

BIO-ELECTRIC PHENOMENA ASSOCIATED WITH MENSTRUATION*

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The development of a vacuum tube microvoltmeter which is stable, extremely sensitive, and draws virtually no current from the system being measured has opened a new field of biological research. This instrument makes it possible for the first time to investigate quite rigorously the electrical properties of living systems. With it potential differences arising as a part of the living process can be measured with a fair degree of certainty. With it studies can be made of the intact organism with little or no interference with normal activity. In other words, by means of this new technic, an objective rigorous record of many biological events should be possible. Inasmuch as the menstrual cycle in the human female has been widely studied by other technics, it seemed advisable to undertake an examination with the Burr-Lane vacuum tube microvoltmeter. Five successive determinations a day, over a period of approximately nine months, have yielded over one thousand determinations on each of two women.

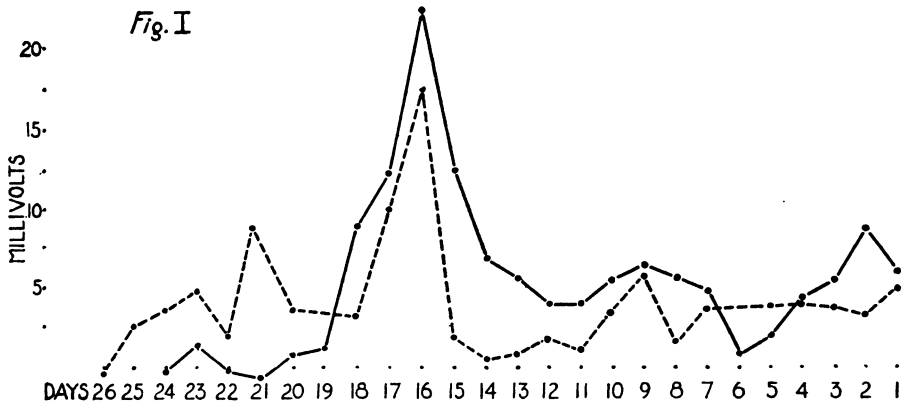
Subject A was normal, unmarried, and ran an approximately 26-day cycle. Subject B was married, with a very irregular cycle, and the determinations began on the 7th week of pregnancy. Connection with the instrument was established through silver-silver chloride electrodes immersed in physiological salt solution, into which were dipped the index finger of each hand. It was noted early that reproducible determinations could be made from day to day over the whole nine-month period.

In subject A, during the four days of the menses, the left index finger was either positive or showed a low negative potential. Beginning with the termination of the menses, the left index finger showed a slowly rising negative potential as compared with the right index finger. In five of the nine cycles, on the sixteenth day preceding the next period, the negative potential on the left rose to an average

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height of more than 10,000 microvolts. In one instance it reached a peak of 27,400 microvolts. This was at the end of the month of January, 1936. The second cycle showed a peak on the fifteenth day and the third cycle on the eighteenth day preceding the onset of the period. The first cycle showed a peak on the eighth day and the seventh cycle showed a peak on the seventeenth day and again on the second day.

The algebraic summation of the daily readings for all nine cycles is shown in the solid line in Fig. 1. The fifth cycle in March is shown in the dotted line in the same figure. The graph shows



clearly that during the period from the ninth to the twelfth day after the onset of the menses or the fifteenth to the seventeenth day before the beginning of the succeeding period, there is a marked increase in the voltage difference between the two fingers. Moreover, it shows an interesting correlation with the probable figures for ovulation in the human female, with the amount of estrin recovered from the urine, and with the copulatory activity and the swelling of the sexual skin in the infrahuman primates. It will be noted that there is a slight rise toward the end of the cycle. It is possible that this second rise parallels a similar rise of estrin in urine. Statistical analysis of the data warrants the conclusion that the mid-cycle peak is a valid finding. Moreover, frequency plots show a fairly constant level of electrical activity during the major portion of the cycle but with a marked increase in the frequency of high voltage differences at the mid-cycle.

Subject B presented a strikingly different series of results. In Fig. 2 each point on the curve represents an average of five successive daily readings. It is to be noted that there were no consistent cyclic phenomena. During the eighteenth week there was a sharp rise on one day to 27,000 microvolts. During the twenty-second week there was a wide swing with a polar reversal. The successive weeks showed a return to what may be called a normal base-line until the beginning of the seventh month. The following three weeks were characterized by a polar reversal with a steadily rising voltage difference. On one of these days, the voltage difference was very

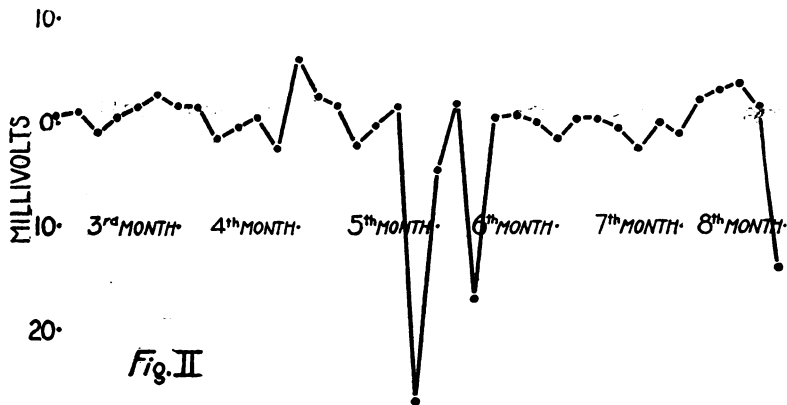


Fig. II

unstable. The left index finger showed a swing from *minus* 2000 microvolts to *plus* 15,000 microvolts. It is obvious that as parturition approached, the characteristic electrical pattern was altered considerably, resulting in high readings and some instability. The characteristics of the findings during pregnancy show an interesting analogy to those noted in adenocarcinoma of the mammary gland in mice, in which the advent of cancer was accompanied by a sharp rise in potential differences across the chest.

The presence of a new growth in the mammary gland of the mouse and of an embryo in the human uterus result in a somewhat similar alteration in the total electrical picture of the organism. This is perhaps not so surprising if consideration is given to the fact that in both instances there is a rapid proliferation of cells which in a certain sense are parasitic.

Consideration of the above data should not neglect the fact that, while the physiological process of menstruation probably involves

the entire organism, its major manifestation is concentrated in the genital tract and, more particularly, that the electrical concomitants of these changes have been picked up through the index fingers. It is difficult to escape the conclusion that a specific physiological process affects in a detectable manner a general electrical pattern even though the regions of detection are at a considerable distance from the site of the major activity. The underlying mechanism involved here is completely unknown, but the evidence seems to point quite definitely to the probability that the organism possesses a total bio-electric field which reflects in definite ways fundamental processes.

The findings reported here are sufficiently suggestive to make it worth while to extend the study to a larger group. This is already under way.