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GLOMERULAR POPULATION IN KIDNEY OF *Raja erinacea* AND *Squalus acanthias*

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Kidney micropuncture studies in the dogfish and little skate as well as recent attempts at more rigorous analyses of energy exchanges serving their renal functions have made it important to know the number of nephrons comprising the kidneys of these elasmobranches. Glomerular counts published by Nash (Am. J. Anat. 47:425-445, 1931) are usually cited but these were made on only one or two individuals of each species and -- in the case of *Squalus* and *Raja* -- differ materially from our findings.

We report here kidney weights and glomerular counts on 14 little skates and six spiny dogfish. All dogfish were female. Data from skates are for single kidneys, that from dogfish are for one-half the entire renal mass.

All kidneys had been removed from freshly-killed animals and fixed in formalin for two-six months. The weighed tissue was macerated in concentrated HCl for 30 hours at room temperature, the acid then drawn off, and the tissue broken up by gentle agitation in water made up to a final volume of 100 ml. The suspension was carefully mixed and all glomeruli in 1.0 ml portions counted on a lined Petri dish. An average of 20 counts times the volume of suspension was taken as the number of glomeruli in that segment of tissue, in the case of the skate this comprised the entire kidney.

The 14 skate kidneys had a mean glomerular count and S.D. of 2260±120 (see Table). Total counts per kidney are narrowly dispersed, the range being 2100-2400. Mean weight of the nine female kidneys was 1.48±0.31 g and

glomerular counts per gram kidney tissue averaged 1580. The five kidneys of male animals had a mean weight of 0.90±0.08 g and a glomerular count per gram that averaged 2530. Nash (cf. ref. above) gives a glomerular count for one kidney of *Raja erinacea* of 1197, half of our mean value.

TABLE

	Glomerular Counts per Kidney	Kidney Weight g.		Glomeruli g^{-1} x KW	
		Male	Female	Male	Female
Raja erinacea mean + SD	2260±120 n=14	0.9±0.08 n=5	1.48±0.31 n=9	2530 n=5	1580 n=9
*Squalus acanthius**					
1	9,098		7.5		1220
2	7,928		5.0		1580
3	10,470		5.4		1950
4	7,000		4.9		1440
5	10,190		5.8		1760
6	8,700		6.7		1300

*Data are total renal mass x 1/2.

Glomerular counts in the dogfish are quite variable both in different sections of the same kidney and from one kidney to another. Each kidney was divided into six to seven approximately equal sections from the thin cephalic to the thick caudal portion. Sections were counted separately and glomerular number calculated for the whole section and per gram of tissue. Total counts per fish for the fused renal mass ranged from 14,000 to 21,000

in kidneys of comparable weight (10-12 g); in the Table the counts for the fused renal mass are divided by 2 to give an expression of glomeruli per kidney.

Variability of density in the glomerular population ranged from 300/g kidney tissue in the thin cephalic to 3000/g in the thick caudal segment of the same kidney. Even in corresponding portions (the most caudal 10 percent) the density of glomerxli shows great variability from one animal to the next (from 1500 to 3000/g kidney weight in this series). The sparsity of population in the thin cephalic portion is such that the caudal 50 percent (by length) contains 90 percent or more of the total glomerular count. Nash divided the fused kidneys of two *Mustelus canis* "as accurately as possible" into right and left halves. The right kidney of one yielded 4397 glomeruli, the left kidney of the other 5248. Either number would give a total kidney count significantly less than our smallest value for *Squalus acanthias*.

In summary, the skate kidney is a homogenous structure having a fixed glomerular population per fish and approximately 2260 glomeruli per kidney. Kidneys of male skates weigh less than those of females so that results -- such as enzyme activities -- should take into account the denser nephron population of the male. The dogfish kidney exhibits a marked variability in the number and distribution of its glomeruli. The average of six counts was 10,350 glomeruli per kidney but is not representative. Over 90 percent of the glomeruli are in the caudal 50 percent (by length) of the kidney.