SESSION 19. Biological Control Systems III

19-2. The Direct Current Field; A New Data Transmission and Control System in Living Organisms

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STEADY STATE OR DIRECT current potentials have been found to be present on the exterior surfaces of many organisms including man. They have shown approximate correlations with growth processes, radiation injury, spinal shock, wound healing, ovulation, sleep, schizophrenia and hypnosis. Similar dc potentials have been found across various portions of the mammalian cerebral cortex and these have been related to the level of neuronal activity therein. However, the sources, distribution and exact function or the potentials as well as their exact nature (i.e., standing potentials or actual current flow) have remained unknown until the present. Utilizing precision methods of field potential plotting, the distribution of the equipotential lines on the surfaces of various amphibians was examined. A remarkably consistent pattern was obtained that was of greater complexity than the simple dipole previously postulated. The spatial arrangement of the field was congruent with the gross anatomical arrangement of the central nervous system with gradients running positive to negative from areas of cellular aggregation in the neuroaxis to the major nerve outflows. (Figure 1). The potential gradient along the limb was markedly distorted and reduced by either proximal nerve root section or by anodal destruction of the appropriate cord area. It therefore appeared that the potentials were closely associated with elements of the CNS. The Hall Effect was utilized to evaluate the possibility of longitudinal charge carrier flow, and transverse Hall voltages were obtained under circumstances requiring charges moving in this direction. (Figure 1). It was further noted that the magnitude of the Hall voltage was related to anesthesia level and that the voltages could be abolished by nerve section. Traumatic injury, ionizing radiation, magnetic force fields, and externally applied direct current were found to alter the pattern and magnitude of the internal dc field. It was found that the dc field was related to various phases of regenerative type healing In a fashion suggesting a control function. A direct relationship between certain aspects of the field in the head area (polarity and types of rhythmic fluctuation) and the level of general anesthesia was also noted. Utilizing newly developed electrodes, the dc potentials on the surface of human subjects have been evaluated. Equipotential line plots can also be drawn for this organism and they demonstrate the same spatial relationship to the CNS as did the amphibian fields (Figure 2). Capacitance properties of the human skin tend to produce steep potential gradients near the termination of the extremities. A more uniform field pattern can be obtained by slightly wetting the skin with isotonic saline. Potentials have been measured between two points shunted by an external variable resistance. Curves of potential vs current to the shunt circuit are typical of regulation curves (terminal voltage vs load current) of a simple potential source with internal resistance. Similar curves have been found for all individuals measured thus far. Preliminary correlations have been made between head area dc potentials and the level of anesthesia. Additionally, the head area shows interesting variations in dc pattern with emotional changes and visual pattern perception.

The thesis has been developed that the internal dc field constitutes a complex, organized, analog-type data transmission and control system related to elements of the CNS. Approximate input and output parameters have been briefly evaluated. Neural dependent longitudinal charge carrier flow has been demonstrated, although the nature of the charge carriers and their mode of generation remain to be studied. Clinical evaluation of this concept directed to the control of growth processes, psychological processes and biological cycles appears justified.

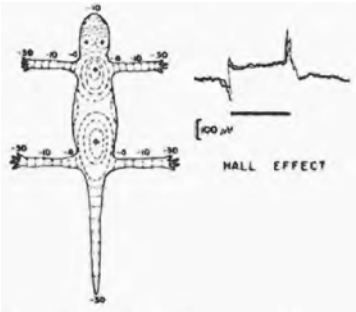

Figure 1—Left: The isopotential lines on the dorsal surfaces of the salamander. Right: A typical transverse Hall potential obtained with a 7000 Gauss field, across an amphibian forelimb.

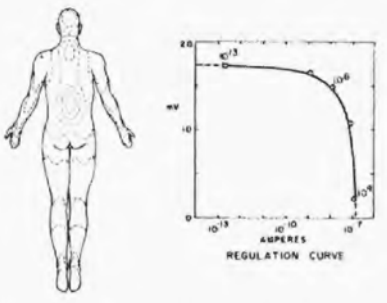

Figure 2—Isopotential line plot on the dorsal surface of the human. Note similar relationships to the CNS. Right: A typical voltage regulation curve (forehead to palm of hand).