

Berliner R W & Davidson D G. Production of hypertonic urine in the absence of pituitary antidiuretic hormone. *J. Clin. Invest.* 36:1416-27, 1957.

[Lab. Kidney and Electrolyte Metabolism, Natl. Heart Inst., Natl. Insts. Health, Public Health Service, Dept. Health, Education, and Welfare, Bethesda, MD]

Urine was collected separately from the two kidneys of trained, unanesthetized dogs. Constriction of one renal artery regularly led to production of hypertonic urine by that kidney while complete absence of antidiuretic hormone was established by maximally dilute urine obtained from the other. [The *SCI*[®] indicates that this paper has been cited in over 315 publications since 1961.]

Robert W. Berliner
School of Medicine
Yale University
New Haven, CT 06510

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"At the time that this work was done, the only demonstrated action of vasopressin had been that of increasing the permeability of responsive membranes to water. Furthermore, there was little or no understanding of the mechanism by which urine hypertonic to body fluids is produced; although the counter-current hypothesis had been proposed by Wirz and Kuhn,^{1,2} it had not really penetrated the thinking of most renal physiologists.

"I had been interested in the possibility that the full range of physiologic action of vasopressin on the kidney might be explained by its effect on membrane permeability to water. If this were the case, it might be possible to obtain hypertonic urine in the complete absence of hormone provided the volume of water to be lost in achieving that hypertonic state were small enough. Indeed, several years earlier, Jack Orloff and I had studied a dog with surgically produced severe diabetes insipidus and

found that upon severe dehydration from water deprivation, hypertonic urine was produced. We realized, however, that it was impossible to establish that there was not some residual capacity to secrete vasopressin. It seemed that the best possibility of establishing the absence of vasopressin would be to have one kidney continue to produce maximally dilute urine while manipulations were carried out on the other kidney. The bladder-splitting operation devised by Desautels made possible chronic preparations in which urine could be collected separately from the two kidneys in trained, unanesthetized dogs.³

"The rationale for the studies by Davidson and me is quite precisely described in the introduction of the paper. The results were definitive in showing that hypertonic urine could regularly be produced by one kidney, when its renal artery was constricted, while the other kidney continued to put out maximally dilute urine. The effect was attributed to the reduction of glomerular filtration in the artery-constricted kidney although the presumed key element was reduction in the volume and salt content of the fluid delivered to the diluting segment in the distal nephron. It has since been found that other means of limiting delivery will also produce the effect.

"I presume that the frequency with which this paper has been cited relates not only to its interest for renal physiology but because a similar phenomenon may be involved in clinical states in which salt retention is associated with impaired ability to excrete dilute urine.

"Recent work in this field has been reported in *Urinary Concentrating Mechanism*.⁴

1. Hargtay B & Kuhn W. Das multiplicationsprinzip als grundlage der harnkonzentrierung in der niere. *Z. Elektrochem.* 55:539-58, 1951. (Cited 160 times.)
2. Wirz H, Hargtay B & Kuhn W. Lokalisation des Konzentrierungsprozesses in der Niere durch direkte Kryoskopie. *Helv. Physiol. Pharmacol. Acta* 9:196-207, 1951. (Cited 295 times.)
3. Desautels R E. Hemisection of the bladder for the collection of separate urine samples. *Surg. Gynecol. Obstet.* 105:767-8, 1957.
4. Jamison R L & Kriz W. *Urinary concentrating mechanism: structure and function*. New York: Oxford University Press, 1982. 340 p.