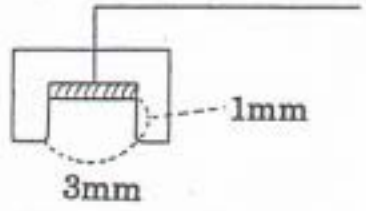
III. Data Obtained Using the AMI and Their Meaning

1) *Measurement Procedure of the AMI* (Picture 7)

Silver electrodes 3mm in diameter (as shown on the right) are attached to various points on the meridians using electrode paste (keratin cream). When the functional condition of a meridian system is to be measured, the electrodes (Picture 8) are attached to the Sei points of each meridian. Indifferent silver electrodes (2cm × 3cm) are attached to the outside of both forearms 5 ~ 10 cm below the elbow. Then a single rectangular wave pulse of 3 volts DC is applied for a duration of 1 millisecond between the electrodes. This pulse travels through the 100Ω load resistance which is built into the circuit and the change to the electrical potential across the resistor is fed into an amplifier and the skin current is detected (Figure 4).



Active Electrode

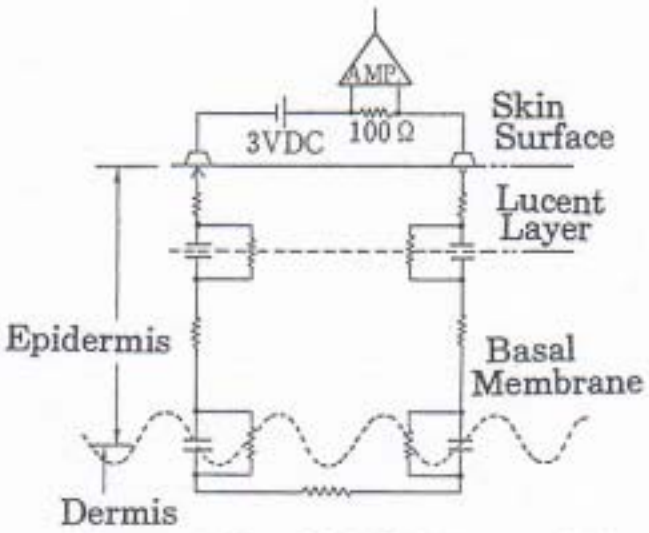


Figure 4: Generalized Diagram of the Dermis and Epidermis

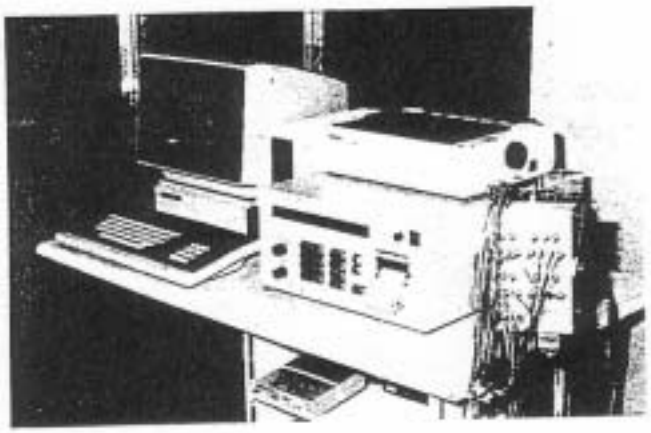
2) *Measured Wave Form*

The measured wave form is illustrated as in Figure 5.

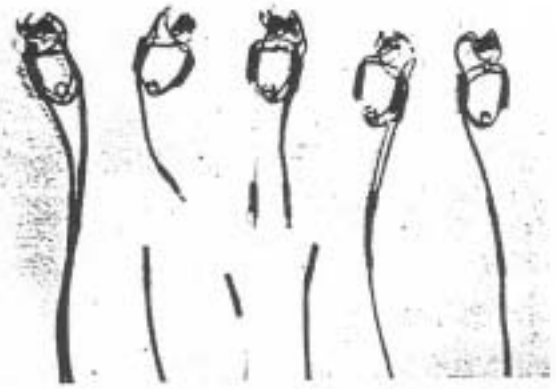
3) *Explanation of Measured Wave Form*

(1) BP

BP value indicates the size of the current value that has passed through the skin via electrodes by the application of an external electrical potential. The duration of this current is less than 1μ second, i.e. much faster than the transfer velocity of the various ions within the systemic fluids of the body, which can only follow up to 20 kHz of alternating current (around 50μ sec). Therefore the current that flows instantaneously in less than 1μ second after the application of a rectangular wave pulse, is a current which passes before the generation of



Picture 7: AMI Model



Picture 8: Electrodes for Toes[8]

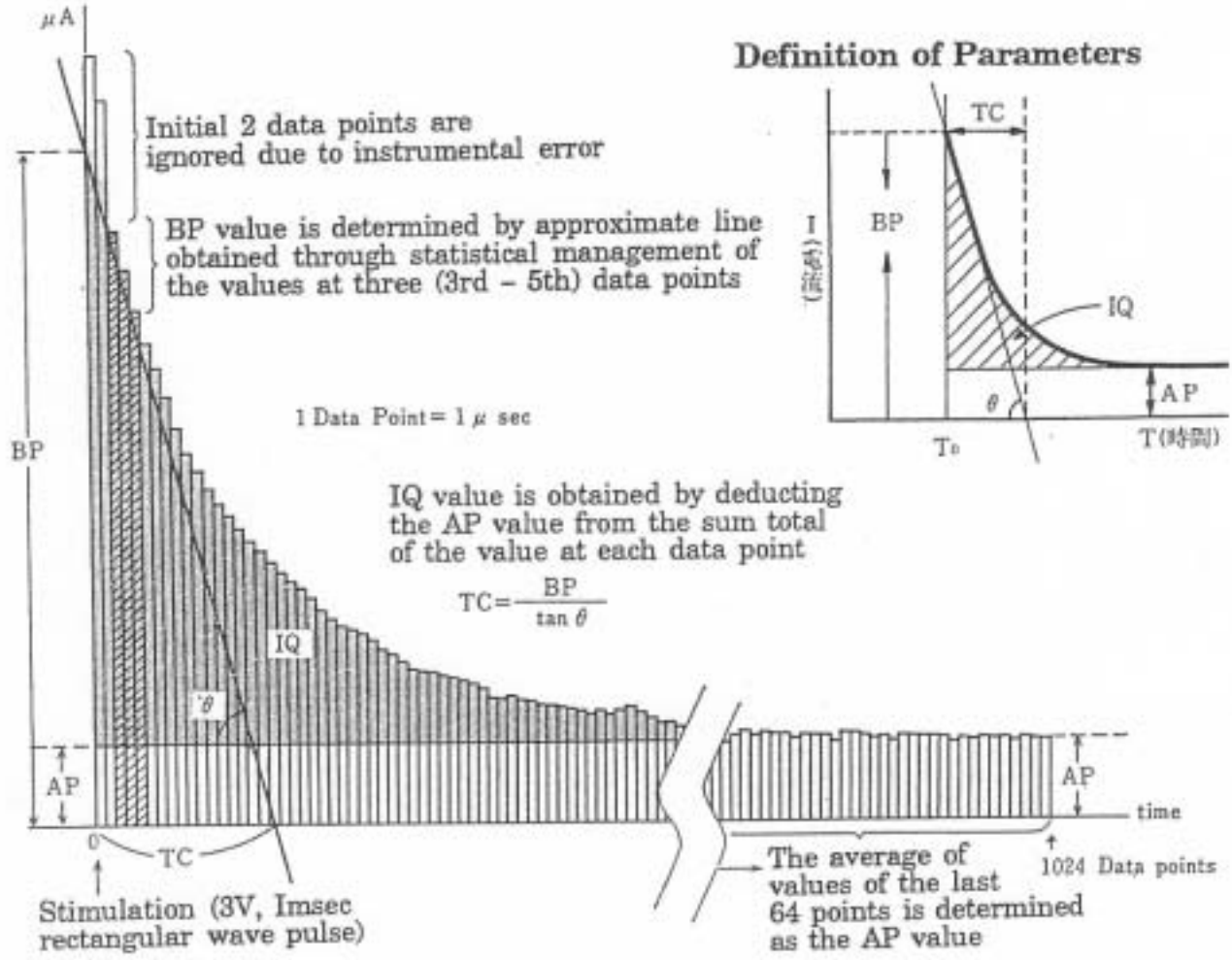
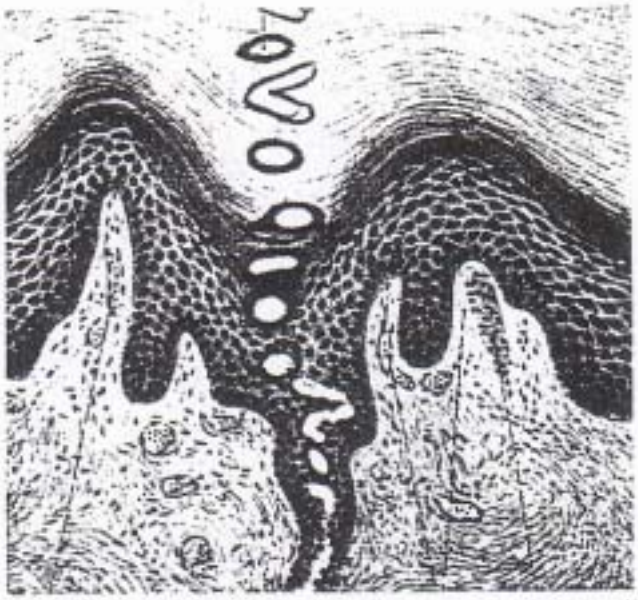
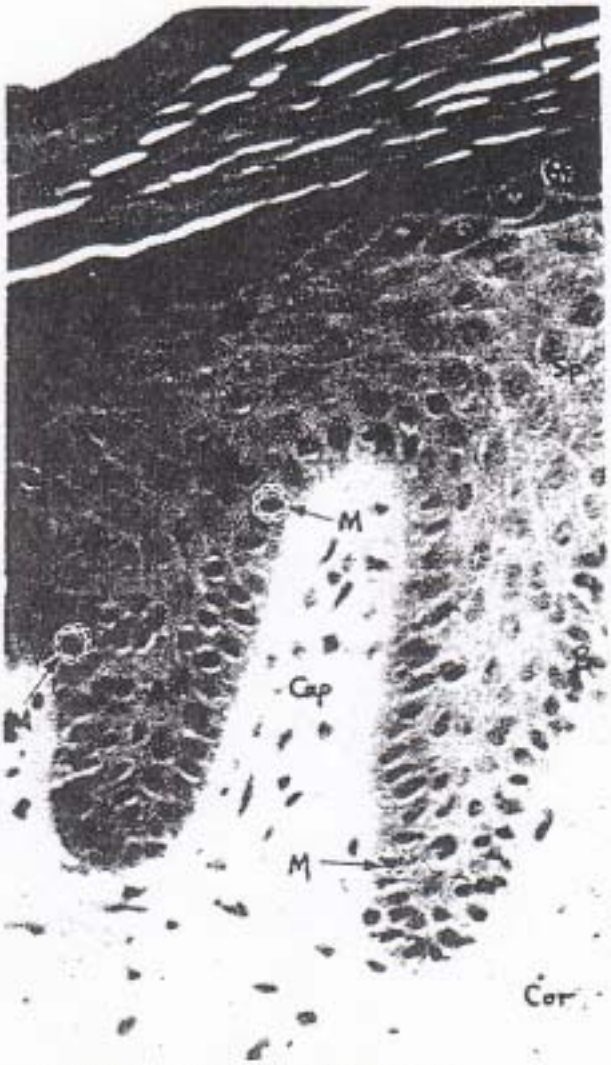


Figure 5: Parameter Derivation Schematic

polarization potential in a direction reverse to the externally applied potential. (Hereafter reverse polarization is referred to as polarization.) Hence it is called a before polarization current. This current value is determined by the intrinsic resistance (ohmic resistance) of the skin components including both



Picture 9: A Cross-Section of the Skin[4]



C: Horny layer, M: Melanocyte
Gr:Granular layer, Cor: Corium (Dermis)
B: Basal membrane, Cap:Capillary
Sp: Spinous layer

Picture 10: The Epidermal-Dermal Boundary at Higher Magnification[5]

epidermis and dermis.

(2) IQ

Directly after the BP current begins to flow, the ions within the skin tissue (those with a fast transfer velocity) start to polarize above and below the lucent layer as well as the basal membrane (Figure 6). This polarization potential takes place in a reverse direction to the externally applied potential, and so it appears as an apparent resistance, causing a decrease in the current value and results in a downward curve. The total electrical charge of ions that have transferred to form this polarization comprises the IQ value. IQ is the value obtained from the area under the downward curve and above the AP level.

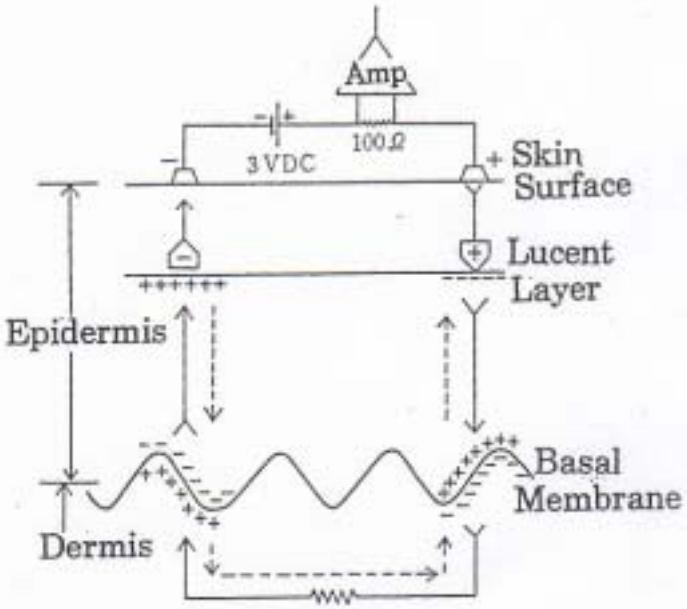


Figure 6: Generalized Diagram of the Ionic Accumulation in the Dermis and Epidermis

(3) TC

Polarization starts with the transfer of ions, but whether this transfer will occur rapidly or slowly depends on the resistance of the overall skin structure as well as the type and condition of the ions contained within the body fluid. If resistance to ionic transfer within the skin structure is low and the velocity of ionic transfer is fast, and simultaneously electrical capacitance at the outer and inner sides of the barrier membranes is small, the slope of the downward curve becomes steep. Conversely, when skin resistance is large, the velocity of ion transfer is slow and at the same time the capacitance is large, the slope of the downward curve becomes gentle. The velocity of this polarization process can be effectively represented by the mathematical product of resistance and capacitance (=CR).

This TC (Time Constant) is the time required for the ion transfer and charging of the electrical capacities at the outer and inner sides of the barrier membranes of the skin, against the intrinsic resistance of the skin structure. Therefore if the TC is large the charging of the capacitor takes a longer time, and if the TC is small then it means the charging is completed quickly.

(4) AP

The ionic polarization which proceeds immediately after the application of electrical potential does not block the current completely, but allows a steady-state direct current of approximately 1/30 of that of the BP to flow. This can be interpreted as an indication that ion dispersion is continuing to some extent through the barrier membranes even after polarization. As evidence, the following fact may be quoted. The epidermis and dermis use the lucent layer and basal membrane as their respective barrier membranes and under normal conditions they polarize so that the epidermis attains a negative potential and the dermis a positive potential. On the other hand it has been experimentally confirmed that the ion permeability of the membranes increases with stimulation from external electricity, heat, or light mechanical pressure. This causes the negative potential of the epidermis of the stimulated area to become more positive relative to its neighboring areas. The increase in permeability of these two membranes by the application of electrical potential causes, even after polarization, a direct current to flow (although only slightly) between the two electrodes, and this is called the AP current.