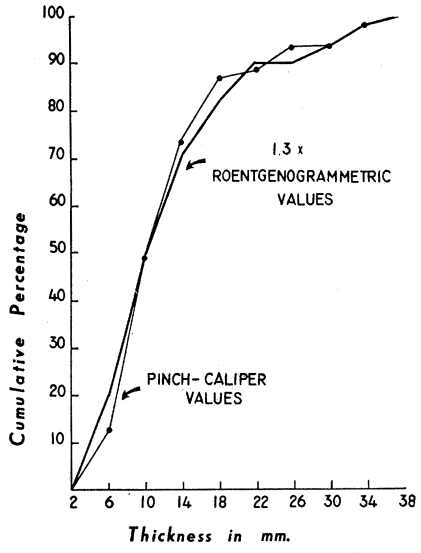

Fig. 1. Comparative cumulative frequency distributions of pinch-caliper thicknesses (dotted line) and roentgenogrammetrically determined thicknesses (heavy line). Since the roentgenogrammetric values multiplied by 1.3 are in close agreement with the pinch-caliper values, it is likely that reduction of the true values by compression is a constant 35 percent.

plus subcutaneous fat thus agree well at this particular site. Percentage compression appears to be constant over the full range of pinch-caliper values obtained (*6*).

Note added in proof: Correlations ranging between 0.8 and 0.9 were obtained by W. H. Hammond (*7*) for boys and girls of unspecified age.

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30 March 1956

Chamber for Microelectrode Studies in the Cerebral Cortex

One of the problems encountered in recording action potentials from single cells in the cerebral cortex is the prevention of undesired movements of the exposed cortex. These movements, chiefly of cardiac and respiratory origin, are large enough to cause significant displacements of a cortical nerve cell relative to a fixed microelectrode tip, and they make it difficult to record the activity of the cell for extended periods of time. Thus, some method is needed for immobilizing the exposed cortex when a microelectrode is in the cortical tissue. It has been known for a long time (*1*) that the cortical pulsations become negligible if volume changes of the exposed brain are prevented by sealing over the opening in the skull with a rigid cover, such as a glass window, and filling the space underneath with liquid. A chamber formed in this manner would be useful for extracellular or intracellular recording if a microelectrode could be brought inside the enclosure through a movable liquid-tight joint.

Li and Jasper have employed this principle for microelectrode recording in the cortex (*2*). They used a chamber with which the microelectrode could be located over a single spot on the cortex and with which the depth of insertion into the cortical tissue could be controlled by a separately mounted micromanipulator.

A somewhat different approach has been adopted in the chamber described here, which is a modification of one used for the study of oxygen gradients at the cortical surface (*3*). In this chamber, as shown in Fig. 1, a small micrometer drive for controlling the depth of insertion of the electrode is directly mounted on the glass window, which is movable. Thus the electrode, which is mounted in the shaft of the microdrive (*4*), may be located over any desired point on the exposed cortex, without opening the chamber, by sliding the window manually. The mode of attachment of the microdrive also gives more stability than would be obtained if its mounting were independent of the skull.

Although it is designed for electrophysiological work on the cortex, the chamber employs a novel form of microdrive that would be useful in many other situations. The rigid attachment of the micrometer to a movable glass plate allows micromanipulations to be performed with good visibility and mechanical stability inside a completely closed chamber. This would be useful, for example, in such fields as chick-embryo work (with shell intact), tissue-culture work in general, or in physics and engineering where micromanipulations in vacuum chambers are necessary.

As Fig. 1 shows, the wall of the chamber consists of a Plexiglas ring attached to the skull around a ½ in. trephine hole by means of a dental impression compound. The ring is ⅜ in. high, a height sufficient to permit observation of the microelectrode tip with a dissecting microscope at as small an inclination from the vertical as practicable. Two side tubes, normally closed, serve for introducing either a 0.9-percent NaCl solution or paraffin oil. The window, which forms the top of the chamber, is a circular glass disk 1¼ in. in diameter; it is made from a microscope slide and has a hole in its center for mounting the microdrive. A two-pronged spring fork serves to keep the disk pressed against the Plexiglas ring. The prongs of the fork are not attached to the microdrive, but they touch the disk at points over the ring. Leakage at the joint between the glass and the machined surface of the ring was prevented by melting a thin layer of the dental impression compound to the top of the ring and molding it flat with a hot, wet microscope slide. The window could still be moved, but it was leakproof.

The microdrive is made entirely of stainless steel, with the exception of the setscrew and key. For those parts that are in contact with the liquid in the chamber, it is preferable to use 18-8 SMO stainless (*5*). The barrel is sealed to the glass disk with DeKhotinsky cement and is secured mechanically with a nut. The shaft is made of 18-gage stainless steel hypodermic tubing; it fits closely into the barrel, forming a bearing with a nominal clearance of 0.0001 in. The bearing is made liquid-tight by a lubricant with a viscosity that is intermediate between that of Vaseline and beeswax.

The advancement of the shaft is indicated by a lower pointer, which shows the number of turns of the thimble, and an upper pointer, which indicates fractions of a turn. The pitch of the thread on the barrel is 1/64 in. The lower end of the thimble has four longitudinal slots for adjusting thread tension in order to

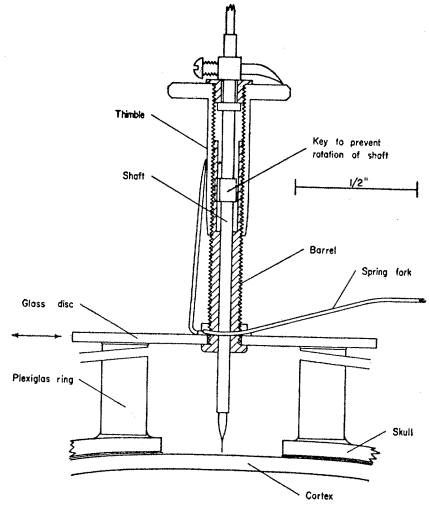

Fig. 1. Cortical chamber with attached microdrive.

eliminate backlash. Rotation of the shaft is prevented by a spring-loaded phosphor-bronze key which is soldered to the shaft and which engages a longitudinal slot in the barrel. There is a tendency of the upper end of the shaft to bend sideward slightly when the thimble is turned, producing a rotation about the slot as fulcrum or center. This is prevented by a washer (not shown in Fig. 1) that fits the shaft snugly and is soldered to the top of the barrel after the shaft has been inserted. End-play of the thrust bearing at the top of the thimble can be adjusted by means of the setscrew in the upper pointer. The total backlash of the thimble owing to this source and to looseness of the thread can be kept down to 15 μ without causing stiffness.

The chamber has been used in the department of physiology at Johns Hopkins University for studies of the first auditory and first somatic areas of the cerebral cortex of the cat (*6*). When the electric activity of a single neuron has been isolated, it is usually possible to record the activity as long as desired, although tests of this point beyond a few hours have not been made. On a few occasions, ball-and-socket joints have been made in the Plexiglas ring for introducing either gross electrodes for recording and stimulating or a cannula for local perfusion of the cortex. A later model of the microdrive has been made with a metric thread of ½ mm pitch.

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23 April 1956

Elevation of Platelets in Mid-Cycle: an Indication of Ovulation

Three methods to determine the time of ovulation in women have been generally accepted: (i) interpretation of graphs of basal temperature; (ii) cytologic examination of vaginal fluid; (iii) endometrial biopsy. Changes in the genital tissues would be expected to be delayed until after rupture of the Graafian follicle, whereas systemic reactions such as temperature elevation or alteration of blood elements might be expected to give a more prompt indication of ovulation. During a prolonged study of a female patient with essential thrombocytopenic purpura, it was observed that the platelets consistently reached their highest levels during ovulation, as determined by basal temperature graphs (*1*).

The present study (*2*) was concerned with variations in platelet levels during repeated menstrual cycles and with correlation of these platelet levels with the time of ovulation, as determined by basal temperature records. Twenty-six young women were studied. Twenty had normal cycles, four had been oophorectomized, and two were pregnant. Nine hundred seventy platelet counts (*3*) were done during 78 menstrual cycles for a 6-month period. Daily oral temperature recordings were kept by each woman. Daily platelet counts were performed in nine women for at least one complete menstrual cycle, and in the remainder of the women approximately 15 counts in each cycle were done mainly during menstruation and during the mid-cycle. Fifty-one cycles were complete and considered adequate for analysis.

The platelet levels in the 26 women varied from 70,000/mm³ to 462,000/mm³ with a mean of 217,000/mm³. Fluctuations of platelet levels from day to day ranged from 5000 to 30,000 in 46 cycles. In five cycles, however, the changes were considerable, varying from 40,000 to 80,000 from day to day, excluding ovulatory peaks and menstrual dips.

Following menstruation, the platelets either remained constant or rose gradually during the next 2 weeks (Fig. 1). In mid-cycle, the levels usually rose suddenly and dramatically within 24 hours, reaching the highest point during the entire cycle. Within another 24 hours, the platelets returned to their previous levels. In some cycles, this acute rise and fall of platelets was as high as 140,000. In nine cycles (17.7 percent) of eight patients, the platelet levels rose gradually and less dramatically during 2 to 3 days but always reached a peak during mid-cycle.

After the mid-cycle rise and fall, the platelet levels remained constant or decreased gradually until the onset of the next menstrual period and were lowest on the first or second day of the menstrual period. The platelets were found to be at equal levels on the first and second days of menstruation in 38 cycles (74.5 percent).

When the platelet levels were correlated with basal temperature graphs during the same menstrual cycle of patients with biphasic temperature records, the highest point of the thermal shift was found to coincide with the highest elevation of the platelets in 22 cycle (43.1 percent). In four cycles (7.8 percent) the platelets reached their highest values at the time of the temperature dip, whenever such a temperature drop was present. In nine cycles (17.7 percent) where no temperature dip was noted, the platelet peak occurred 24 hours before the temperature reached the highest eleva-

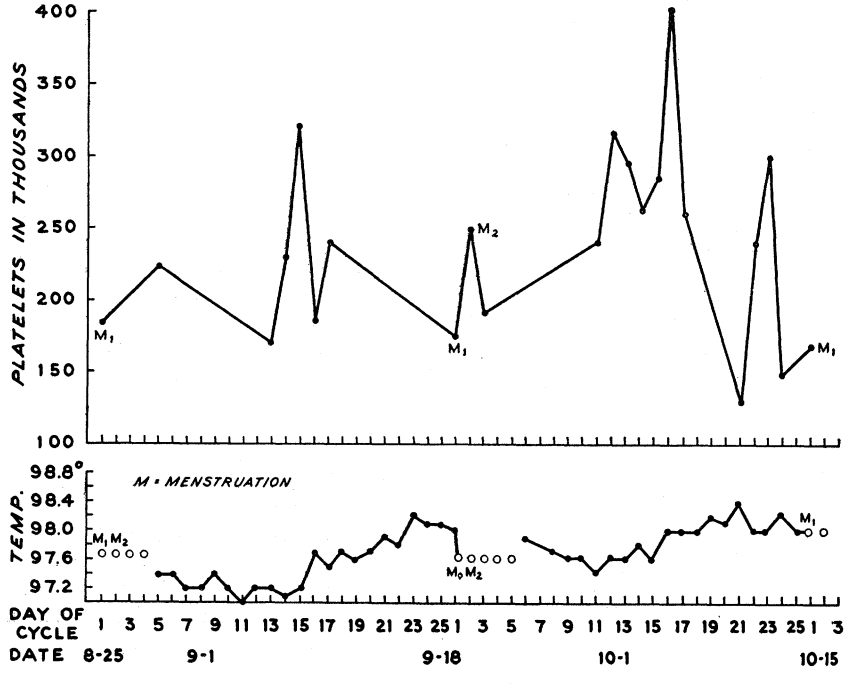

Fig. 1. Platelet levels and basal temperature during two successive biphasic menstrual cycles.