tion to urea was present in excretions from both organs, but the possibility remained that the ammonia was a decomposition product and was not excreted as such. Accordingly, objectives of the present work were to determine: (1) the quantity of ammonia excreted by the adult frog skin, (2) the relative amount of nitrogen excreted by the skin and kidney, and (3) the factors influencing the mode of nitrogen excretion.

Retention catheters were inserted in the cloaca and the frogs were placed in small vessels containing water buffered at pH 7. Excretions from the kidneys and skin were then analyzed separately for ammonia and urea. Repeated experiments in the presence of high concentrations of streptomycin, penicillin G, and achromycin showed that ammonia was still present in the excretions from both organs. The division of excretion between skin and kidney varied widely, but in all cases both organs excreted significant amounts of nitrogen; the ammonia nitrogen from each organ was in most cases between 0 and 20 per cent of the total.

The data were marked by wide variations in the mode of excretion, however, and it was not determined which of the many variables such as diet, temperature, presence or absence of bath water, sex or species of frog were responsible for this variation. The presence or absence of bath water did not appear to be an important variable in this respect.

Preliminary experiments were performed on the relative rate of excretion of urea and thiourea by the skin and kidney. Again, both organs were important in excreting exogenous loads of these compounds and, by comparison with in vitro data, simple diffusion seemed adequate to explain loss through the skin. Permeability of the skin to thiourea was approximately 50 per cent greater than to urea.

Transpleural Exchange Rates in the Frog

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Three types of experiments were performed on 24 adult bullfrogs (Rana Catesbiana): 1) the display of the blood vessels on the surface of the lung; this procedure involved the in-situ injection of 10 ml of saturated calcium chloride into the beating heart, filling of the lungs with saturated sodium bicarbonate, fixation of the fluid-containing lungs in formalin and clearing of the lungs in a one per cent solution of potassium hydroxide containing Alizarin Red S, 2) introduction of the test solution by tracheal catheter into one lung of the pithed, live frog followed by removal of the lung ("dead lung") for immersion in an isosmotic frog Ringer's solution and 3) expression of one lung through a slit in the thorax of a pithed frog followed by introduction of the test solution by tracheal catheter into the exposed lung and immersion of the in-situ lung ("live lung") in an isosmotic solution. The injection method served to illustrate the fine vascular pattern of the surface of the lung by precipitating calcium in the vessels and staining the precipitate with Alizarin Red. The behavior of the

"live" and "dead" lungs showed no consistent difference with respect to either phenol red or chlorphenol red. On the other hand, different rates of passage of urea from inside-out (A) and from outside-in (B) were observed.

	A		B	
Time	"live" outside	"dead" outside	"live" inside	"dead" inside
min	mm/ml		mm/ml	
30	1.92	.0005	0.196	0.192
60	3.66	.0009	0.177	0.168
90	4.62	.0013	0.140	0.165
120	6.20	—	0.002	—

These data suggest that the "live" pleural surface differs in its transport characteristics from the "dead" pleural surface.

Renal Function During Frog Metamorphosis

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The primary objective was to determine whether renal tubules of tadpoles could actively secrete exogenous urea before Stagg XX, a period during which, as previously demonstrated by others, the rate-limiting component in urea synthesis by the liver (arginine synthetase) shows little or no activity. The adult bullfrog actively transports urea across renal tubular epithelium by an energy demanding process which is subject to competitive inhibition. Carriers in such secretory processes exhibit an order of specificity similar to that of enzymes, and the tentative hypothesis could be proposed that for developing tadpoles the simultaneous onset of urea secretion by the renal tubule and urea synthesis by the liver might point to the rate-limiting synthesizing enzyme, or one of the others known to be involved in urea synthesis, as the carrier in the renal transport process.

Our current studies show that Stage XX (leg to tail ratio of 1.0), the same developmental stage that was critical for the onset of urea synthesis in *Rana catesbeiana*, is also the stage at which urea urine/plasma concentration ratios exceed those of exogenous creatinine. The latter was used here in locally collected *Rana clamitans* to assess the fraction eliminated solely by glomerular filtration. Nine tadpoles ranging between Stage X and IXX (leg:tail ratios of .05 to .85) had urea to creatinine U/P ratios which averaged 1.0, while six between Stages XX to XXIII (leg:tail ratios of 1.0 to 3.0) averaged 1.82.