

QUANTITATIVE ASPECTS OF THE GROWTH OF THE HUMAN OVUM AND FOLLICLE

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The development of the mammalian follicle relative to that of the oocyte can be divided into two distinct phases, the regression line relating ovular to follicular size being steep in the first phase, and practically horizontal in the second. The point at which the two lines intersect gives the approximate time, in relation to follicular size, at which the oocyte completes its growth. Detailed information on this subject is available for the mouse (Brambell, 1928); the rat, ferret, rabbit and pig (Parkes, 1931); the baboon (Zuckerman & Parkes, 1932); the common shrew (Brambell, 1935); the lesser shrew (Brambell & Hall, 1936); the rhinolophid bats, *Rhinolophus hipposideros minutus* and *R. ferrum-equinum insulanus* (Matthews, 1937); and the rhesus macaque, *Macacus mulatta* (Green & Zuckerman, 1947).

The purpose of the present note is to provide corresponding information for the human oocyte and follicle.

MATERIAL AND METHODS

Serial sections of eighty ovaries were examined, but few provided any information of value because (1) some of the material had been gathered in post-mortem rooms, and degeneration had occurred in the interval between death and autopsy; or (2) even when the interval was not unduly prolonged, the routine methods used in pathological laboratories are usually inadequate for the fixation of an organ as large as the human ovary.

Nevertheless, since, in spite of widespread inquiry, we have failed to obtain for examination adult human ovaries in a state comparable with those of experimental animals, we have thought it worth while to assemble and analyse such data as we have managed to collect. It is hoped that the publication of the present results will make it possible for them to be improved upon by workers in a better position than we to obtain normal human ovaries for examination.

The methods of measurements were the same as those used in our previous study (Green & Zuckerman, 1947). Taking a continuous series of sections, a search was made under the microscope for measurable follicles. The section giving the largest dimensions of each follicle was selected, and the oocyte and follicle measured in two directions at right-angles to each other on tracings of projected images.

RESULTS

Ninety-one observations relating to the first stage of growth were obtained from measurements of a single ovary of a child of 6 years. Since most large follicles and ova were undergoing degeneration in the specimens available to us, only a few observations relating to the second phase of follicular growth could be obtained from a single specimen. In all, we managed to collect thirty-three observations relating to this phase of growth from thirteen ovaries.

Regression equations in the form of $y = a + bx$, where y is the diameter of the oocyte and x that of the follicle, were calculated for the two phases of growth after the data had been plotted so as to eliminate those measurements which fell in the region of intersection of the two regression lines. The values obtained were as follows:

$$\text{Phase I : } a = +10.28 \pm 1.45 : b = +0.59 \pm 0.03;$$

$$\text{Phase II : } a = +75.11 \pm 3.09 : b = +0.001 \pm 0.0015.$$

The 'best-fit' lines are shown in Fig. 1.

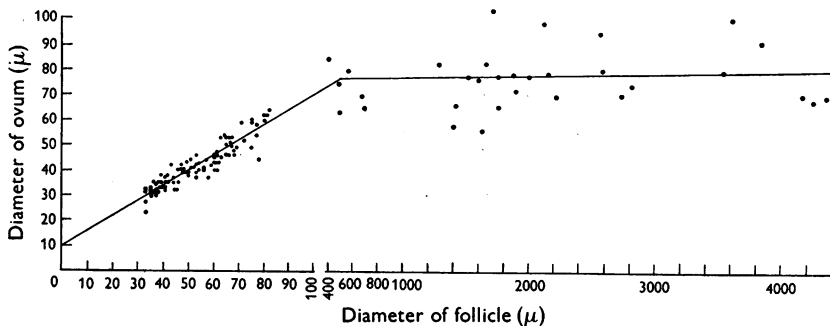


Fig. 1. Regression lines relating size of ovum and follicle in fixed human ovaries.

DISCUSSION

The present data indicate that in its quantitative aspects, the growth of the human ovum and follicle follows the same course as in other placental mammals. Furthermore, the value of b (0.59), as determined in the present study for the first phase of growth of the human ovum, does not differ markedly from that in some other species (e.g. the rhinolophid bat: $b = 0.60$; ferret: $b = 0.58$). It should be remembered, however, that differences in the slope of the best-fit line for the first phase of follicular growth may be statistically significant not only between species but also between individuals within a species.

As already observed, the point of intersection of the best-fit line relating the size of oocyte to follicle in the two phases of follicular growth gives an indication of the size at which the oocyte completes its growth. The value indicated by the present data (based on fixed and sectioned material) is 110μ . It is obvious, however, that the point of intersection is very sensitive to slight differences in the value of a and b . Its 5% fiducial limits for the present data are approximately 90 and 140μ .

This range is smaller than that of 120–190 mm., which Hamilton (1944) gives for fresh human ova which various workers, including himself, have recovered from the uterine tube. The difference between the two sets of figures is probably due to shrinkage during fixation. In Hamilton's experience this may account for a decrease of as much as 20%. Menkin & Rock's (1948) observations on two- or three-cell stage human embryos suggest that it may be as much as 50%.

SUMMARY

The relationship of the growth of the ovum to follicle follows the same course in man as in other placental mammals in which the quantitative aspects of the process have been studied. The process may be divided into two phases. The regression line

relating ovular to follicular size is steep in the first phase, and practically horizontal in the second. The value of b for the first phase of follicular development is similar to that in other mammalian species.

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