

Lipids in the Human Oocyte

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SUMMARY

The cytoplasm of the human oocyte contains two categories of lipid bodies that are here called L_1 and L_2 for the sake of brevity. The L_1 granules and spheres consist of phospholipids and triglycerides. The L_2 bodies occur as aggregations of granules or fenestrated plates, consisting of phospholipids. The yolk granules are made up of phospholipids, proteins, and carbohydrates.

INTRODUCTION

BY applying histochemical and 'Golgi' techniques the present author has studied various lipid-containing bodies in the oocytes of several reptiles, birds, and mammals (Guraya, 1957, 1958, 1959a, b, c, d, e, 1960, 1961). He has already summarized the previous work on the morphology of cell components in the mammalian egg (Guraya, 1959a). Beams and Sheehan (1941) have described the Golgi material in the form of irregular bodies and mitochondria in the form of granules in the human oocyte.

MATERIAL AND METHODS

The human ovaries used in the present investigation were provided by the surgeons of the Raja Hospital, Jullundur. Small pieces were treated according to the histochemical techniques tabulated in the appendix (p. 385) to this paper. For the study of lipids the material was embedded in gelatine after Baker (1946, 1949). After Carnoy and Zenker fixations the material was embedded in paraffin.

RESULTS AND DISCUSSION

The various histochemical techniques listed in the appendix reveal in the cytoplasm of the human oocyte two categories of sudanophil lipids that are here called L_1 and L_2 for the sake of brevity. The mitochondria and yolk granules also contain sudanophil lipids.

L_1 bodies. These are in the form of granules and spheres. They first appear near the nucleus (fig. 1, A). With further development of the oocyte, they become larger (fig. 1, B). Later they begin to disperse (fig. 1, C) and occupy the peripheral cytoplasm in the larger oocytes (fig. 1, D). They are also present in the follicular epithelium of young oocytes (fig. 1, B, C).

The L_1 bodies consist of phospholipids and triglycerides (see appendix for the histochemical reactions). They seem to be identical with the so-called 'Golgi material' of Aykroyd (1938) and Beams and Sheehan (1941).

The L_2 bodies, which consist of triglycerides in reptilian oocytes and of triglycerides and cholesterol and its esters in those of birds, do not occur in

the mammalian egg. The lipoprotein bodies, described in the young oocytes of birds (Guraya, 1957, 1959b), do not appear in those of reptiles or mammals. They have been identified as 'Golgi bodies' by some earlier workers.

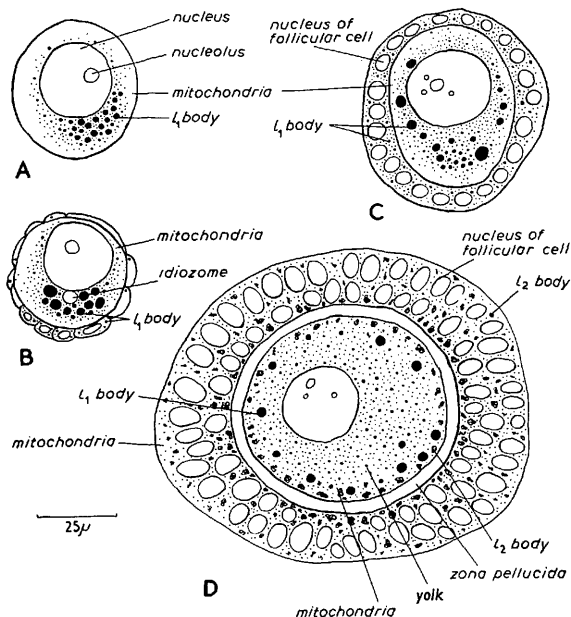


FIG. 1. Human oocytes; FCA+PC/SBB preparation. A, showing L_1 bodies and mitochondria near the nucleus of a young oocyte. B, showing L_1 bodies, mitochondria, and idiozome near the nucleus. C, showing dispersion of L_1 bodies and mitochondria; also L_1 bodies and mitochondria in the cells of the follicular epithelium. D, showing L_1 and L_2 bodies, mitochondria, and yolk granules in the cytoplasm of the larger oocyte, and L_2 bodies and mitochondria in its follicular epithelial cells.

L_2 bodies. In the human oocyte these are in the form of aggregations of granules or of fenestrated plates having sudanophobe areas. They appear at the periphery of the large oocytes, and also in the follicular epithelium surrounding these (fig. 1, D). Their sudanophil material is composed of a peculiar type of phospholipids. They were missed by Aykroyd and by Beams and Sheehan.

The L_2 bodies differ from the L_1 bodies in that they are preserved only when the material is fixed in formaldehyde/calcium and postchromed in dichromate/calcium after Baker (1946, 1956). This applies also to the L_2 bodies in the oocytes of various amniotes studied by the author. The L_2 bodies either

were missed by earlier workers, or else their incompletely fixed material was identified as 'Golgi apparatus', 'Golgi material', 'Golgi bodies', 'Golgi groups', 'clusters of Golgi bodies', 'compound Golgi bodies', &c. (See previous publications of the author.) Gupta and others (1959) have described the L_2 bodies of the present author as 'fenestrated bodies' in the oocyte of the rat.

Mitochondria. The mitochondria, in the form of granules, lie near the nucleus in young oocytes (fig. 1, A, B). With the growth of the oocyte they begin to disperse (fig. 1, C), till they are distributed throughout the cytoplasm in the larger oocytes (fig. 1, D). They give reactions for phospholipids and proteins.

Yolk. The sudanophil yolk granules, which are larger than the mitochondria, are seen among the latter in the larger oocytes (fig. 1, D).

Idiozome. A sudanophobe area identical with the idiozome of Beams and Sheehan is shown in fig. 1, B. It does not occur in large oocytes.

Various lipid-containing bodies (L_1 , L_2 , and L_3 bodies, lipoprotein bodies, various types of yolk, mitochondria) occur in the oocytes of reptiles, birds, and mammals. Their chemical composition is diverse. When the 'Golgi' methods are applied, osmium or silver is deposited on them and they are darkened. Thus there is no particular object in these cells to which the name of Golgi can properly be attached. Baker (1957) and Nath (1957) have denied the validity of the hypothesis that all cells of animals contain a cytoplasmic inclusion homologous with the internal reticular apparatus described by Golgi in the neurones of vertebrates.

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APPENDIX
 Table showing the histochemical reactions of cytoplasmic inclusions in human oocytes
 (Gelatine sections were cut at 10 μ and paraffin at 7 $\frac{1}{2}$ μ)

Technique	Fixation	Reference	L ₁ bodies	L ₂ bodies	Mitochondria	Yolk	Idiozome
Sudan black B(SBB) in 70% ethanol	FCa+PC	Baker, 1946, 1956	+++	+++	++	+++	O
Sudan black B(SBB) in 70% ethanol	FCa; FS+PC; F	Baker, 1944, 1949; Pearse, 1954	+++	NF	++	+++	O
SBB in propylene glycol	FCa+PC	Chiffelle and Putt, 1951	+++	+++	++	+++	O
Nile blue	FCa+PC	Cain, 1947, 1948	Pk+++	O	O	O	O
Sudan III and IV	FCa+PC	Kay and Whitehead, 1941; Govan, 1944	+++	+++	+	+++	O
Ferrot 7B	FCa+PC	Pearse, 1954	+++	+++	+	+++	O
Acid haematein (AH)	FCa+PC	Baker, 1946	+++	+++	++	+++	O
AH * PE	WB+PE	Baker, 1946	O	O	O	O	O
Fischer's test	F	Pearse, 1954; Lillie, 1954	O	O	O	O	O
Schultz's cholesterol test	FCa+PC; FCa; FS+PC; F	Gornori, 1952; Lillie, 1954	O	O	O	O	O
Mercuric bromophenol blue	C; WB+PE	Mazia and others, 1953	O	O	++	+++	O
Periodic acid / Schiff (PAS)	WB+PE; C; Z	Hotchkiss, 1948	O	O	O	+	O
SBB * acetone and ethanol	Fr	Pearse, 1954	O	O	O	+	O
SBB * PE	WB+PE	Baker, 1946	O	O	O	O	O

KEY TO LETTERING: * = after treatment with; C = Carnoy; F = 10% neutral formalin; FCa = formaldehyde calcium; FCa+PC = formaldehyde / calcium and postchromed; Fr = fresh material; FS+PC = formaldehyde / saline and postchromed; NF = not fixed; Pk = pink; WB+PE = weak Bouin followed by pyridine extraction; Z = Zenker; +++ = strong reaction; ++ = moderate reaction; + = weak reaction; O = negative.