to say, of the tracings made by the subject in a state of health. Identification requires an unchangeable curve from birth to death. Variability alone is not sufficient; it is necessary that it be accompanied by permanency and immutability, like that of the finger print, palm print, and sole print. The electrocardiogram is modified and altered not only by pathologic changes, wherefore it is employed in medicine, but is liable also to alterations from many causes, including the will of the subject (respiration).

Even if we acknowledge that the normal characteristics of the electrocardiogram are immutable, we must recognize that its variations are rather limited, thus rendering differentiation slow and difficult. We must keep also in mind the fact that all authors up to the present have not gone beyond comparing one with another, the tracings of a particular individual, which is very different from searching through a large file of curves from many individuals for one which will correspond completely with that which we wish to identify.

No one has offered a classification of the electrocardiogram, and without scientifically organized files, whatever system be employed, it becomes impossible to find a duplicate of the original.

We see, therefore, that electrocardiography has few possibilities as a method for identification. The X-Rays are more useful as they can be employed for dactyloscopy. The electrocardiograph cannot be considered as a rival of finger printing, not even in exceptional cases, when we consider the following comparison:

The electrocardiograph is expensive, is not easily portable, and requires many precautions in its operation.	The dactyloscopic outfit is very simple, cheap, and easily portable, involving no risk whatever to the subject.
The electorcardiogram has to be made by an expert or special operator.	Finger prints can be taken perfectly by anyone after a little practice.
The electrocardiographic method is expensive, even when using the most simple apparatus.	The dactyloscopic method is infinitely cheaper, both in installation and maintenance.
No system of classification for the individual electrocardiogram has thus far been evolved.	Finger prints can be classified and subclassified infinitely, as well by morphologic details as by numeric indices.
The electrocardiographic method permits a wide margin of errors.	The dactyloscopic method removes any possibility of error.
The electrocardiograph can be used only for the living subject; as it requires the functioning of the heart.	Finger prints can be taken as well after death as during life.
The electrocardiogram is alterable by disease and by the will of the individual.	Finger prints are permanent and unchangeable; while they are being taken, the will of the individual cannot alter their characteristics in the least.

Electrocardiography is suggestive, impressive, and most useful in the clinic, where we have seen it record, with wonderful preciseness, the heart condition of the subject. As physicians, we employ it, but as students of human identification, we shall continue to use the papillary print, which in the last analysis remains the method without a peer.

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