In a previous paper (1935), it was reported that in the cells of uropygial glands of chicken, sparrow and pigeon, the secretory globules did not first become visible in contact with Golgi material. From evidence available, it was concluded that the spatial relationship between the globules of secretory product and the Golgi material obtained later in the secretory process was a result of chance contact due to a hypertrophy of Golgi material on the one hand and an increase in size and number of the secretory globules on the other. It was further pointed out that though most of the Golgi "girdles" were seen around the large globules, it was not uncommon to observe them clapped around individual mitochondria. Thus on the basis of a topographical relationship, it is not justifiable to regard the Golgi material as the place of origin for the secretory product. On the other hand, a few figures were published in which the nucleus was shown to contain numerous droplets. Attention was also drawn to the disposition of these intra-nuclear droplets and that of those seen in the cytoplasm. Such observations would seem to point to a rather obvious conclusion; but for various reasons, the question was then dismissed with the remark that "this phase of the problem is left to be treated in a later paper".

It is now proposed to show (1) just what, if any, relationship exists between the intra-nuclear droplets and the extra-nuclear ones, and (2) if the mitochondria can be observably demonstrated to be immediately connected with the phenomenon of secretion.

The methods of study are the standard ones for fat and mitochondria; and in addition to chicken, sparrow and pigeon, wild duck has also been studied for this report.

Observations.

Secretory globules. Sections made according to any of the standard technics all show cells full of large globules, provided the cells are sufficiently mature. Yet it is an interesting fact that both Altman (1894) and Bowen (1926) obtained only negative images with osmic acid treatment. As mentioned in my previous paper, I succeeded in darkening only a few in the chicken glands by means of Kolatschev method. Schridde's method with from 2—9 days of post-osmication, and a four-week sojourn in 2% osmic acid at room temperature after Mann's
Further cytological observations on the uropygial glands of birds.

Fixation yielded no better result. Sudan III, Scharlach R, and Nile Blue boiled with sulphuric acid applied on fresh material also failed to stain the globules any more successfully. From experience gained from a large amount of material, it seems that the ability on the part of the globules to reduce osmic acid is attained only in a few cells at a time, and this is but of a transitory nature. Apparently, a chemical change is progressively going on in the secretory globules, and it is only when they are in the right chemical state that osmium tetra-oxide is reduced by them. Judging by the fact that the darkened globules are so seldom met with in sections, the state in which they possess the reducing power must be of a comparatively short duration.

The stained secretory globules may assume different shades, varying from very black to slightly colored. When the globules are very small, that is when they are found in cells wherein the secretory synthesis is just beginning, they are not impregnable at all. As they reach a size easily observable under the microscope, they begin to be colored a brownish shade (Figs. 1 and 2). When they have become fair-sized ones, they may either assume about the same shade as the previous state or intensely black (Fig. 3). It must be noted, however, that the cells represented by the figures are still comparatively young, as judged by their relative size, position and the number of globules in each cell. In regions where the cells are still more mature — the size of globules, however, does not necessarily undergo a corresponding increase — the secretory product either becomes again but slightly colored or not stained at all (Figs. 4, 5, and 6). It is interesting to note further that at this stage whenever the secretory product is still impregnable, it is practically always shown shrunken, and, but for a point of contact, is almost entirely separated from the surrounding cytoplasmic wall. Very often minute and intensely dark dots of fat can be easily made out in the shrunken mass.

So, from the stand-point of their ability to reduce osmium tetra-oxide, the changes undergone by the globules may be summed up as follows: From the time when they are barely visible until they have reached a size easily seen under the microscope, they do not seem to have any effect on the oxide. As they mature and increase in size, they progressively give from a brown to intensely black color reaction. Then their ability to reduce the oxide decreases and finally disappears.

Now, what is the relation between these globules and the intra-nuclear droplets as figured in my previous paper? Definite evidence is available that they do not bear any relations to each other. By prolonged immersion in osmium tetra-oxide solution after Mann's fixation, it has been possible to demonstrate the intra-nuclear droplets to be fat. After this method, and also other methods, such as Schridde and Kolaschew, though less successfully, they may be brought out most clearly as minute black dots of different sizes within a dull and usually uniformly brown nucleus (Figs. 7, 8, 9 and 10). As to the very small droplets seen in