Table 1. MEAN VALUES OF α -KETOGlutARIC AND PYRUVIC ACIDS IN BLOOD AND URINE DURING 24 HR. AND THE CLEARANCES IN HEALTHY PERSONS, AND IN PATIENTS WITH KIDNEY DAMAGE

		No. of cases	Corresponding keto-acid	Mgm. per 100 ml. of blood	Mgm. in 24 hr. urine	Mean clearance values in 24 hr. (ml. per min.)
Healthy	women	3	KG	0.14 ± 0.05	18.66 ± 4.41	8.47 ± 1.86
			P	0.44 ± 0.09	11.41 ± 3.10	1.76 ± 0.43
	men	3	KG	0.15 ± 0.06	11.95 ± 2.52	7.67 ± 1.91
			P	0.51 ± 0.12	9.62 ± 2.67	1.46 ± 0.42
Kidney damage	women	5	KG	0.16 ± 0.07	17.36 ± 3.81	7.93 ± 1.66
			P	0.58 ± 0.13	11.36 ± 2.95	1.52 ± 0.39
	men	5	KG	0.17 ± 0.06	11.99 ± 2.16	5.80 ± 1.10
			P	0.65 ± 0.16	10.27 ± 2.15	1.30 ± 0.36

KG, α -Ketoglutaric acid; P, pyruvic acid,

decarboxylations will be of principal importance here. It is possible to explain the relatively high concentration of α -ketoglutaric acid in urine (almost 10 times higher than that in blood) by either its lower re-absorption in renal tubules or by its higher elimination rate in the kidneys.

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¹ Zelníček, E., *Nature*, **184**, 727 (1959).² Zelníček, E., *Cas. lékař. ces.* (in the press).³ Nordmann, J., and Nordmann, R., *Klin. Chem.*, **3**, Supp. 462 (1957).

Respiratory Function of the Swim-bladder of *Notopterus* (Lacepede)

BRIDGE¹, working on the swim-bladder of *Notopterus borneensis* (Bleeker), and Srivastava², on that of *Notopterus chitala* (Buchanan-Hamilton), concentrated their attention only on the general plan of the organ.

A detailed account of the swim-bladder and its relation with the internal ear in the genus *Notopterus* has already been published by me³. During the course of study, the fish lived for an indefinite period in the laboratory even when the water in the aquarium became foul and contained less than 0.5 p.p.m. of dissolved oxygen for most of the time. The specimens of *N. chitala* and *N. notopterus* (Pallas) kept in the aquarium rose to the surface to gulp air at regular intervals. If they were prevented from rising they died in 4–6 hr. The duration of time between the two consecutive gulps of air varied generally from 2 to 8 min. under normal conditions. The frequency of surface visits increased after air was removed from the swim-bladder forcibly by pressing at its caudal

cæcum (Fig. 1) or by drawing air out of the organ by means of a hypodermic syringe. Thus it may be presumed that a part of the air gulped by the fish enters its swim-bladder through its pneumatic duct at intervals and thus brings about a regular exchange of gases between the cavity of the organ and the exterior.

Histological study of the swim-bladder wall shows that the tunica interna is abundantly supplied with blood capillaries. The blood is brought in close contact with the contained gases which diffuse through the thin layer of epithelial cells. The circulation of blood is modified in the organ to facilitate its function as an accessory respiratory organ on the plan observed by Carter and Beadle⁴. The blood supply is from the dorsal aorta and the oxygenated blood is drained back to the heart through the posterior cardinal vein.

Further evidence of aerial respiration came from the analyses of gases from the swim-bladder of the fish. The gases were drawn from the caudal cæcum of the swim-bladder by means of a hypodermic syringe and analysed by an apparatus made in the laboratory on the plan described by Fry⁵. Immediately after *N. chitala* had gulped air, the percentages of oxygen and carbon dioxide in the gases of its swim-bladder were found to be (mean) 16 and 0.5 respectively. But when the fish were prevented from gulping air for 10 min., the percentages of oxygen and carbon dioxide in the gases of its swim-bladder were found to be (mean) 6 and 4 respectively. The water contained 1 p.p.m. of dissolved oxygen and 20 p.p.m. of free carbon dioxide during the above observations.

The air-breathing habit of *Notopterus* has not been recorded so far. Behaviour of *Notopterus* regarding its aerial and aquatic respiration under various free carbon dioxide and dissolved oxygen contents in water is being studied. Work on the physiological aspects of its aerial respiration is in progress, and a detailed account will be published elsewhere.

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Fig. 1. Lateral view of swim-bladder of *Notopterus chitala*. ab.p., Abdominal portion; a.c., auditory cæcum; c.c., caudal cæcum; ces., cesophagus; p.d., pneumatic duct; r., rectum; sb.s., subspherical sac; v.d., ventral diverticulum

¹ Bridge, T. W., *J. Linn. Soc. (Zool.)*, **27**, 503 (1899–1900).² Srivastava, P. N., *Proc. Nat. Acad. Sci. (India)*, **25**, B, III–IV, 46 (1955).³ Dehadrai, P. V., *J. Zool. Soc. India*, **9** (1), 50 (1957).⁴ Carter, G. S., and Beadle, L. C., *J. Linn. Soc. (Zool.)*, **37**, 205 (1931).⁵ Fry, F. E. J., *Canad. J. Res.*, **E**, **27**, 188 (1949).