

**MORPHOLOGICAL AND HISTOLOGICAL STUDIES  
ON UROPYGEAL GLAND OF DUCKS**

*By*

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The uropygeal glands of males and females Pekin ducks were dissected and examined morphologically and histologically for a whole year at an age interval of one month. The glands of 12 months of age Pekin, Rouen and Sudani ducks were also examined.

The relative weight of the uropygeal gland was low at hatch as its activity is not urgently required at this age for the bird. The period from one to three months of age was characterized by the highest relative weight of the gland due to the increased requirements for the oily secretion as at this time the ducks begin to swim. The average absolute and relative weights of the uropygeal gland were relatively equal in the three breeds of the experiment: Pekin, Rouen and Sudani.

Each lobe of the uropygeal gland increased in length and diameter until the age of three months then all the subsequent growth was only in length. Afterwards, no appreciable changes can be detected as the gland continues its normal function in oiling the feathers with the same rate. It seems also that the activity of the gland is correlated with body size more than age as their relative weight does not differ greatly after the attainment of mature body size. In general this gland is comparable to the sebaceous gland.

It seems that the uropygeal gland is more active in Pekin than in Rouen and Sudani, although the Sudani has the larger gland either in absolute, relative weight or diameter.

The uropygeal gland is the only cutaneous gland in poultry. Most of the studies were done on the structure of the gland and its comparable structure with the sebaceous gland (Bradly, 1950). This gland is of two lobes and attains the size of a pea in the fowl. The oily secretion is produced by numerous tubules which pour their secretion into a common cavity by an opening in the papilla. The secretion is formed by the transformation of the surface epithelium in the trabiculae into large layered glandular epithelium which become polygonal fat globules at the center of the lobe. The nuclei undergo shrinkage followed by disintegration of the cells, which form fatlike spheroid droplets through the excretory duct of the gland Bradly (1950) and Trautman and Fibeger (1960).

**Materials and Methods**

Five males and five females of Pekin ducks, at hatching day 1, 2,3, 4, 5, 6, 9 and 12 months of age were examined to study the effect of age and

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sex. To eliminate the effect of season, these ducks were hatched at one month interval. At the end of the year all the ages were available and the required number summing up 90 individuals were separated from the stock for the study. The slaughter test was done for all the individuals from 13th of July to 28th of August. One individual from both sexes from each age group was examined each three days. However, the day old ducklings were all studied at the same at one day on the 13th of July before the beginning of the test of other ages.

On the other hand, to study breed and sex differences at 12 month of age, five drakes and five ducks of each of the Pekin and the Rouen being standard breeds, and the Sudani being a native one (Yamani 1964), were examined. The foundation stock of Sudani ducks used in this study was collected from local markets to resemble the normal population as far as possible. The study was done for all the individuals from 23rd to 28th August. One individual from each sex from each breed was examined each day. Up to the time of killing all the birds were fed and reared alike.

Absolute and relative weights were recorded for the gland. Relative weights were calculated by dividing the absolute weight of the gland by the absolute weight of the body and multiplied by 100. In all the study the weights were in milligrams.

Oil gland was completely separated with its two lobes, freed from adjoining tissues and weighed. The length and the diameter of each was measured in microns by a micrometer.

Samples for histological examinations were preserved in five percent formalin solution at the time of test to be sectioned afterwards.

Samples from the gland were taken from the formalin solution and washed for 24 hours under tap water stream to wash as far as possible the formalin from the tissues.

Samples were cut into pieces of three to five millimetres in thickness, fixed on the freezing microtome, then sectioned at 10 microns. This sections were stained with Haematoxylin and Sudan Black Method and mounted in glycerine-jelly.

Transverse and cross sections in each age group for both sexes were examined microscopically and were fully described. The diameter of the lumen and the length of the base of the trabiculae in cross sections from both sexes without separation were measured in microns in 100 fields in each age group. At the ages of one, four and nine months of Pekin ducks the measurements were made for male and female sections separately in 100 fields for each sex at each age.

Longitudinal sections were also made on all the ages. Photographs were taken at magnification of  $\times 60$ .

Analysis of variance was used for studying the effect of age, sex and breed for the gland. The statistical methods used were those suggested by Snedecor (1957).

### Results and Discussion

#### *Morphological Description :*

The uropygeal gland is of two lobes joined with a papilla which appears on the last coccygeal vertebra just under the skin. The two lobes are well-developed and large in size (Plate 1 : A). In general, they are greatly larger in size than those of the fowls (Bradly, 1950). It seems that the role of the uropygeal gland is more essential in ducks as aquatic birds, than chickens, so its size and activity appears to be higher in the former than the latter as will be discussed later.

#### *Histological Description :*

##### *The structure of the well developed gland :*

Each lobe of the gland is divided internally by trabiculae which are lined internally with stratified epithelium. These trabiculae are columnar and perpendicular on the surface of the lobe. At the centre the trabiculae is modified into tubular like tubules which pour the oily secretion of the gland to the excretory duct, which ends to an opening in the papilla on the surface of the skin. There are three types of epithelial cells, superficial, glandular and disintegrated ones. The superficial multiply to produce the glandular type of cells towards the center of the trabiculae. The glandular cells were larger in size and lighter in colour. The disintegrated cells form the fatlike spheroid droplets which glide down from the trabiculae to the excretory duct at the center of the lobe. This is the oily secretion which is normally excreted from the opening of the papilla (Plate 1 : A,B and 2 : A,C,D.).

The papilla which joined the two lobes of the gland is a loose spongy connective tissue in which there are the two openings of the two excretory ducts of the two lobes, blood vessels and niches of the feathers. The connective tissue of the same nature of the papilla also covered the whole outer layer of each lobe. In this layer evidence of fat deposition occurred (Plate 1 : B.).

### Developmental Changes

#### *Morphological estimates :*

##### *2.—Age and sex differences :*

Each lobe of the uropygeal gland increased in length and diameter until the age of three months, then all the subsequent growth was only in length (Table 3).

## PLATE 1

- A.—The uropygeal gland at different ages (Age in months). "Normal size".
- B.—Diagrammatic transverse section in uropygeal gland of one day old ducks ( $\times 60$ ).
1. Adipose tissue.
  2. Epithelial cells.
  3. Glandular epithelium preliferation.
  4. Trabeculae.
  5. Polyhydral fat globules.
  6. Excretory duct.
- C.—Transverse section in uropygeal gland of one day old ducks ( $\times 60$ ).

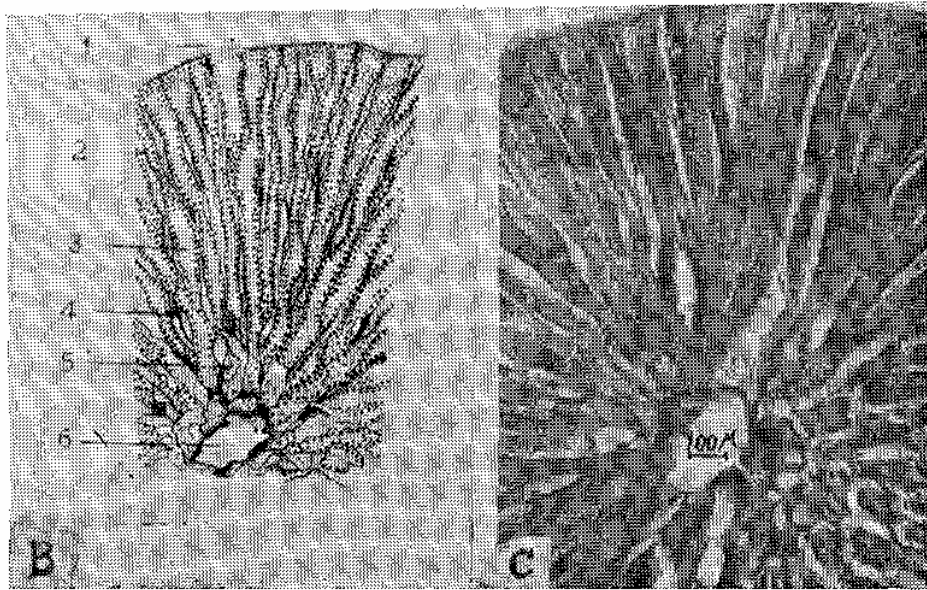
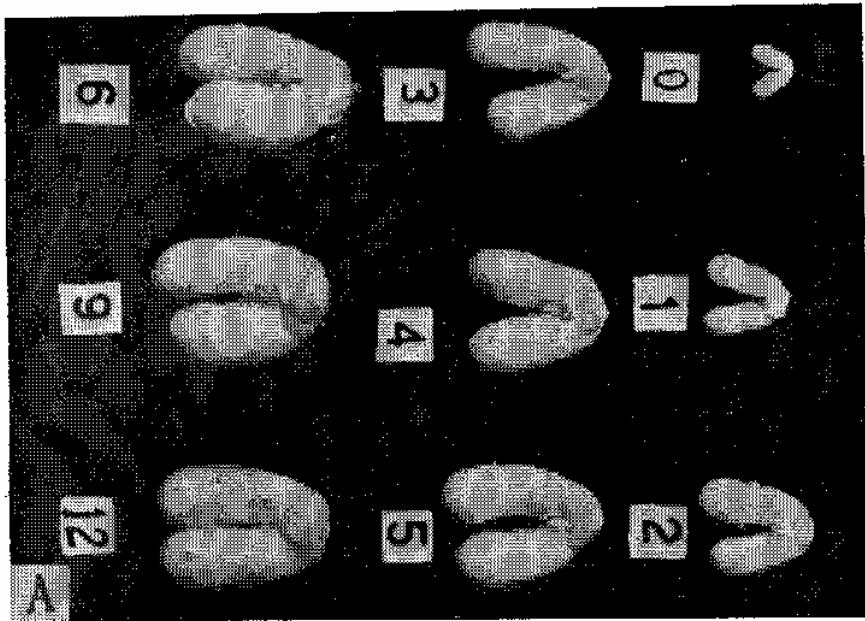


Plate (1)

*U.A.R. J. Anim. Prod.*, 10, No. 1 (1970).

The uropygeal gland increased steadily in absolute weight with the advancement of age until the end of the experiment (Table 1). The relative weight of the gland was low at hatch as its activity is not urgently required at this age. The period from one to three months was characterized by the highest relative weight of the gland due to the increased requirements for the oily secretions, as at this time the ducks begin to swim. Afterwards, no appreciable changes can be detected as the gland continues its normal function in oiling the feathers with the same rate. Age difference was highly significant in the relative weight of the uropygeal gland while sex difference was not significant (Table 1). It seems also that the activity of the gland is correlated with body size more than age as their relative weight does not differ greatly after the attainment of mature body size. Accordingly, the function of this gland is restricted to the secretion of the oil covering for body feathers and no further function is thought to be superior to that in waterfowls or in chickens Bradley, (1950) Trautman and Fiebiger, (1960)

TABLE 1.—AVERAGE ABSOLUTE AND RELATIVE WEIGHT OF THE UROPHYGEAL GLAND FOR MALES AND FEMALES PEKIN DUCKS AT DIFFERENT AGES.

Age in Months	Males		Females		Average	
	Wt.	Rel. Wt.	Wt.	Rel. Wt.	Wt.	Rel. Wt.
At hatch	78	199	64	167	71	183
1	490	253	690	223	590	235
2	1360	284	1380	306	1370	295
3	2560	255	2650	235	2610	244
4	3390	195	3130	199	2360	197
5	4120	193	3810	211	3970	206
6	4710	196	4020	192	4370	194
9	4900	204	4160	193	4530	199
12	5650	282	3670	190	4660	237
Average . .	3029	229	2619	213	2826	221

F. value: Between ages = 4.50<sub>xx</sub>

Between sexes = 2.7

xx Highly significant at 1% level

### 2.—Breed and Differences :

The average diameters of the two lobes were higher in the Sudani than both the Pekins and Rouens, while on the reverse were the length of the lobes (Table 4). This indicated, however, the large size of the uropygeal gland of the Sudani than the other two breeds.

The average absolute and relative weights of the uropygeal gland were almost equal in the three breeds (Table 2). Breed and sex differences in uropygeal gland relative weights were not significant (Table 2).

TABLE 2.—AVERAGE ABSOLUTE AND RELATIVE WEIGHTS IN UROPYGEAL GLAND OF DIFFERENT BREEDS AND SEXES

Sex	Pekin		Rouen		Sudani	
	Weight	Rel. Wt.	Weight	Rel. Wt.	Weight	Rel. Wt.
Males . . .	5.650	0.282	3.360	0.243	6.360	0.265
Females . .	3.670	0.190	2.820	0.222	4.150	0.255
Average . .	4.660	0.237	3.220	0.233	5.250	0.260

F. Value : Between breeds = 1.69  
Between sexes = 1.08

### Histological Estimates

#### 1.—Age differences :

The diameter of the lumen and the length of the base of the perpendicular trabiculae, were very low at hatch as the gland was in the beginning of proliferation stage. At the subsequent ages, these values increased gradually until the 12th month of age. The excretory function of the gland, as measured by the rate of proliferation and the desintegration of the epithelial walls of the trabiculae, followed the same trend observed in the development of the gland lobes diameters and weights. The histological examinations showed no sex differences as all the estimations were relatively similar in the two sexes.

*U.A.R. J. Anim. Prod.*, 10, No. 1 (1970).

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TABLE 3.—AGE AND SEX DIFFERENCES IN DIFFERENT UROPHYGEAL GLAND ESTIMATES OF PERIN DUCKS

Items	Age in months											
	At hatch	1	2	3	4	5	6	9	12			
Male weight gm. . . . .	0.078	0.490	1.360	2.560	3.390	4.120	4.710	4.900	5.650			
Male relative weight . . . . .	0.199	0.284	0.284	0.255	0.195	0.193	0.196	0.204	0.282			
Female weight gm. . . . .	0.064	0.690	1.880	2.650	3.130	3.810	4.020	4.160	3.670			
Female relative weight . . . . .	0.167	0.223	0.306	0.235	0.199	0.211	0.192	0.193	0.190			
Average weight gm. . . . .	0.071	0.590	1.370	2.610	3.260	3.970	4.370	4.530	4.660			
Average relative weight . . . . .	0.183	0.235	0.295	0.244	0.197	0.202	0.194	0.199	0.237			
Diameter of the lobe (cm) . . . . .	0.3	0.7	0.9	1.0	1.0	1.1	1.1	1.3	1.4			
Length of the lobe (cm) . . . . .	0.7	1.7	2.1	2.4	2.7	3.1	3.1	3.2	3.3			
<i>Diameter of the lumen (M):</i>												
Male . . . . .	—	1992	—	—	4200	—	—	4648	—			
Female . . . . .	—	2128	—	—	4040	—	—	3836	—			
Average . . . . .	266	1960	2924	3808	4120	4060	4080	4242	5712			
<i>Length of base of trabiculae (M):</i>												
Male . . . . .	—	96	—	—	194	—	—	196	—			
Female . . . . .	—	112	—	—	168	—	—	188	—			
Average . . . . .	56	104	118	182	181	196	210	192	238			

(M) = Micron.



## PLATE 2

A.—Longitudinal section in uropygeal gland of one day old ducks (one lobe) ( $\times 60$ ).

B.—Diagrammatic longitudinal section in uropygeal gland of one month old ducks (Two lobes ( $\times 60$ )).

1. A loose spongy connective tissue.
2. The open of the excretory duct in the papilla.
3. A trabicule filled with epithelial and glandular cells.
4. Adipose tissue between the two lobes.
5. Excretory duct.

C.—Diagrammatic transverse section in uropygeal gland of one month old ducks ( $\times 60$ ).

1. Adipose tissue.
2. Epithelial cells.
3. Glandular epithelium.
4. Trabaculae.
5. Polyhydral fat globules.
6. Excretory duct.

D.—Transverse section in uropygeal gland of one month old ducks ( $\times 60$ ).

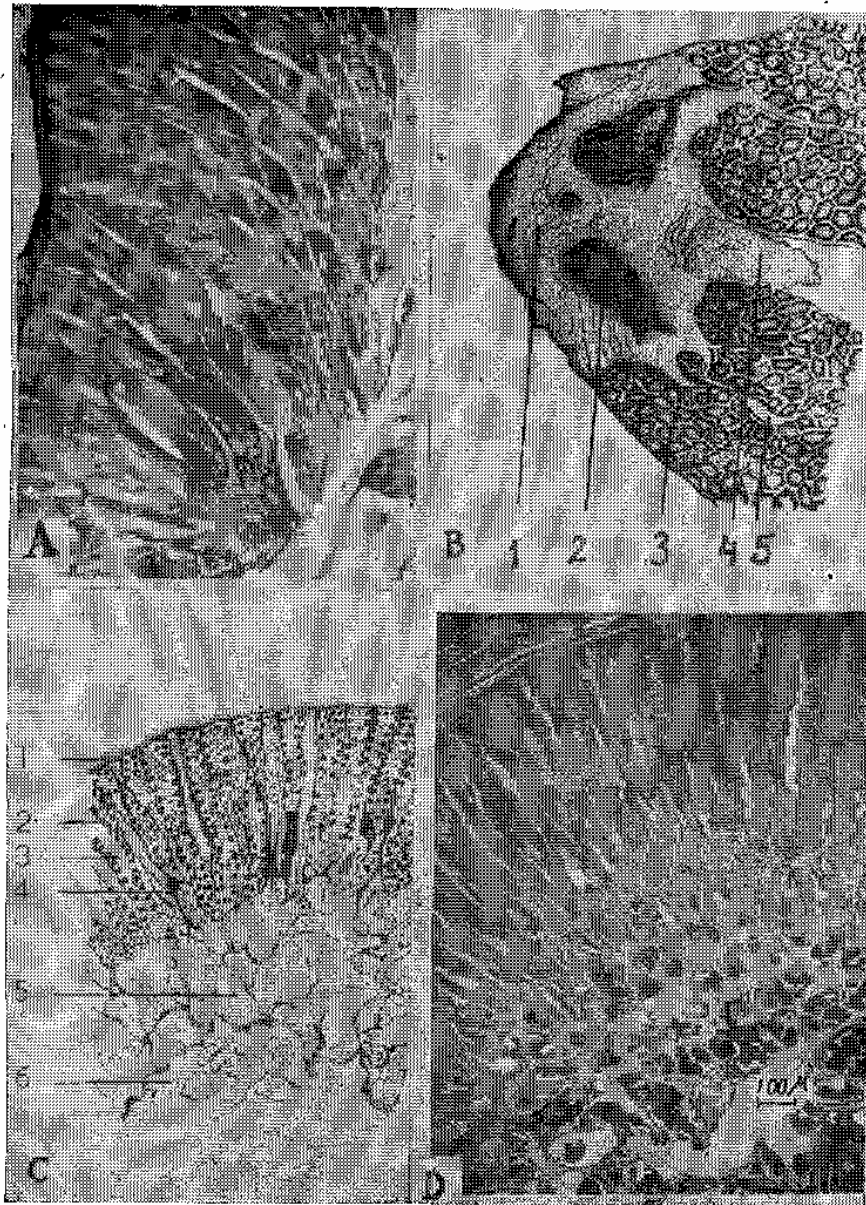


Plate (2)

The uropygeal gland, being a holocrine, branched and alveolar gland is comparable to a great extent to the sebaceous gland. At hatch, each lobe is divided with elongated, columnar perpendicular trabiculae full of superficial and stratified epithelium, which took darker appearance in the transverse section. It seems that all the activity of the gland at these early ages is directed to the mitotic divisions of the cells to proliferate the superficial and the stratified epithelium cells. With the advancement of age, the mitotic division continued in the periferal cells and the stratified cells to provide the mechanism for replacing cells in the center of the trabiculae. The differentiation begins in the center of the lobes and trabiculae and progresses centerifugally to transform the epithelium cells to the glandular epithelium. At the tubular branch of the trabiculae the glandular epithelium desintegrated to fat-like droplets which glide down to the excretory duct as the oily secretion of the gland. As the activity of the gland increased with age, excretory duct increased in diameter, while the elongated trabiculae shortened in length (Plate 2 : C, D). The superficial epithelium were the most common at hatch, while the surface area of glandular and desintegrated epithelium increased on subsequent ages as the gland acts its secretion process.

#### 2.—Breed Differences :

The diameter of the lumen and the length of the base of the trabiculae in the Pekin were higher than in other breeds. It seems that the uropygeal gland is more active in Pekin than in Rouen and Sudani, although the Sudani has the larger gland either in absolute, relative weights or diameters (Table 4).

TABLE 4.—BREED AND SEX DIFFERENCES IN DIFFERENT  
OIL GLAND ESTIMATS

Items	Pekin	Rouen	Sudani
Male's weight gm . . . . .	5.650	3.630	6.360
Relative weight . . . . .	0.282	0.243	0.265
Female's weight gm . . . . .	3.670	2.820	4.150
Relative weight . . . . .	0.190	0.222	0.255
Average weight's gm. . . . .	4.660	3.220	5.250
Average relative weight . . . . .	0.237	0.233	0.261
Diameter of the lobe (cm) . . . . .	1.4	1.2	3.2
Length of the lobe (cm) . . . . .	3.3	3.2	2.8
Diameter of the lumen (M) . . . . .	5712	4312	3248
Length of the base of the trabiculae (M)	238	182	196

(M)=Micron

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*M. Sc. Thesis. Faculty of Agri. Cairo. Univ.*

## دراسة مورفولوجية وهستولوجية على الغدة الزيتية في البط

جمال قمر ، كمال عرفه يمى

### الملخص

فحصت الغدة الزيتية للذكور وإناث البط البكين بعد تشريحها وذلك مظهرياً وهستولوجياً وذلك لمدة سنة على أعمار بينها شهر في كل حالة . وعند عمر ١٢ شهراً فحصت الغدة الزيتية لثلاثة أنواع من البط وهى البكين والروان والسودانى وذلك لنفس الصفات .

الوزن النسبى للغدة الزيتية كان منخفضاً عند الفقس لأن نشاط الغدة كان غير مطلوب وتميزت الغدة من عمر شهر الى ثلاثة شهور بزيادة كبيرة فى الوزن النسبى لاحتياج الطائر لنشاط الغدة فى هذا العمر لأنه يبدأ فى المساحة فى ذلك الوقت . وكان الوزن النسبى متساوياً للأنواع الثلاثة المدروسة وهى البكين والروان والسودانى .

كل غدة زادت فصوصها فى الطول والقطر حتى عمر ٣ شهور بينما كان النمو بعد ذلك منحصراً فى الطول . وبعد هذا العمر لم يحدث أى تغير فى الغدة حيث أنها تظل فى عملها بمعزل ثابت ووجد أن نشاط الغدة فى هذه المرحلة يكون متعلقاً بالحجم وليس بالعمر . وعلى العموم يبدو أن الغدة كانت أكثر نشاطاً فى البكين عن الروان والسودانى برغم أن السودانى أكبرها حجماً .