The Structure of Nuclear Membrane in Larval Gonads of *Heliothis obsoleta*.*†‡ (22296)

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Evidence from electron microscope studies suggests that the nuclear membrane, at least in part, is not a continuous structure but is interrupted at intervals by pores, nodes, granules or ring-like formations. For example, the nuclear membrane of the amphibian egg is a double-layered structure with a continuous inner layer and a porous outer layer(1). The nuclear membrane of *Amoeba proteus* likewise is a 2-layered structure, but here the porous layer constitutes the innermost and the continuous layer the outermost lamella of the membrane(2,3). Other cells showing some form of porous structure in the nuclear membrane are oocytes of the salamander(4), kidney tubule cells(5), acinar cells of the pancreas(6), nerve cells from spinal ganglia (7,8), insect salivary gland cells(9-11), echinoderm eggs(12), several different types of rat cells(13), and chick embryonic cells (14).

Since the evidence for the porous nature of the nuclear membrane is based upon relatively few studies and since, if true, it would have important bearing on our notion of the mode of transfer of materials through it, further studies related to this subject seem warranted.

Materials and methods. Pieces of gonads from the larval insect *Heliothis obsoleta* (*Lepidoptera,* corn ear worm) were fixed for 30 minutes in buffered osmic acid at pH 7.25 (15), embedded in methacrylate(16) and sectioned at 0.025 μ by means of an International Rotary Minot type microtome(17) equipped with a glass knife(18). In Fig. 1, parts (1), (2), (3), and (4) were made by an RCA model EMU-2B electron microscope; part (5) was made with an RCA model EMU-3B electron microscope.

Results. The appearance and distribution of the nuclear membrane pores, or annuli, are clearly displayed in Fig. 1. The pores are best observed in oblique sections where they can be seen to be evenly distributed throughout the nuclear membrane at an average distance apart of approximately 1300 A (Fig. 1-1, 1-2, 1-5). In Fig. 1-2 the section is through a folded membrane showing bits of it (A) cut obliquely and the remaining part cut more or less longitudinally through the long axes of the pores.

The pores have an average diameter of about 280 A. They are encompassed by a relatively dense portion of the nuclear membrane measuring approximately 320 A in thickness (Fig. 1-3 and 1-5). Thus, the total diameter of the pore and surrounding membrane is approximately 920 A. In some preparations the relatively dense layer lining the pores appears smooth (Fig. 1-1, 1-2, and 1-3), while in others a somewhat granular appearance is observed (Fig. 1-5). The small dark granular mass appearing in the center of some of the pores (Fig. 1-5) may possibly represent material that was in the process of diffusing through them at the time the tissue was fixed.

Sections cut through the long axes of the pores show the profiles of the membranes constituting the walls to be darkly outlined (Fig. 1-2 and 1-4). In Fig. 1-4 the nuclear membrane is displayed as a single layer with an estimated thickness of from 60 to 70 A.

Discussion. From the literature cited in this paper it becomes evident that in many types of cells the nuclear membrane contains porous structures. Their orderly arrangement within the membrane and the fact that they have been demonstrated independently

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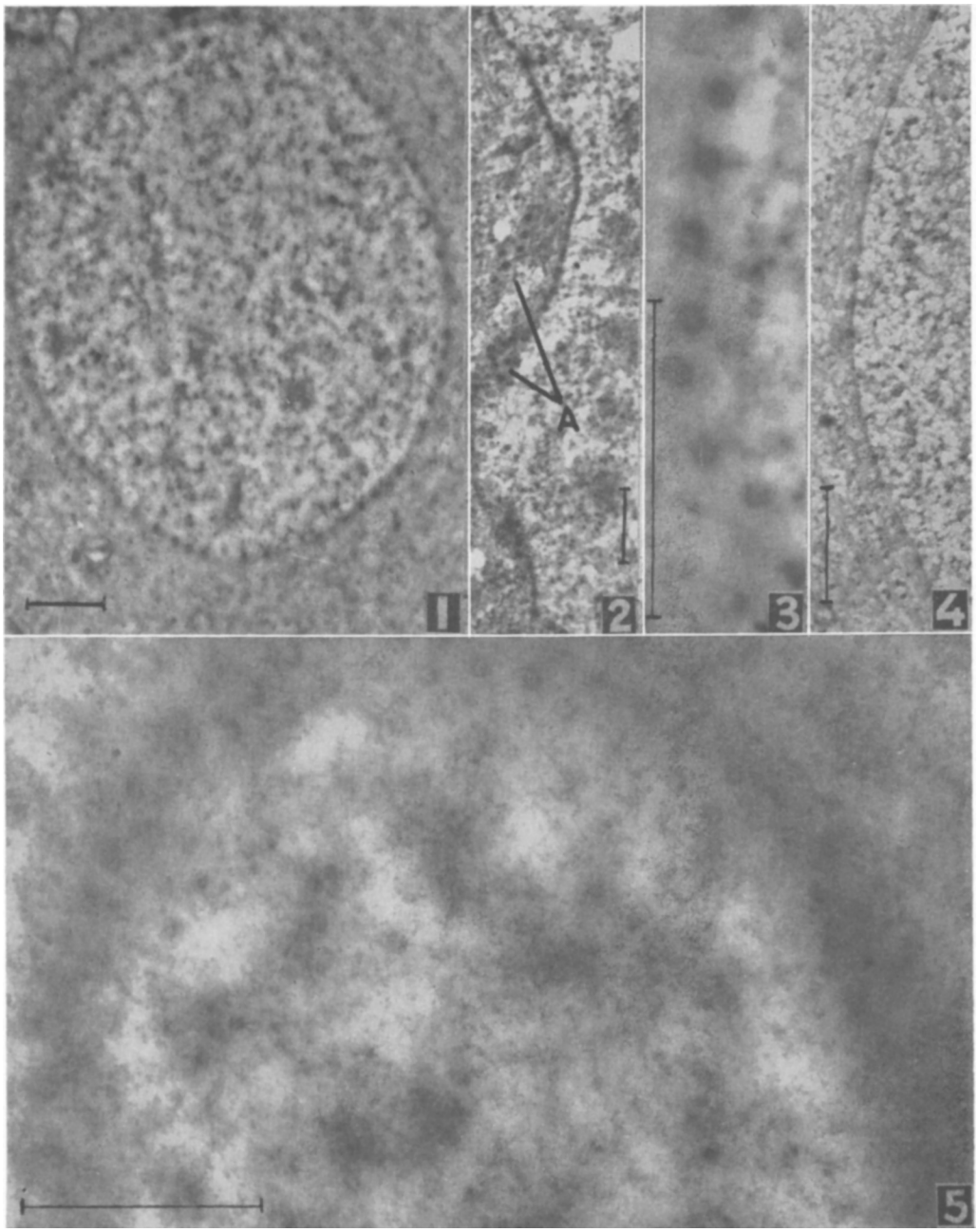

FIG. 1. Section through nuclear membrane showing pores cut either obliquely (1), (2A), (3) and (5), or longitudinally (2) and (4). The scale represents 1 μ.

by several different investigators is evidence against the view that they are artifacts. It has been suggested that they function as passageways for the diffusion of large molecules through the membrane(6).

It has been demonstrated that in certain cells bits of the nuclear membrane may be pinched off into the cytoplasm where they may contribute to the formation of the endoplasmic reticulum(10,11). In other cells, the

outer layer of the membrane is thought to be continuous with the endoplasmic reticulum; in such cases, it has been calculated that about one-tenth of the nuclear surface is in direct contact with the cytoplasmic matrix through pores, and the remaining surface is in indirect contact with it through the enclosed cavities of the endoplasmic reticulum (13). Such a close relationship between the nuclear membrane and endoplasmic reticulum is not apparent in the germ cells of the larva *Heliothis obsoleta*.

Summary. 1. Electron microscope studies on thin sections of germ cells of the larva *Heliothis obsoleta* have revealed the presence in the nuclear membrane of pore-like structures which are spaced about 1300 A apart. The pores are approximately 280 A in diameter and are surrounded by a relatively dense wall about 320 A in diameter. Thus, the diameter of the pore plus the surrounding wall is approximately 920 A. 2. The pores appear to be of a size that would permit the passage of large molecules through the nuclear membrane.

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Ineffectiveness of Sulfonylureas in Alloxan Diabetic Rats.* (22297)

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In explanation of the mechanism whereby the sulfonamide derivative, 1-butyl-3-p-aminobenzenesulfonylurea (BZ55) produces hypoglycemia in animal and man, Franke and Fuchs(1), Bertram, Bendfeldt and Otto(2) and Achelis and Hardebeck(3) postulate that the sulfonylurea interferes with the production of glucagon. In support of this hypothesis, these investigators refer to studies by others who demonstrated that some sulfonamide derivatives may reduce the blood sugar of alloxan diabetic animals(4,5). Further, Achelis and Hardebeck state that the sulfonylurea used by Franke and Fuchs(1), and by Bertram, *et al.*(2), produces a decrease in the blood sugar of some alloxan diabetic rabbits though they do state their impression that there may be no decrease in the blood sugar of severely diabetic alloxanized rats. In view of the paucity of data concerning this question, it became pertinent to determine whether or not the sulfonylureas are hypoglycemic in the alloxanized diabetic rat.

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